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THE TREATMENT EFFECT OF CRYOTHERAPY, COMPRESSION, A TOBACCO POULTICE, AND THE POLYMEM SPORTSWRAP® ON AN EXPERIMENTALLY INDUCED BRUISE

by

Jeremy R. Hawkins

A dissertation submitted to the faculty of

Brigham Young University

in partial fulfillment of the requirements for the degree of

Doctor of Philosophy

Department of Exercise Sciences

Brigham Young University

April 2009

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BRIGHAM YOUNG UNIVERSITY

GRADUATE COMMITTEE APPROVAL

of a dissertation submitted by

Jeremy R. Hawkins

This dissertation has been read by each member of the following graduate committee and by majority vote has been found to be satisfactory.

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BRIGHAM YOUNG UNIVERSITY

As chair of the candidate's graduate committee, I have read the dissertation of Jeremy R. Hawkins in its final form and have found that (1) its format, citations, and bibliographical style are consistent and acceptable and fulfill university and department style requirements; (2) its illustrative materials including figures, tables, and charts are in place; and (3) the final manuscript is satisfactory to the graduate committee and is ready for submission to the university library.

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ABSTRACT

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Jeremy R. Hawkins

Department of Exercise Sciences

Doctor of Philosophy

Context: It is common practice to treat musculoskeletal injury acutely with cryotherapy with compression. A tobacco poultice and the SportsWrap are touted as effective acute care treatments, yet are unproven. *Objective:* Compare four treatments (cryotherapy with compression, compression alone, a tobacco poultice, and the SportsWrap) of an experimentally induced bruise to determine their effectiveness at limiting bruise formation, thereby decreasing overall bruise duration. *Design:* Randomized, controlled, blinded trial. *Setting:* Research laboratory. *Participants:* 64 male participants (height: 180.2±6.4cm, weight: 78.0±16.2kg, age: 22.1±2.8yrs). Participants committed to not exercise during participation and were free of medication affecting coagulation or inflammation at least 3 days before and throughout the study. *Interventions:* Participants were shot in both quadriceps with a tennis ball fired from a tennis ball machine at ~31m/sec from 46cm. Digital pictures were taken of the trauma site immediately before

and on days 2, 4, 6, 8, and 10 post-trauma. Within 5 minutes of being shot, participants were randomly assigned to receive 1 of 4 treatments to one of their legs: 1) cryotherapy with compression (applied 5 times separated by 2 hours, compression applied with and without the ice until return on Day 2); 2) compression alone (worn continuously until Day 2); 3) a tobacco poultice (worn for no less than 12 hours, then removed; compression reapplied until Day 2); and 4) the SportsWrap (worn continuously until Day 2). Treatment times reflected clinical practice. Untreated leg served as control. Two raters, blinded to treatment and treatment leg, analyzed each bruise, while a third analyzed an unbruised control area for normalization. Software calculated average pixel values of cyan, magenta, yellow, black, and luminosity for each picture. This analysis was shown to be reliable during pilot data collection (ICC = .77). *Main Outcome Measures:* Color difference, a unitless value, was calculated as the difference between the treatment and control legs from the normalized average pixel values. A 2 x 4 x 6 mixed model ANOVA followed by Bonferroni post hoc analysis determined differences between limbs and treatments over time. *Results:* There was no treatment ($F_{3,60} = .47$, $P = .70$) or limb ($F_{1,60} = .04$, $P = .84$) effect, but there was a day effect ($F_{3.9,234.5} = 6.82$, $P < .001$). The mean color difference values were greater on Days 4 and 6 than 0 and 10, and Day 4 was greater than 2 (Bonferroni < .05). None of the interactions were significant. *Conclusions:* Treatment had no effect on the degree of bruising that we produced in this study. We are reluctant to generalize this data to musculoskeletal injury beyond what we caused because of insufficient bruising/too great of variance in bruising.

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The treatment effect of cryotherapy, compression, a tobacco poultice, and the PolyMem SportsWrap® on an experimentally induced bruise

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ABSTRACT

Context: It is common practice to treat musculoskeletal injury acutely with cryotherapy with compression. A tobacco poultice and the SportsWrap are touted as effective acute care treatments, yet are unproven. **Objective:** Compare four treatments (cryotherapy with compression, compression alone, a tobacco poultice, and the SportsWrap) of an experimentally induced bruise to determine their effectiveness at limiting bruise formation, thereby decreasing overall bruise duration. **Design:** Randomized, controlled, blinded trial. **Setting:** Research laboratory. **Participants:** 64 male participants (height: 180.2±6.4cm, weight: 78.0±16.2kg, age: 22.1±2.8yrs) volunteered. Participants committed to not exercise during participation and were free of medication affecting coagulation or inflammation at least 3 days before and throughout the study. **Interventions:** Participants were shot in both quadriceps with a tennis ball fired from a tennis ball machine at ~31m/sec from 46cm. Digital pictures were taken of the trauma site immediately before and on days 2, 4, 6, 8, and 10 post-trauma. Within 5 minutes of being shot, participants were randomly assigned to receive 1 of 4 treatments to one of their legs: 1) cryotherapy with compression (applied 5 times separated by 2 hours, compression applied with and without the ice until return on Day 2); 2) compression alone (worn continuously until Day 2); 3) a tobacco poultice (worn for no less than 12 hours, then removed; compression reapplied until Day 2); and 4) the SportsWrap (worn continuously until Day 2). Treatment times reflected clinical practice. Untreated leg served as control. Two raters, blinded to treatment and treatment leg, analyzed each bruise, while a third analyzed an unbruised control area for normalization. Software calculated average pixel values of cyan, magenta, yellow, black, and luminosity for each picture. This analysis was shown to be reliable during pilot data collection (ICC = .77) and has been used

previously. **Main Outcome Measures:** Color difference, a unitless value, was calculated as the difference between the treatment and control legs from the normalized average pixel values. A 2 x 4 x 6 mixed model ANOVA followed by Bonferroni post hoc analysis determined differences between limbs and treatments over time. **Results:** There was no treatment ($F_{3,60} = .47$, $P = .70$) or limb ($F_{1,60} = .04$, $P = .84$) effect, but there was a day effect ($F_{3.9,234.5} = 6.82$, $P < .001$). The mean color difference values were greater on Days 4 and 6 than Days 0 and 10, and Day 4 was greater than Day 2 (Bonferroni < .05). None of the interactions were significant. **Conclusions:** Treatment had no effect on the degree of bruising that we produced in this study. We are reluctant to generalize this data to musculoskeletal injury beyond what we caused because of insufficient bruising/too great of variance in bruising.

Key Words: color difference analysis, contused quadriceps, injury intervention

INTRODUCTION

Cutaneous applications of the SportsWrap[1] and a tobacco poultice are touted as effective alternatives to intermittent compression devices and manual techniques for the removal of hematomas and edema. Numerous human case studies support the use of the SportsWrap and its parent product PolyMem QuadraFoam, showing promising evidence for their use to remove bruising and swelling (3-day-old grade II ankle sprain[2]), limit hematoma and edema formation (recovery from arthroscopic knee surgery[2-5]), and facilitate wound healing.[6-24] Likewise, many cultures have used tobacco to remove bruising and swelling since the late 1400s.[25-30] However, with the exception of one study,[27] support for these practices is anecdotal or single case studies.

The nonscientific evidence for using the SportsWrap and a tobacco poultice is compelling, but controlled research is needed to assess their effectiveness. Further, the purported benefits of these two products have not been compared to the common practice of treating with cryotherapy and compression. Using a reproducible experimentally controlled injury model and color analysis procedures,[31] we sought to provide evidence to support the use of these modalities.

Color analysis serves as an objective, superficial measurement of underlying tissue damage and subsequent healing. A hematoma will change from red-purple, to blue-black, and gradually to yellow-brown or green,[32] as the hemoglobin from the damaged vessels is broken down to biliverdin, bilirubin, and hemosiderin,[33] the end result being bruise disappearance. Monitoring these changes in color allowed for the formation of conclusions about how well each treatment limited bruise formation and whether total bruised time (bruise duration) was less following the acute application of the different modalities.

The purpose of this study, therefore, was to compare four different treatments (cryotherapy and compression, compression alone, a tobacco poultice, and the SportsWrap) of an experimentally induced bruise to determine their effectiveness at limiting bruise formation and thereby decreasing bruise duration. We included compression alone to balance out the other three treatments, as each of them had compression involved for an extended period of time. We hypothesized that cryotherapy and compression would limit bruise formation the best, leading to decreased bruise duration, followed by the tobacco poultice and the SportsWrap, with compression alone having the least effect.

METHODS

This study was a randomized, controlled, blinded study. A 2 x 4 x 6 factorial guided data collection. Both thighs of the participants were bruised, one was treated, and both were monitored for changes in the color of the bruise for 10 days. The independent variables were thigh (treated and control), treatment (cryotherapy and compression, compression alone, a tobacco poultice, and the SportsWrap), and day (0 = before trauma and 2, 4, 6, 8, and 10 days post trauma). The dependent variables were the four colors measured, luminosity, and color difference.

Instruments

A chilled (9°C) Penn Pressureless Tennis Ball (Penn Racquet Sports, Phoenix, AZ), shot from a Master Sports SAM Millennium II tennis ball machine (Master Sports, LLC, Fort Wayne, IN), provided the trauma. The machine was operated manually, on the groundstroke setting, with maximal spin and velocity. Each ball was used only 4 times. Pictures were taken with a Nikon D60 digital camera (Nikon Corporation, Tokyo, Japan) with a Nikon 60 mm f/2.8G ED AF-S DX Micro Nikkor Lens (Nikon Corporation, Tokyo, Japan)

attached. Each photo was illuminated with 4 fluorescent photo lights. Adobe Photoshop CS3, Version 10.0.1 (Adobe Systems Inc., San Jose, CA) was used for picture analysis, MATLAB (The MathWorks Inc., Natick, MA) was used to calculate area under the curve, and all resultant data were analyzed using SPSS version 16.0 (SPSS Inc., Chicago, IL). Treatment supplies consisted of standard crushed ice, 4 in x 10 yd elastic wraps (Ambra Le Roy Supreme Elastic Bandage, Charlotte, NC), Redman Chewing Tobacco (Pinkerton Tobacco Co., Owensboro, KY) applied under Cramerol Plastic Backed Compress (Cramer Products Inc., Gardner, KS), and 4 in x 24 in PolyMem SportsWrap (Ferris Mfg. Corp., Burr Ridge, IL).

Participants

Sixty-four apparently healthy college-aged males (height: 180.2 ± 6.4 cm, mass: 78.0 ± 16.2 kg, age: 22.1 ± 2.8 yrs) participated. The study was limited to males because of variations in bruising witnessed in females during pilot work. Any individuals suffering from a cardiovascular ailment, who had a family history of such, and/or were currently taking medications prescribed for such, were excluded from participation. Additionally, subjects had to be free from anti-inflammatory medications and pain killers at least 3 days before and throughout the study. Each participant meeting inclusion criteria was informed of the methods, risks, and benefits of the investigation, and gave IRB approved written informed consent.

Testing Procedures

Each participant was shot with a tennis ball on both anterior thighs and tracked every other day for 10 days (Tuesday, Thursday, Saturday, Monday, Wednesday, and Friday). The 64 participants selected a number which corresponded with one of four 16-subject treatment

groups: 1) cryotherapy and compression (1 kg ice bag under an elastic wrap), 2) compression alone (elastic wrap wrapped snuggly), 3) a tobacco poultice (tobacco leaves soaked in water hot to the touch for 4 minutes, drained, applied to the bruise, covered with Cramerol, secured with an elastic wrap, and left in place for no less than 12 hours), or 4) the SportsWrap (SportsWrap wrapped snuggly). The number selected also indicated which leg would be treated (dominant or nondominant, as determined by kicking leg preference), which leg would be hit first (dominant or nondominant), and which of 16 tennis balls they would be hit with. The organization of this was determined with a balanced Latin Square. The nontreated bruise served as control.

Each participant reported on a Tuesday. Participants stood on a platform, 46 cm directly in front of the tennis ball machine. The spot on the front of the legs where the ball would hit was marked with a pen. A digital photograph was taken with the center of the picture being the marked spot on each leg. This image served as the baseline measurement to quantify the progression of the bruise.

The participant was then shot in the mid-thigh of both legs with a tennis ball fired from the tennis ball machine at approximately 31 m/sec. This bruising method was shown to be reliable during pilot data collection. The pilot consisted of ten participants who were bruised on both anterior thighs and were followed for 9 days. Neither bruise was treated; the goal was to determine if individuals bruise the same on both legs. Using variance component estimation,[34] a reliability coefficient was calculated using Restricted Maximum Likelihood Estimation.[34] The resultant intraclass correlation was .77 (Figure 1).

Five minutes following being hit by the tennis ball in the second leg, the assigned bruise was treated with one of the four treatments; the time lag was meant to replicate clinical

practice—a few minutes are needed to perform an evaluation, remove equipment, etc. prior to beginning the treatment. Care was taken to apply the treatments as they would be clinically. Additionally, participants were asked not to treat the bruises in any way other than instructed, including the taking of pain medications.

Following the application of the therapeutic modality, all participants laid down on a treatment table, with the treated leg elevated 15 cm for 30 minutes.[35] After the 30-minute treatment, the cryotherapy and compression group removed the ice bag, and compression was reapplied. They were sent home with 4 additional ice bags and were instructed to apply ice and compression for 30 minutes every two hours. Those who were selected to receive compression alone or the SportsWrap, as well as those in the cryotherapy and compression and the tobacco poultice groups who had completed the ice or tobacco treatments, were instructed to wear the compression or SportsWrap at all times, except when bathing,[1] until they returned for their next picture on Thursday (Day 2). Compression was not worn from Day 2 on.

In an effort to increase compliance, participants were sent home on the first day with instructions and a log sheet. The instructions reviewed the specifics of the preparticipation questionnaire, including the importance of refraining from taking the medications indicated and not exercising during study participation. Participants were asked not to perform any activities beyond activities of daily living during study participation as activity affects healing.[36] The log sheet had space provided to indicate when ice bags were applied and when compression wraps and tobacco poultices were removed. Physical activity was also tracked on this log as a control variable. These items were followed up on at each visit.

Pictures and Picture Analysis

Pictures were taken immediately before being bruised and 2, 4, 6, 8, and 10 days post bruising. Participants reported at or near the same time of the day (± 1 hour) for each of these pictures. Pictures were taken from a distance of 31 cm with the digital camera, manually focused. The up-close setting on the camera was used in conjunction with the micro lens to add to picture clarity. Four florescent lights illuminated the bruised area. The lights were positioned behind the camera, two illuminating the leg from each side, one from below the level of the bruise and the other from above.

Images were downloaded to a computer and analyzed following the procedures outlined by Seeley et al.[31] In summary, using Adobe Photoshop CS3, a 2400 x 2400 pixel area was cropped from each digital image, which was about 60% of the total picture area. This size was determined by pilot data—it captured the entire bruised area. A second 400 x 400 pixel area was cropped from a nonbruised area within the original image. This nonbruised area was used to normalize the bruises. Photoshop analyzed each cropped image for cyan (C), yellow (Y), magenta (M), black (B), and luminosity (L: degree of lightness of the composite color). This analysis determined how many pixels were present within the cropped area and provided the mean value, on a scale from 0 to 255, for the four colors and luminosity. Pure white is represented by the value of 255 while 0 represents pure color, or in the case of luminosity, the absence of light. After the data for the bruised and nonbruised areas were obtained, the numbers were entered into a formula for color difference (CD), where:

$$CD = (\Delta C^2 + \Delta Y^2 + \Delta M^2 + \Delta K^2 + \Delta L^2)^{½}$$

In this formula, ΔC represents the difference between the mean cyan values of the bruised and nonbruised skin. The same can be said of the other four values. The resultant value of CD is unitless, representing the difference between the bruised and nonbruised areas.[31] Color difference was computed at each time point. To blind this analysis, two independent raters, neither of which was involved in any other aspect of the study, performed the initial cropping of pictures. A separate individual cropped the normalization image. They did not know which leg was the treatment leg nor did they know which treatment was received.

Statistical Analysis

Correlation between raters was computed using intraclass correlation coefficients. We compared the values of the four colors and luminosity ($n = 384$ for each) individually between the two raters for each leg, totaling 10 calculations.

Demographics (height, mass, age) of the four treatment groups were compared with a three, one-way ANOVAs.

The difference between individual colors and luminosity resulted in negative values most of the time. This was not a problem for the color difference calculation because the individual color and luminosity values were squared. However, to compare individual colors we performed a linear transformation to remove the negative value. Adding 50 to each value accomplished this.

Six 2 x 4 x 6 mixed model ANOVAs were computed, one for each of the four colors, luminosity, and overall color difference. Two independent variables, limb (treatment and control) and day (0, 2, 4, 6, 8, 10), were treated as within subjects variables and the third independent variable, treatment (cryotherapy and compression, compression alone, a tobacco

poultice, and the SportsWrap) was a between subjects variable. Bonferroni correction for multiple pairwise comparisons was used for post hoc analysis.

The effect of exercise was computed using six 2 x 2 x 6 mixed model ANOVAs, one for each of the four colors, luminosity, and overall color difference. Limb (treatment and control), exercise (yes or no), and day (0, 2, 4, 6, 8, 10) were the independent variables. Bonferroni correction for multiple pairwise comparisons was used for post hoc analysis.

Lastly, area under the curve from the graphical representation of the color difference from Day 0 to Day 10 was calculated for each color, luminosity, and overall color difference using the trapezoidal integration method.[37] These values were analyzed with six 2 x 4 mixed model ANOVAs, with limb as the repeated measure (within subjects) variable and treatment as the between subjects variable.

The assumption of homogenous variances was violated for the color, luminosity, and color difference analyses. Therefore, Greenhouse-Geisser corrections were computed for these tests. Alpha level was set at 0.05.

RESULTS

The values of the four colors and luminosity were highly correlated between the two raters for each leg. Intraclass correlation coefficients ranged from .943 - .979 on the 10 tests; all were significant ($P < .001$).

Subjects in the four treatment groups means did not differ with respect to height ($F_{3,63} = 1.06$, $P = .37$), mass ($F_{3,63} = .66$, $P = .58$), or age ($F_{3,63} = 1.24$, $P = .30$; Table 1).

The analyses of the individual colors and luminosity mirrored the overall color difference analysis and will not be discussed individually.

Six of the 16-cryotherapy and compression subjects applied only 4 of the 5 ice bags. Those who did not, did not because they went to bed before the time of the 5th application. The tobacco poultice was applied for 14.9 ± 2.5 hrs (range: 12.0 – 20.5 hrs).

There was no treatment ($F_{3,60} = .47$, $P = .70$) or limb ($F_{1,60} = .04$, $P = .84$) effect, but there was a day effect ($F_{3.9,234.5} = 6.82$, $P < .001$). The mean color difference values were greater on Days 4 and 6 than Days 0 and 10, and Day 4 was greater than Day 2 (Bonferroni < .05). None of the interactions were significant (Tables 2 and 3).

Forty-four of the 64 subjects were compliant with limiting activity to those of daily living. Of the 20 subjects who exercised, 13 exercised only once, 4 twice, 1 three times, and 2 four times. Twenty of the 30 exercise sessions were light intensity; 18 lasted less than 30 minutes and 9 of the remaining 12 were between 30 and 60 minutes. The three individuals who exercised more than twice performed primarily upper body resistance exercises (push-ups).

There was no exercise ($F_{1,62} = 1.36$ $P = .25$) or limb ($F_{1,62} = .05$ $P = .83$) effect, but there was a day effect ($F_{4.0,248.3} = 5.80$ $P < .001$). The mean color difference values were greater on Days 4 and 6 than Days 0 and 10 (Bonferroni < .05). None of the interactions were significant (Table 4).

Similarly, there was no difference between treatments ($F_{3,60} = .43$, $P = .73$) or limbs ($F_{1,60} = .03$, $P = .87$), nor an interaction between treatments and limbs ($F_{3,60} = 1.60$, $P = .20$) when area under the curve was analyzed (Table 5).

DISCUSSION

Using color analysis of reproducible experimentally controlled bruises, we observed no treatment or limb effect for the degree of bruising we caused. This lack of a difference

between the treatment and control conditions indicates that none of the treatments made a difference in reducing bruise formation or bruise duration.

Our lack of treatment effect is inconsistent with previous research. In two controlled injury studies utilizing a trauma mechanism similar to the one used in the present study, cryotherapy[38] and tobacco[27] treatments were shown to be effective. With both of these studies, treatment time was far greater than in our study (Merrick et al.[38] treated for 5 hours straight and Francis and Kamieneski[27] applied a tobacco wash daily for 2 weeks with no removal). Similarly, both Humphrey[2] and Hayden and Cole[4] applied the SportsWrap for 8 days and observed decreased bruise duration. Additionally, Merrick et al.[38] and Francis and Kamieneski[27] used a biochemical analysis as their dependant variable; the work by Humphrey[2] and Hayden and Cole[4] were case studies with only subjective outcomes. Although we had good rationale to treat and analyze as we did, the difference in methodology, including the use of rats by Merrick et al.[38] and Francis and Kamieneski,[27] may be a reason why our results differed from theirs.

It is important to note that compression was a component of three of the four aforementioned treatments,[2, 4, 38] and part of all four treatments in our study. Because compression helps control edema formation,[39] one may argue that compression overshadowed the cryotherapy, tobacco, or SportsWrap effects, i.e., compression affected all of the treatments equally. However, a lack of limb effect negates this argument, adding further credibility to the conclusion that treatment did not matter for the degree of bruising we caused.

There are two areas where the model itself leads us to question the generalizability of the our results to the acute care of musculoskeletal injury. First, the bruising may not have

been severe enough to distinguish between treatments. The analysis approach we followed shadowed that of Seeley et al.,[31] who used this approach to ascertain the treatment effect of *Arnica montana* on face-lift bruising. Their numbers for color difference were considerably greater than ours, indicating their bruising was greater (postoperative minus preoperative values ranged from 24.78 to 54.31,[31] whereas our greatest color difference was 19.7 without an adjustment). Had we created greater damage, and thus more bruising, we may have elicited a treatment effect. This is further supported by the studies conducted by Hopkins et al.[40] and Beam,[41] both of whom used a similar analysis (red, blue, and green channels) to determine the effect of low level laser therapy and occlusive dressings, respectively, on a partial thickness wound. Beam[41] observed a difference in chromatic red and luminance whereas Hopkins et al.[40] did not. As with the comparison of the Seeley et al.[31] data to ours, the values reported by Beam[41] were higher than those reported by Hopkins et al.,[40] indicating greater damage.

Second, there was considerable variation from subject to subject in magnitude and duration of bruising. During early stages of pilot work we observed that females bruised differently, perhaps because of differences in the timing of their menstrual cycles. Their bruising was very individualized. Because of this we chose to control for these differences by excluding women from this study. As witnessed by the large standard deviations in Table 2, the bruising of males is also very individualized. We can explore ways of causing greater bruising, but controlling for the individualized way someone bruises may not be possible.

CONCLUSIONS

There was no difference in bruise formation or bruise duration between subjects treated by cryotherapy and compression, compression alone, a tobacco poultice, and a SportsWrap. This indicates that treatment in this study did not make a difference. We do, however, caution against the broad application of these results to the acute care of musculoskeletal injury where damage is greater than what we caused. Future research needs to focus on ways to cause greater bruising and/or methods to better quantify that bruising.

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Table 1. Demographic information for each group (mean ± SD). The groups did not differ from one another on height, mass, or age ($P \leq .05$).

	Cryotherapy and compression	Compression Alone	Tobacco Poultice	SportsWrap	Total
Height (cm)	181.8 ± 4.5	178.3 ± 5.5	179.4 ± 7.7	181.3 ± 7.2	180.2 ± 6.4
Mass (kg)	80.9 ± 11.5	73.9 ± 7.0	76.8 ± 14.8	80.5 ± 25.8	78.0 ± 16.2
Age (yrs)	21.3 ± 2.4	23.0 ± 2.4	21.6 ± 2.1	22.5 ± 4.0	22.1 ± 2.8

Table 2. Treatment color difference values for the treatment (Tx) and control (Con) legs at each time point (mean ± SD). Totals for each treatment are mean ± SE.

Day	Limb	Cryotherapy and Compression	Compression Alone	Tobacco Poultice	SportsWrap	Total
0	Tx	12.0 ± 6.5	12.5 ± 8.0	12.8 ± 10.8	11.8 ± 9.1	12.3 ± 8.5[a]
	Con	15.0 ± 10.1	11.8 ± 7.1	9.8 ± 6.0	16.8 ± 17.3	13.3 ± 11.1[a]
2	Tx	13.5 ± 8.4	17.2 ± 7.8	13.9 ± 9.1	16.2 ± 12.6	15.2 ± 9.5[b]
	Con	13.3 ± 7.8	14.5 ± 7.0	11.8 ± 7.1	17.2 ± 15.7	14.2 ± 10.0[b]
4	Tx	15.2 ± 10.3	18.1 ± 8.7	15.9 ± 12.4	17.1 ± 11.2	16.6 ±10.5[ab]
	Con	19.7 ± 12.2	18.3 ± 10.2	14.7 ± 12.1	16.6 ± 10.6	17.3 ±11.2[ab]
6	Tx	17.1 ± 9.4	18.1 ± 7.8	15.5 ± 13.5	14.4 ± 9.6	16.3 ± 10.1[a]
	Con	18.8 ± 11.2	16.8 ± 9.9	11.8 ± 9.2	18.1 ± 13.3	16.4 ± 11.1[a]
8	Tx	12.4 ± 9.7	14.3 ± 4.9	16.1 ± 11.7	17.2 ± 11.0	15.0 ± 9.6
	Con	19.2 ± 13.7	13.3 ± 9.4	11.4 ± 10.0	13.9 ± 8.0	14.4 ± 10.6
10	Tx	13.0 ± 6.8	17.6 ± 7.8	12.9 ± 11.8	14.7 ± 12.1	14.6 ± 9.8[a]
	Con	14.2 ± 11.9	12.3 ± 6.8	9.6 ± 6.6	16.1 ± 11.5	13.0 ± 9.6[a]
Total		15.3 ± 1.8	15.4 ± 1.8	13.0 ± 1.8	15.8 ± 1.8	

[a] Days 0 & 10 < Days 4 & 6
[b] Day 2 < Day 4

Table 3. Mixed model ANOVA results with treatment as the between subjects variable. (**Bold**) Indicates significance after the Greenhouse-Geisser correction.

Comparison	Cyan	Yellow	Magenta	Black	Luminosity	Color Difference
Treatment (Tx)	$F_{3,60} = .52$ $P = .67$	$F_{3,60} = .61$ $P = .61$	$F_{3,60} = .65$ $P = .58$	$F_{3,60} = .77$ $P = .52$	$F_{3,60} = .62$ $P = .61$	$F_{3,60} = .47$ $P = .70$
Day	**$F_{3.1,185.4} = 8.36$** **$P < .001$**	**$F_{3.4,205.9} = 22.5$** **$P < .001$**	**$F_{4.1,245.9} = 4.27$** **$P = .002$**	**$F_{3.7,222.7} = 7.72$** **$P < .001$**	**$F_{3.8,228.1} = 7.52$** **$P < .001$**	**$F_{3.9,234.5} = 6.82$** **$P < .001$**
Day * Tx	$F_{9.3,185.4} = .80$ $P = .62$	**$F_{10.3,205.9} = 1.95$** **$P = .039$**	$F_{12.3,245.7} = 1.06$ $P = .40$	$F_{11.1,222.7} = .41$ $P = .95$	$F_{11.4,228.1} = 1.11$ $P = .36$	$F_{11.7,234.5} = .81$ $P = .64$
Limb	$F_{1,60} = .61$ $P = .44$	$F_{1,60} = .09$ $P = .76$	$F_{1,60} = .37$ $P = .55$	$F_{1,60} = .40$ $P = .53$	$F_{1,60} = .45$ $P = .51$	$F_{1,60} = .04$ $P = .84$
Limb * Tx	$F_{3,60} = .35$ $P = .79$	$F_{3,60} = 1.94$ $P = .13$	$F_{3,60} = 1.05$ $P = .38$	$F_{3,60} = .90$ $P = .45$	$F_{3,60} = 1.05$ $P = .38$	$F_{3,60} = 1.83$ $P = .15$
Day * Limb	$F_{3.9,231.4} = 1.17$ $P = .33$	$F_{3.8,227.5} = .71$ $P = .58$	$F_{3.9,231.7} = .72$ $P = .57$	$F_{3.9,232.7} = .82$ $P = .51$	$F_{3.8,229.0} = .82$ $P = .51$	$F_{3.9,230.7} = .87$ $P = .48$
Day * Limb * Tx	$F_{11.6,231.4} = .73$ $P = .72$	$F_{11.4,227.5} = 1.01$ $P = .44$	$F_{11.6,231.7} = .56$ $P = .87$	$F_{11.6,232.7} = .78$ $P = .66$	$F_{11.5,229.0} = .59$ $P = .84$	$F_{11.5,230.7} = 1.14$ $P = .33$

Table 4. Mixed model ANOVA results with exercise as the between subjects variable. (**Bold**) Indicates significance after the Greenhouse-Geisser correction.

Comparison	Cyan	Yellow	Magenta	Black	Luminosity	Color Difference
Exercise (Ex)	$F_{1,62} = 1.37$ $P = .25$	$F_{1,62} = 1.33$ $P = .25$	$F_{1,62} = 1.84$ $P = .18$	$F_{1,62} = .64$ $P = .43$	$F_{1,62} = 1.72$ $P = .19$	$F_{1,62} = 1.36$ $P = .25$
Day	**$F_{3.1,193.6} = 7.30$** ***P* < .001***	**$F_{3.5,214.8} = 17.7$** ***P* < .001***	**$F_{4.1,255.1} = 3.84$** ***P* = .004***	**$F_{3.7,229.4} = 8.00$** ***P* < .001***	**$F_{3.9,238.8} = 6.64$** ***P* < .001***	**$F_{4.0,248.3} = 5.80$** ***P* < .001***
Day * Ex	$F_{3.1,193.6} = .43$ $P = .74$	$F_{3.5,214.8} = .58$ $P = .65$	$F_{4.1,255.1} = .63$ $P = .65$	$F_{3.7,229.4} = 1.05$ $P = .38$	$F_{3.9,238.8} = .61$ $P = .65$	$F_{4.0,248.3} = .10$ $P = .98$
Limb	$F_{1,62} = .34$ $P = .56$	$F_{1,62} = .21$ $P = .65$	$F_{1,62} = .37$ $P = .54$	$F_{1,62} = .23$ $P = .64$	$F_{1,62} = .39$ $P = .53$	$F_{1,62} = .05$ $P = .83$
Limb * Ex	$F_{1,62} = .14$ $P = .71$	$F_{1,62} = .25$ $P = .62$	$F_{1,62} = .02$ $P = .89$	$F_{1,62} = .08$ $P = .78$	$F_{1,62} < .01$ $P = .98$	$F_{1,62} = .01$ $P = .93$
Day * Limb	$F_{3.9,238.8} = 1.36$ $P = .25$	$F_{3.8,233.5} = .83$ $P = .50$	$F_{3.9,238.6} = .76$ $P = .55$	$F_{3.9,241.6} = .78$ $P = .54$	$F_{3.8,235.6} = .88$ $P = .48$	$F_{3.8,237.8} = .77$ $P = .54$
Day * Limb * Ex	$F_{3.9,238.8} = 1.06$ $P = .38$	$F_{3.8,233.5} = .79$ $P = .53$	$F_{3.9,238.6} = .75$ $P = .56$	$F_{3.9,241.6} = .88$ $P = .48$	$F_{3.8,235.6} = .77$ $P = .54$	$F_{3.8,237.8} = .47$ $P = .75$

Table 5. Mixed model ANOVA results for the area under the curve following the Greenhouse-Geisser correction.

Comparison	Cyan	Yellow	Magenta	Black	Luminosity	Color Difference
Treatment (Tx)	$F_{3,60} = .36$ $P = .78$	$F_{3,60} = .67$ $P = .58$	$F_{3,60} = .64$ $P = .59$	$F_{3,60} = .71$ $P = .55$	$F_{3,60} = .56$ $P = .63$	$F_{3,60} = .43$ $P = .73$
Limb	$F_{1,60} = .40$ $P = .53$	$F_{1,60} = .03$ $P = .87$	$F_{1,60} = .27$ $P = .60$	$F_{1,60} = .27$ $P = .60$	$F_{1,60} = .37$ $P = .56$	$F_{1,60} = .03$ $P = .87$
Limb * Tx	$F_{3,60} = .46$ $P = .71$	$F_{3,60} = 2.09$ $P = .11$	$F_{3,60} = .97$ $P = .41$	$F_{3,60} = 1.11$ $P = .35$	$F_{3,60} = 1.04$ $P = .38$	$F_{3,60} = 1.60$ $P = .20$

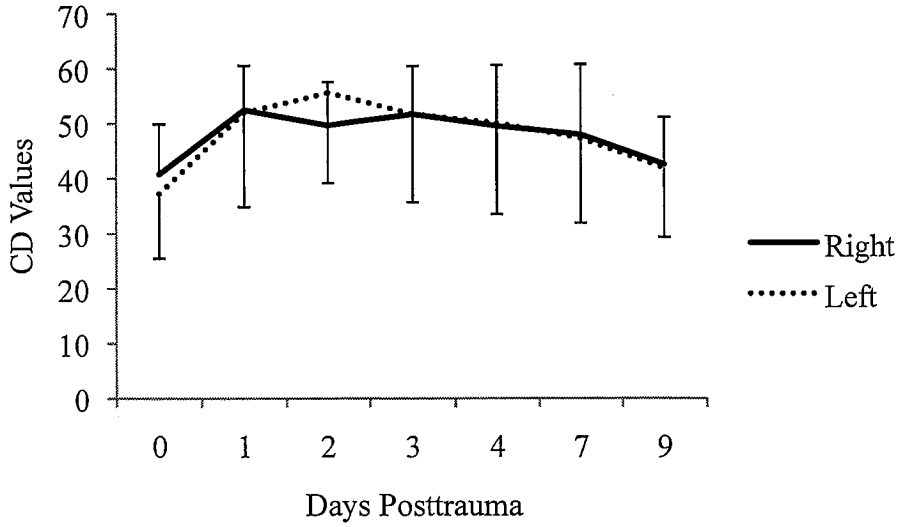

Figure 1. Average color difference values of 10 participants obtained during pilot data collection. Participants were bruised on both anterior thighs, as in this study. Bruising took place on a Monday (Day 0), with pictures taken that day and daily through Friday (Days 1 – 4) of Week 1, and on Monday (Day 7) and Wednesday (Day 9) of Week 2. Neither bruise was treated in an attempt to determine if individuals bruise the same on both legs. Color difference differed between days ($F_{6,54} = 6.97$, $P < .001$) but not between legs ($F_{1,9} = .82$, $P = .97$). There was no interaction ($F_{6,54} = 1.05$, $P = .41$).

Appendix A

Prospectus

Prospectus

The Treatment Effect of Cryotherapy, Compression, a Tobacco Poultice, and the PolyMem SportsWrap® on an Experimentally Induced Bruise

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Chapter 1

INTRODUCTION

Following an acute injury, a series of events take place that result in the formation of a hematoma. A hematoma is the collection of tissue debris from the primary and secondary injury, resulting in free protein and other fluids in the interstitial space. Edema forms as excess fluid is drawn from the circulatory system by the free protein. The outward manifestation of these processes is bruising and swelling.

Limiting secondary injury through the immediate use of cryotherapy can control the extent of hematoma and edema formation.[1] Lowering the temperature of the tissues decreases their metabolic demand and allows the cells to survive longer in the oxygen depleted state; this results in less tissue damage.[2, 3] With less tissue damaged, less debris needs to be removed, and healing takes place more quickly. Regardless of the effectiveness of cryotherapy, there always is some residual tissue damage and edema. They must be removed in order for healing to occur.

The body removes hematomas and edema through the lymphatic system. Lymphatic vessels run in parallel with blood vessels, but unlike blood vessels, do not have a pump to move the lymphatic fluid. Lymphatic fluid movement is stimulated through intermittent compression provided by active exercise, intermittent compression devices (e.g., Jobst pump or Game Ready), and/or manual techniques like massage.

Cutaneous applications of the SportsWrap (Ferris Mfg. Corp., Burr Ridge, IL)[4] and a tobacco poultice (Personal communication with Marv Roberson, November, 2006) are touted as effective alternatives to intermittent compression devices and manual

techniques for the removal of hematomas and edema. Numerous human case studies support the use of the SportsWrap and its parent product PolyMem QuadraFoam (Ferris Mfg. Corp., Burr Ridge, IL), showing promising evidence for their use to remove bruising and swelling (3-day old grade II ankle sprain[5]), limit hematoma and edema formation (recovery from arthroscopic knee surgery[5-8]), and facilitate wound healing.[9-27] Likewise, many cultures have used tobacco to remove bruising and swelling since the late 1400's.[28-33]

The nonscientific evidence for using these two products is compelling, but controlled research is needed to assess their effectiveness. To date, it is unknown what is in these two products that leads to the aforementioned benefits. Further, no one knows how the benefits of these two products compare to the gold standard of cryotherapy and compression. It is our hope that by using a reproducible controlled injury model, we can provide evidence to support the use or disuse of the SportsWrap/tobacco poultice, as well as gain insight to a potential mechanism of action.

Purpose

The purpose of this study is to compare four different treatments (cryotherapy with compression, compression alone, the SportsWrap, and a tobacco poultice) of an induced bruise to determine the efficacy of their use. Cryotherapy with compression represents the gold standard for acute care. The SportsWrap and a tobacco poultice are touted as being effective, yet are unproven. Compression alone serves to balance out the other three treatments, as each of them have compression involved for an extended period of time. The following research question will be answered by this experiment:

What is the most effective acute care therapeutic modality for the treatment of an induced bruise, as measured by bruise visibility: cryotherapy with compression, compression alone, the SportsWrap, or a tobacco poultice?

Research Hypotheses

Based upon clinical experience and anecdotal evidence, the following hypotheses will be tested:

1. The curvilinear trend will not be the same for the various modalities.
    a. The color difference trend for the cryotherapy and compression treatment will be greater than the trend for the other modalities.
    b. The color difference trend for the SportsWrap and tobacco poultice will not be significantly different from each other, but will be greater than the trend for compression alone.

Definitions Of Terms

Bruise – an injury appearing as discolored skin on the body, caused by a blow or impact that damages underlying tissue.

Bruise visibility – decrease in discoloration as determined by changes in digital photographs. Analyzed with image measurement software.[34]

Compression – double length 4" elastic wrap wrapped around the leg.

Cryotherapy with compression – 1 kg crushed ice bag applied to the injury site for 30-minutes and secured with a double length 4" elastic wrap.

Hematoma – collection of clotted blood, free protein, and debris within the tissue.

Induced bruise – bruising resulting from being hit with a chilled tennis ball, shot from a tennis ball machine .46 m away at approximately 31 m/sec.

SportsWrap – PolyMem Quadrafoam^{TM} dressing, containing glycerin, surfactant, starch copolymer, with a semipermeable film backing.[4] Wrapped around the injured body part in order to limit bruising and to decrease pain, hematoma, and edema formation that results from orthopedic injury.

Tobacco poultice – moistened leaf tobacco applied topically to the skin.

Assumptions

This experiment will be conducted with the assumption that a change in bruise color is indicative of underlying tissue healing, but does not indicate actual healing is taking place.

Chapter 2

REVIEW OF LITERATURE

Major Concepts

This literature review will cover the following topics:

I. Data Bases Searched
II. Musculoskeletal Injury
    A. Review of Secondary Injury
        1. Secondary Metabolic Injury
        2. Secondary Enzymatic Injury
    B. The Role of Cryotherapy
    C. Hematoma Formation and Resolution
    D. Preventing vs. Removing Swelling
III. Tobacco
    A. Word of Wisdom
    B. Application Methods
    C. Proposed Mechanism of Action
        1. Vitamin K
            a. Quantification of Vitamin K in Tobacco
            b. Pharmacokinetics
            c. Pilot data results
            d. Role in Clotting Mechanism
        2. Nicotine
    E. Other Plants with Similar Properties
IV. SportsWrap
V. Trauma Mechanisms
    A. Pulsed Dye Laser Induced Bruising
    B. Vacuum Induced Bruising
    C. Paintball Induced Bruising
    D. Tennis Ball Induced Bruising

VI. MEASUREMENTS
   A. Pixel Analysis
   B. Realtime Ultrasound and Laser Doppler Imaging

DATA BASES SEARCHED

To gain a greater understanding of the events that occur within the body once an external trauma has occurred and how the resultant injury can be treated, a literature review was conducted. A combination of the following terms was searched using search engines (Agricola, CINAHL, Clinical Pharmacology, Medline, and SPORTDiscus) on the BYU library database and the Provo City Library shelves:

- Acutane
- Athletic injury
- Bruise
- Cold
- Contusion
- Cryotherapy
- Ecchymosis
- Edema formation
- Hematoma
- Ice
- Injury
- Muscle injury
- Nicotine
- Pathophysiology
- Pharmacokinetics
- Skeletal injury
- Skin absorption
- Vitamin A & K

A series of case studies provided by the Ferris Manufacturing Corporation were also reviewed. The bibliographies of the collected articles, case studies, and books resulted in additional articles and books used in this literature review.

MUSCULOSKELETAL INJURY

Inflammation is "a local response to cellular injury that is marked by capillary dilation, leukocyte infiltration, redness, heat, and pain and that serves as a mechanism initiating the elimination of noxious agents and of damaged tissue."[35] There are three primary purposes for inflammation:

- To defend the body against alien substances;
- To dispose of dead and dying tissue so that repair can take place;
- To promote regeneration of normal tissue.[36]

As the body goes through this necessary process, five outward signs are typically present, referred to as the cardinal signs of inflammation:[37-39]

- Redness – Rubor
- Swelling or edema – Tumor
- Pain – Dolor
- Heat – Calor
- Loss of function – Functio laesa

Inflammation is not the only process resulting in these symptoms, nor are these symptoms present at a specific time. Knight[38, 40] furthered our understanding of the inflammatory process as it relates to orthopedic injury with the development of his eight phase Sport Injury Model.

Phase I – Injury. An injury is any event affecting tissue structure and function that changes the cell's ability to function normally and maintain homeostasis. Damage may occur to the blood vessels and/or nerves of the muscle or connective tissue involved. When this happens within the body, an inflammatory response will take place for the purposes outlined previously. There are seven potential causes of injuries:

- Trauma
- Physical agents (e.g., burns and radiation)
- Metabolic factors (hypoxia)
- Biological agents (e.g., bacteria, viruses, and parasites)
- Chemical agents (e.g., acids, gases, organic solvents, and chemicals within the body)
- Normal secretions, either in abnormal locations (such as gout), or in increased quantity in a normal location (such as stomach ulcers)
- Iatrogenic agents (e.g., side effects from chemotherapy)

Athletic injuries fall under the first category listed, trauma, occurring either from macrotrauma (impact or contact) or microtrauma (overuse or friction).[38, 39] Metabolic factors also play a role as we will discuss shortly.

Phase II – Ultrastructural changes. The affected cell's cellular membrane breaks down as a result of the injury. As the membrane breaks down, it is no longer structurally sound, allowing for the contents of the cell to spill into the extracellular space.[36, 38, 41] The structural breakdown of the membrane may also result from events following the injury, as outlined in Phase V. The structural damage to the cellular membranes of the involved muscle and connective tissue are known as primary injury.[40, 41] As a consequence of the primary injury, a hematoma begins forming.[38] The body's desire is to rid itself of this hematoma. This is accomplished in Phases IV, VI, VII, and VIII.

Phase III – Activation of chemical mediators. The body attempts to limit the extent of the damage of the ultrastructural changes through the release of chemical mediators, such as histamine, serotonin, and bradykinin. These chemical mediators are released to alert the body that cell damage has taken place.[36, 38] These processes occur in an attempt to contain the injury, and they continue to work until the damaged tissue is removed and the necessary repair has taken place.

Phase IV – Hemodynamic changes. Two circulatory changes take place. First, arteries dilate and dormant capillaries and venules open. Total blood flow increases, but rate of flow decreases to allow circulating neutrophils (discussed in Phase VI) to move to the sides of the blood vessels in preparation to contain the injury. The movement of neutrophils to the sides of the vessels is referred to as margination. Margination occurs in the undamaged vessels within

the injury, as well as to vessels along the edges of the injury. In a very short time the sides of the vessels throughout the injured tissue are lined with these neutrophils.[36, 38]

Phase V – Metabolic changes. The affected cell's ability to produce energy through aerobic metabolism is hampered due to decreased blood flow. Decreased blood flow leaves the cells in an oxygen deprived, or hypoxic state. Glycolytic (anaerobic) pathways take over, but are limited in the amount of energy they produce.[42, 43] As the necessary energy begins to fail, functions within the cell also fail, notably the sodium-potassium pump. The function of the sodium-potassium pump is to maintain sodium at a low level within the cell, thus facilitating the transmembrane potential necessary for action potential propagation.[44] The inability of the sodium-potassium pump to work properly leads to a build up of sodium within the cell. Water passes though the cell membrane along this newly formed ion gradient. Excess water within the cell eventually causes the cell membrane to burst. Continued anaerobic metabolism will also cause acidosis within the cell as the biproducts of anaerobic glycolysis accumulate. Acidosis also breaks down the cell membrane.[38, 42, 43]

Phase VI – Permeability changes. In addition to their role in alerting the body of the cellular damage, chemical mediators also increase the permeability of the small blood vessels within and around the injured site. The endothelial cells of the vessel move apart to allow room for the leukocytes to squeeze through.[36, 38] The process does not occur without a price. Protein-rich fluid from the vessels moves in to the interstitial space, increasing the viscosity of the blood in the area, further slowing circulation.[38]

Phase VII – Leukocyte migration. The hemodynamic and permeability changes allow leukocytes to migrate to the area. Two leukocytes of note are neutrophils and macrophages. Neutrophils arrive at the injury site first, providing the first line of defense. Neutorphil

mobilization occurs in response to cytokine signaling from the perturbed myocytes and/or mast cells in the injured area. The movement of the neutrophils into the tissues is known as diapedesis.[45] During the first 4 to 24 hours, neutrophils are the dominant immune cell at the injury site, even though their individual life cycle is relatively short, approximately 12 to 20 hours.[46] Macrophages dominate the latter stages of the injury, appearing sometime between 3 to 24 hours, and are present until the necrotic tissue is removed, potentially as long as 3 weeks.[46, 47]

Phase VIII – Phagocytosis. Neutrophils, macrophages, and cellular lysosomes digest the cellular debris, a process known as phagocytosis.[3] The neutrophils and macrophages digest the cellular debris by engulfing the particles, forming a phagosome. The phagosome moves within the cell to join a lysosome. The digestive enzymes of the lysosome spill into the phagosome, digesting its contents. Through this process the body rids itself of foreign products without doing further damage to itself. Even after dying, neutrophils continue to help the cleanup by releasing digestive enzymes which dissolve cellular debris, and thus prepare the site for healing.[46] Additionally, macrophages release growth factors essential for tissue repair and regeneration. The digested contents of the phagolysosome are added to the intracellular waste and must be removed through the lymphatic system. **Figure 1** is a summary of these nine phases.

Review of Secondary Injury

Secondary injury can be caused by one of two factors, a lack of metabolism and unchecked chemical degradation.[3] A discussion of each factor follows.

Secondary Metabolic Injury.—Secondary metabolic injury is the result of decreased metabolism, a consequence of ischemia, or a decrease of blood flow, in and around the area of the primary injury. Ischemia occurs in the vessels of the primary injury to allow for the

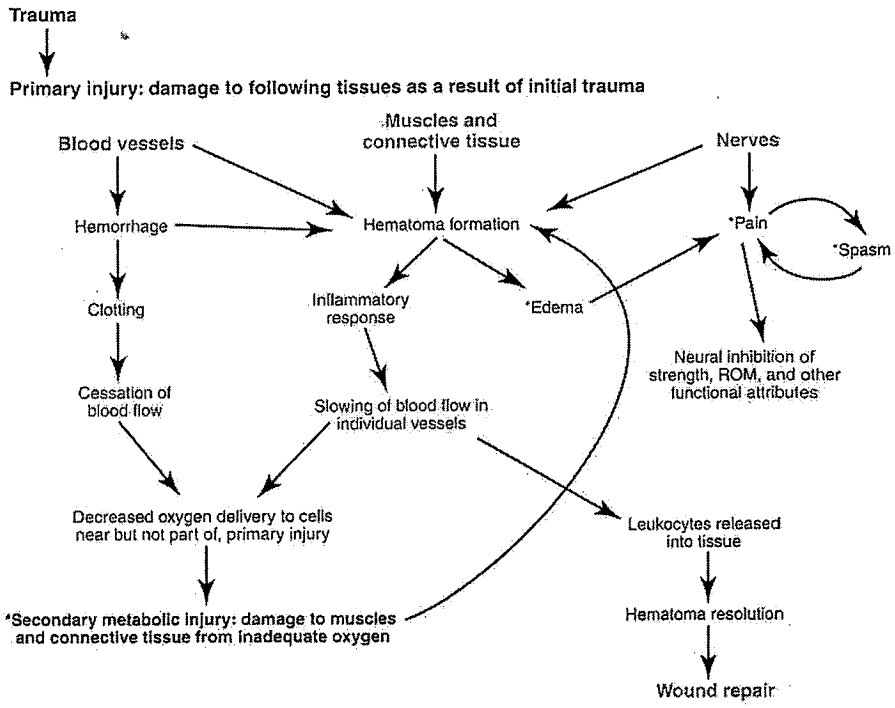

Figure 1. Summary of the response of the inflammatory system to acute trauma.[3, 48]

inflammatory process to proceed. Additional ischemia results in the tissues surrounding the primary injury due to hemorrhaging from the damaged vessels, hemostasis from the clotting cascade, pressure from the expanding hematoma and muscle spasm, and the swelling of involved cells after membrane damage. Each of these processes would decrease the total amount ofoxygen delivered to tissues as the blood supply is reduced or cut off entirely. Regardless of the cause of the ischemia, the lack of oxygen leads to metabolic injury.[38, 41]

Secondary Enzymatic Injury.—Secondary enzymatic injury results from the digestive enzymes from the damaged cells coming in to contact with the live cells on the periphery of the injury, leading to their breakdown. Neutrophils are important to corral the initial injury, but their non-specific killing function can exacerbate the injury. Neutrophils can break down the

membrane of the lysosomes, spilling their digestive enzymes in to the extracellular matrix.[47, 49] When the digestive enzymes from the injured cells come in to contact with the undamaged cells at the periphery, the enzymes begin to attack the membranes of these healthy cells. Merrick[41] proposes the lysosomes most active are a "variety of acid hydrolases, phospholipases, and various proteases and perhaps any number of human neutrophil proteins." The acid hydrolases and phospholipases cleave the hydrocarbons from the lipid portion of membrane phospholipids while the proteases inactivate the proteins by cleaving their peptide bonds. The end result is additional cellular death.[1, 38, 41]

The Role of Cryotherapy

Cryotherapy is one of the most common therapeutic modalities used during the acute care of musculoskeletal injury. Cryotherapy slows the metabolism of the cells surrounding the primary injury, decreasing their need for oxygen.[38, 48] This is beneficial because of the decreased oxygen supply to the tissue. Because less oxygen is required, the cells are able to live longer in the their hypoxic state.[38, 48] Through this process the extent of additional (secondary metabolic) damage is decreased and there is less of a hematoma to be removed. Less damaged tissue translates to a shorter recovery and quicker return to play.[38, 48]

Using rats as their subject population, Merrick, Rankin, et al.[1] added strength to the Sport Injury Model. By injuring the calf muscle with hemostatic forceps, they simulated a crush injury similar to one experienced in an athletic contest. Following the injury, the rats either received a 5-hour cryotherapy treatment or no treatment at all. Following the cryotherapy treatment, the muscles were harvested and tested for indicators of mitochondrial disruption or depleted enzymes of oxidative phosphorylation.[1] These markers decreased, signifying secondary injury

was actually taking place, as outlined by Knight.[38, 40] The application of cryotherapy lessened the extent of this secondary injury.

Hematoma Formation and Resolution

Hematoma formation is the product of processes that occur subsequent to acute trauma. Immediately following an injury, ultrastructural changes take place in the involved tissues. These changes may affect the connective tissues, muscle tissues, blood vessels, and/or nerves in the area. Additionally, hemorrhaging from the damaged blood vessels adds whole blood to the extravascular spaces of the primary injury. Because of the quickness of the clotting cascade, hemorrhaging typically ceases shortly after the traumatic event. The combination of the hemorrhaged blood and cellular debris is known as a hematoma.[38]

The process of removing the hematoma is also intricate. Several factors determine the length of time needed for complete hematoma resolution, including the extent and location of the injury and how vascularized the damaged area is.[46] Phases IV, VI, VII, and VII of the Sport Injury Model deal directly with these factors—the greater the damage (extent) and the more difficult to get to (location and vascularization), the longer it will take the neutrophils and macrophages to remove the damaged tissue. Limiting the extent of the injury through cryotherapy, compression, and elevation is the accepted approach to take.[38, 40, 48, 50-52]

Preventing vs. Removing Swelling

Under normal, homeostatic conditions, fluid is constantly moving between the blood vessels and the tissues. Two-thirds of the fluid exchanged is automatically reabsorbed into the distal end of the capillaries, with the other 1/3 returned via the lymphatic system. The natural absorption of water is due to the balance of oncotic and hydrostatic pressures. Oncotic pressure is a pulling pressure. Hydrostatic pressure is a pushing pressure. Both pressures are present in

the capillaries and the tissue, with the balance of these pressures determining the capillary filtration pressure.

$$CFP = (CHP + TOP) - (COP + THP + EFP)$$

where

CFP = capillary filtration pressure,
CHP = capillary hydrostatic pressure,
TOP = tissue oncotic pressure,
COP = capillary oncotic pressure,
THP = tissue hydrostatic pressure, and
EFP = external force pressure[38]

When an injury occurs, these pressures do not function as normal. The hematoma debris increases tissue oncotic pressure, thus pulling more fluid into the extravascular spaces. Unless this is overcome by increasing the external force pressure through compression or some other means, edema (swelling), the accumulation of the fluid portion of the blood in the tissues, results.

The standard method used to prevent the formation of swelling is RICES—Rest, Ice, Compression, Elevation, and Stabilization.[3] We rest during the acute phase to ensure no additional damage is done to the injured tissue. Ice is used for pain control, as well as to decrease the secondary metabolic injury to the cells on the periphery of the primary injury. By keeping the damaged tissue to a minimum, oncotic pressure is minimized. Compression affects the last portion of the previously stated equation, external force pressure. By having the tissues as a whole compressed, there is less space for the fluid portion of the blood to go into. Less space results in less swelling. Lastly, by elevating the injured limb, capillary hydrostatic pressure is decreased.

The removal of swelling is a different process than preventing its formation. Swelling is the result of excess free protein in the interstitial space. Minimizing the free proteins in the interstitial space minimizes swelling. Only removing the excess free proteins from the interstitial space via the lymphatic system reduces swelling. Lymphatic flow is stimulated through intermittent compression provided by active exercise, intermittent compression devices (e.g. Jobst pump or Game Ready), and/or manual techniques, like massage. Although cryotherapy is crucial to limiting the formation of excess free proteins, it has no effect on lymphatic flow, other than facilitating exercise.

TOBACCO

Tobacco (*Nicotiana tabacum L.* or *Nicotiana rustica L.*) has long been touted for its many medicinal uses. It has been referred to as the "panacea of panaceas" and "one of the God-sent remedies."[28] Native to the Americas, tobacco was introduced to the rest of the world by Columbus. Columbus observed the Native Americans treating their sicknesses with an herb that he had never before seen. Many attribute the disease free state of the pre-explorer Native American to their use of tobacco. As tobacco's popularity spread from the Americas to Europe, its medicinal uses began to be taught in the European medical schools. As one stated, "Anything that harms a man inwardly from his girdle upward might be removed by a moderate use of the herb."[28] This panacean philosophy is further illustrated in the following from Culpeper's text on herbal remedies,[53] originally published in 1653:

> It is found by good experience to be available to expectorate tough plegm from the stomach, chest, and lungs. The juice thereof made into a syrup, or the distilled water of the herb drank with some sugar, or without, if you will, or the smoak taken by a pipe, as

> is usual, but fainting, helps to expel worms from the stomach and belly, and to ease the pains in the head, or megrim, and the griping pains in the bowels. It is profitable for those that are troubled with the stone in the kidneys, both to ease the pains by provoking urine, and also to expel gravel and the stone engendered therein, and hath been found very effectual to expel windiness, and other humours, which cause the strangling of the mother. The seed hereof is very effectual to expel tooth ache, and the ashes of the burnt herb to cleanse the gums, and make teeth white. The herb bruised and applied to the place grieved with the king's evil, helps it in nine or ten days effectually. Monardus saith, it is a counter poison against the biting of any venomous creature, the herb also being outwardly applied to the hurt place. The distilled water is often given with some sugar before the fit of an ague, to lessen it, and take it away in three or four times using. If the distilled fæces of the herb, having been bruised before the distillation, and not distilled dry, be set in warm dung for fourteen days, and afterwards be hung in a bag in a wine cellar, the liquor distills therefrom is singularly good for use for cramps, aches, the gout and sciatica, and to heal itches, scabs, and running ulcers, cankers, and all foul sores whatsoever. The juice is also good for all the said griefs, and likewise to kill lice in children's heads. The green herb bruised and applied to any green wounds, cures any fresh wound or cut whatsoever: and the juice put into old sores, both cleanses and heals them. There is also made hereof a singularly good salve to help imposthumes, hard tumours, and other swellings by blows and falls.

The appropriateness of tobaccos widespread use began to be questioned as early as 1602. Philaretes,[28] publishing under a pseudonym, was the first to write about the harmful effects of the herb. He declared,

> No one remedy could be applied to all maladies any more than one shoe could well serve all men's feet; tobacco purged its users too violently, and it dried up the sperm of a man so that if used over-long the propagation and continuation of mankind must needs be abridged. Tobacco has a stupefying effect, not unlike opium; it increased melancholy greatly and wasted the liquid part of the blood, and more.

One possible reason for tobaccos widespread use was its addictive properties.[28] These views led to the debate known as the London tobacco controversy, which resulted in a ban of tobacco from previous uses in parts of Europe in 1665.[33]

Because of scientific advances, tobacco began to be used more for pleasure than as a medicine during the 1700s. Scientists had discovered the alkaloid nicotine within tobacco. Although no longer trusted as a medicine,[28] many physicians continued to prescribe it because it alleviated pain in cases where there was no known cure. However, by 1860 the majority of the medicinal uses of tobacco had been abandoned due to the addictive properties outweighing the proposed benefits. In modern times, topical application of tobacco as a poultice is still used by sports and herbal medicine practitioners to remove bruising and swelling,[29, 30] but its use is not widespread.

Word of Wisdom

For members of the Church of Jesus Christ of Latter-day Saints (LDS), the medicinal use of tobacco has spiritual underpinnings. On February 27, 1833, Joseph Smith received the revelation known as the Word of Wisdom. Smith received this revelation as he questioned tobacco use by early Church leaders. According to Doctrine and Covenants section 89, verse 8, "... tobacco is not for the body, neither for the belly, and is not good for man, but is an herb for bruises and all sick cattle, to be used with judgment and skill."[54] Interestingly, no further mention of tobacco as an herbal medicine was made by Smith.[55] Francis and Kamieneski,[30] testing the clinical application of tobacco for the treatment of bruises, referenced Doctrine and Covenants section 89, but this is the only additional known reference tying therapeutic tobacco use to Joseph Smith and the LDS church.

Application Methods

There are 5 methods to prepare tobacco as an herbal medicine—infusion, decoction, wash, poultice, and tincture.

- An *infusion* is made by soaking the tobacco leaves in hot water for 10 – 20 minutes; cold infusions are made by soaking the tobacco leaves in cold water for much longer (2 hours to overnight), or by letting a hot infusion sit until cool.[56]
- Simmering the tobacco roots or seeds under low heat makes a *decoction.* Both infusions and decoctions are drunk in tea form.[56]
- A *wash* differs from an infusion or a decoction in that it is applied as an external application, i.e., washed over the affected area.[56]
- A *poultice* is similar to a wash, in that it is externally applied. Poultices are moist pastes made by either beating (mortar and pestle or some other instrument) the fresh leaves to a pulp, or by soaking dried leaves in warm water. The paste is then applied to the affected area, either directly or over a cloth.[56]
- The last preparation method, *tincture*, involves the distillation of the leaves with alcohol, either by soaking it for about two weeks and straining the collected liquid through cheesecloth or by percolation.[56]

Proposed Mechanism of Action

Two different substances within tobacco have been proposed as contributors to the mechanism of action for removing hematomas and swelling, Vitamin K and nicotine. Although the proposed methods will not provide evidence for or against either of these mechanisms, a review is warranted.

Vitamin K.—The term *Vitamin K* is a generic term referring to 2-methyl-1,4-naphthoquinone (I) and all the derivatives of this compound that have an antihemorrhagic effect. It is commonly and correctly referred to as menadione.[57] Two types are important to this review. The Vitamin K homologue present in plants is Vitamin K_1 (2-methyl-3-phytyl-1,4-naphthoquinone (II)), preferably called phylloquinone. The second variation is Vitamin K_2, or menaquinone (menaquinone-7 (MK-7) (III)). Menaquinone is present in animal tissue and bacteria.[57-59] Approximately half the Vitamin K used by the body comes via menaquinone produced in the gut, with the remaining coming through ingestion of food sources containing phylloquinone, such as kale, parsley, spinach, broccoli, and other green leafy vegetables.[57, 60]

Quantification of Vitamin K in Tobacco.—Historically, Vitamin K values were reported only for qualitative purposes, not as absolute values. Many of these values were based on unspecified calculations from chick bioassays and unpublished data.[57] Tobacco falls into this latter category. Unpublished lab notes of Doisy, one of the first scientists to study Vitamin K, indicate Vitamin K levels in tobacco to be around 5,000 μg phylloquinone/100 g of edible portion.[57] To put this in perspective, kale has the highest level of phylloquinone of all vegetables at 817 μg phylloquinone/100 g of edible portion, soybean oil is the highest of nuts, oils, and seeds at 193 μg phylloquinone/100 g of edible portion, and an avocado is the highest of fruits at 40 μg phylloquinone/100 g of edible portion. These levels have been quantified utilizing high pressure liquid chromatography and lipid extraction procedures.[57] There is a need to for similar analysis to be conducted on tobacco to substantiate Doisy's claims.[57]

Pharmacokinetics.—Vitamin K is absorbed and transported via the lymphatic system. The absorption happens in the small and large intestines. The presence of pancreatic juices and bile has been shown to be a necessary component of this absorption. Once in the lymphatic

system, phylloquinone is transported unmodified. Individuals with elevated very low-density lipoproteins (VLDL) have elevated phylloquinone concentrations as well.[57] These elevated VLDL levels aid in the transportation of phylloquinone via the lymphatic system.

No information is available concerning the potential for or mechanism of Vitamin K absorption through the dermis. To gain a greater understanding of how a fat-soluble vitamin like Vitamin K passes through the skin, Vitamin A was reviewed. Retinyl esters are the storage form of Vitamin A in the skin, and retinyl palmitate accounts for the majority of the retinyl esters stored.[61] Retinyl palmitate is highly fat-soluble and requires a micelle carrier to be absorbed,[62] just as vitamin K does.[57] Yan et al.[61] observed that retinyl palmitate rapidly diffused in to the stratum corneum and epidermal layers within 24 hours of topical application. Retinyl palmitate levels were highest in the epidermis, followed by the stratum corneum, then the dermal layer. The level of retinyl palmitate decreased in each of these skin levels over time, but levels remained elevated over control for as long as 18 days.

Pilot Data Results.—In an attempt to determine if Vitamin K did indeed cross the skin from a tobacco poultice or vitamin K cream, a pilot study was conducted on two subjects. On two separate occasions either a tobacco poultice or a commercially marketed vitamin-K cream was applied. Using an indwelling catheter, blood samples were taken at 15-minute intervals for 3 hours. The blood was analyzed for Vitamin K at each interval using high-pressure liquid chromatography following several clean-up steps.[63] Blood levels of Vitamin K never rose above baseline. Even though Vitamin K is structurally similar to Vitamin A, it does not appear to behave the same when absorbed through the skin.

Role in the Clotting Mechanism.—Vitamin K serves two bodily functions, blood clotting and bone health.[58-60] This review will focus solely on blood clotting (see **Figure 2**). The

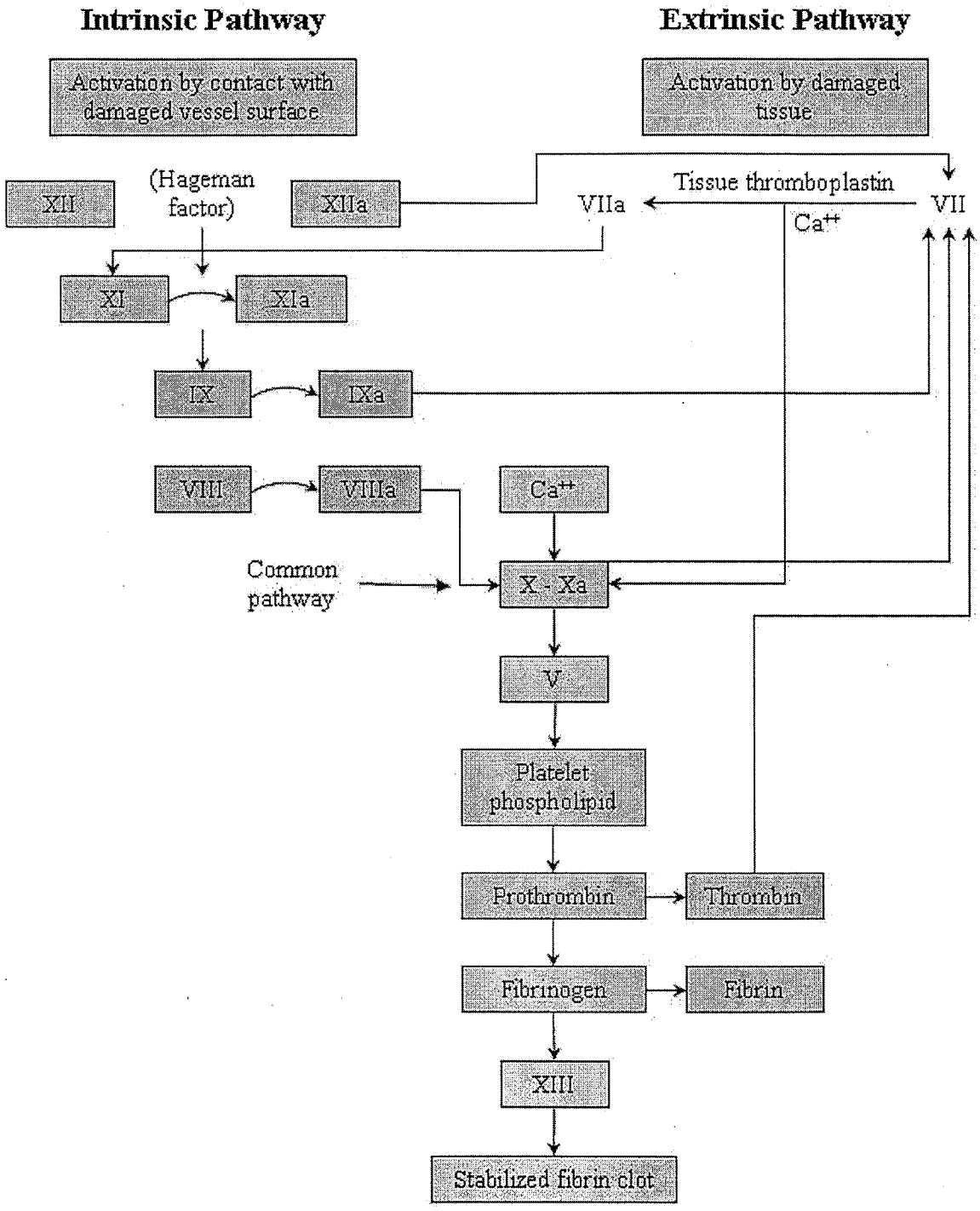

Figure 2. The "cascade" theory of coagulation. Adapted from McCance and Huether.[46]

formation of a blood clot is the result of a series of coordinated enzymatic reactions from two pathways, the intrinsic and extrinsic.[46] The intrinsic pathway is activated when the Hagerman factor (factor XII) comes into contact with the damaged vessel surface. The extrinsic pathway is activated when tissue thromboplastin comes in to contact with the clotting factor serum prothrombin conversion factor (factor VII). The injured endothelial cells release tissue thromboplastin. Both pathways activate factor X, also known as the Stuart-Power factor, which leads to clot formation.[46] Vitamin K is key to the process by binding calcium through the carboxylation of glutamate to γ-carboxyglutamic acid (Gla). This binding is necessary for prothrombin (factor II) and blood factors VII, IX, and X to work properly.[58, 59, 64] Scientists have observed that the presence of additional amounts of Vitamin K are beneficial to bruise resolution,[60, 64-68] while the absence of it is detrimental.[57, 69-72] The role, if any, that Vitamin K plays in the clearing up of a bruise is unknown, since the blood clot is formed within a matter of seconds after the injury has taken place.[46]

Individuals who are on anticoagulant therapy have reacted adversely to the presence of high levels of Vitamin K. Warfarin (Coumadin), one of the main anticoagulants prescribed, acts by inhibiting the synthesis of clotting factors II, VII, IX, and X.[71] As indicated previously, each of these factors are dependant upon Vitamin K for activation; warfarin inhibits the reduction of Vitamin K to its active form, thus stopping the resulting actions of Vitamin K.[57, 70] One case hasbeen reported in which warfarin was found ineffective because the patient was using smokeless tobacco concurrently. The treating physicians proposed that the high levels of Vitamin K introduced to the system through the tobacco use overcame the potent effects of the warfarin. This was substantiated when the individual discontinued smokeless tobacco use and

warfarin entered therapeutic ranges within 1 week. The benefits were reversed when smokeless tobacco use began again a short time later.[73]

Nicotine.—The more common belief concerning the mechanism of action of tobacco poultice is through nicotine absorption (Personal communication with Marv Roberson, November 2006). This theory is based on nicotine being a vasoconstrictor. Nicotine causes the vessels in the area of the injury to constrict, allowing less fluid to move towards free proteins in the interstitial space, resulting in less edema. Key to this theory is the immediate application of a tobacco poultice—putting the poultice on before edema develops. Applying this theory to the removal of hematomas and swelling is problematic as the processes are different (see previous discussion on preventing vs. removal of swelling). Additionally, during pilot work nicotine levels were tested following the application of a tobacco poultice to bruised and normal skin using NicAlert[74] (Nymox Pharmaceutical Corporation, Hasbrouck Heights, NJ) nicotine exposure strips. Results at 8 and 18 hours postapplication were in the 1 – 10 ng/ml range. As the test is considered conclusive for nicotine exposure at 100 ng/ml and above,[74] it is fairly safe to say that little if any nicotine is crossing the skin from a tobacco poultice. This observation would agree with clinical practice, as this researcher has never had a patient report feeling the buzz or nausea that many first-time tobacco users report (Personal communication with Terry Hawkins and Blaine Long, January, 2008). However, as the levels appear to be quite low, the patient may not feel the buzz or nausea, and the nicotine could be metabolized long before the time points measured, with vasoconstriction having taken place.

Other Plants with Similar Properties

Tobacco is not the only herbal remedy used to remove the discoloration and swelling resulting from a bruise. One of the other most commonly used plants is Arnica (A. *montana* L.

or A. *cordifolia*), also known as Leopard's Bane or Mountain Tobacco.[32, 75-78] Some recommend boosting your dietary intake with Vitamin C and K, or applying a cream containing these two vitamins to make yourself less "bruisable."[60, 65, 67, 68, 79-81] A review of selected references produced a list of 90 different plants used to treat bruising and 142 to treat swelling.[29-32, 56, 75-78, 81-83] It is interesting to note that with many of the treatment applications of these herbal medicines, the injured patient is also asked to do other things, such as rest, ice, provide compression, elevate, and stabilize (RICES).[32]

SPORTSWRAP

SportsWrap (Ferris Mfg. Corp., Burr Ridge, IL) is a polymeric (substance that has a molecular structure consisting of a large number of similar units bonded together) membrane (pliable sheet like structure acting as a boundary lining, or partition) created specifically for the management of athletic injuries.[4] SportsWrap is an offshoot of a parent product, PolyMem QuadroFoam (Ferris Mfg. Corp., Burr Ridge, IL), which is a sterile dressing that has been shown to be effective for wound healing.[9, 10, 12-27] The polymeric membrane consists of four ingredients (glycerin, surfactant, starch copolymer, and semipermeable backing) which together create the optimal wound-healing environment.[4] Glycerin provides moisture and comfort. Surfactant cleanses the injured area. The starch copolymer absorbs and holds fluids. The semipermiable film backing protects and serves as a liquid barrier while allowing oxygen and carbon dioxide exchange and vapor transmission.[4] The SportsWrap differs from PolyMem QuadraFoam only in its method of application and size—it is applied as a non-sterile wrap and is considerably longer to allow for circumferential application.

The effectiveness of the SportsWrap and proposed mechanism of action are based on clinical case studies. Numerous human case studies claim reductions in edema, bruising, and pain in a variety of athletic injuries.[7-9, 11-18, 20-27] Although the precise mechanism is unknown, it is believed that the SportsWrap works by inhibiting the action of nociceptors in the skin.[6] By inhibiting the nociceptors, no pain signal is sent to the brain and the inflammatory process is interrupted, resulting in little or no additional bruising and swelling beyond what is caused by the primary injury. This belief does not agree with the secondary injury model discussed previously.[38, 40] Under the guidelines of that model, further damage results from metabolic processes being disrupted, not the presence of pain.

No controlled research studies have been conducted on humans to determine the efficacy of the use of a tobacco poultice or the SportsWrap in an acute or sub-acute injury. Further, few controlled research studies have been conducted to determine the exact mechanism of action for either a tobacco poultice or SportsWrap. Although this research project will not focus on mechanisms, we believe the tennis ball induced bruise discussed next will provide a means to determine the efficacy of a tobacco poultice and the SportsWrap, providing rationale to look further into mechanisms of action.

TRAUMA MECHANISMS

Four trauma mechanisms have been reviewed: bruising induced by a pulsed dye laser, a household vacuum cleaner, paintball, and tennis ball. Each will be discussed in turn below.

Pulsed Dye Laser Induced Bruising

The clinical application of a pulsed dye laser results in bruising. Pulsed dye lasers have been used to treat cutaneous vascular lesions such as port wine stains[66, 84-94] and telangiectasia.[95-

[99] Although the authors primarily discuss the application parameters of a pulsed dye laser, all indicate that the trauma of the procedure caused bruising. Alonso et al.[99] and Shah et al.[65] used a pulsed dye laser induced bruise to study arnica gel and Vitamin K treatments. Initially it was thought this would be a viable option to induce a bruise for this study. Unfortunately, because of the negative outcome of bruising, lasers that do not cause bruising have replaced pulsed dye lasers. A pulsed dye laser is now hard to find.

Vacuum Induced Bruising

Bruising results from the suction of a vacuum. During vacuum extraction assisted childbirth, a subgaleal hematoma will commonly form at the suction site. The bruising and swelling lasts for 2 – 3 days, with no long term side effects (Personal communication with Brent Rich, March 2007). Scientists have also used vacuums to induce bruising.[100] Kovács et al.[100] used a vacuum induced bruise to refute the claims made by Shah et al.[65] that Vitamin K is a beneficial bruise treatment. Petechiae (small red or purple spots caused by bleeding in the skin) were induced on the subjects' forearms using "standard suction for 60 seconds"[100] from a 40 kPa (kilopascal) vacuum (a Pascal is a unit of pressure or stress, expressed in Newton's per square meter[101]). The resultant petechiae were counted and then treated with Vitamin K cream or a placebo. No significant differences were reported on days 1, 2, and 3.[100]

To determine if the vacuum was a viable option for this study similar bruising on a forearm was created, albeit with minimal success. Methods included one, 5-minute application, five, 5-minute applications with 5-minute off periods, and five, 5-minute applications with 5-minute off periods during blood occlusion, as in one of the laser studies.[102] This did not result in the same occurrence of petechiae as reported by Kovács et al.[100] because of insufficient vacuum pressure. In each case a welt formed and in the case of the repeated applications, a small number

of petechiae. When petechiae did present, they lasted less than 24 hours. Email contact with Kovács clarified why the pilot data disagreed with theirs—they used a much more powerful vacuum, one that is not readily available in the United States. Additionally, although petechiae form as a result of the vacuum application, the generalizability of this type of bruising to a bruise resulting from athletic competition is questionable.

Paintball Induced Bruising

Being shot with a paintball gun causes bruising. In an attempt to see if this trauma could be standardized, shots were fired at 3 different body parts (left middle deltoid, right triceps, and left calf) from between 10 and 12 yards. The paintball was fired at a rate of 88.39 m/sec. The desire was to determine which bruised more readily, the upper or lower body, and to determine if being shot directly to the skin created a greater bruise than through clothing.

The results of being shot with a paintball were enlightening. The skin was broken in both instances where the paintball hit the skin directly. This did not happen on the right, shirt-covered triceps. Both sites where the skin was broken hurt considerably more initially and for longer than the third site. Pain on the shirt-covered site was a 5 on a scale of 1 to 10 immediately posttrauma, with no pain within 5 minutes. All 3 sites bruised within the first 12 hours—the upper body bruises were more visible than the lower body one, most likely because the upper body was more pale than the lower body. The bruises resolved in approximately 10 days, but the outline of the paintball on the skin was present more than nine months later. This is not seen as a viable bruising option due to the lasting effects (scarring) and the potential difficulty of getting the Institutional Review Board to approve shooting subjects with a paintball gun.

Tennis Ball Induced Bruising

The fourth method of inducing a bruise investigated was being hit by a tennis ball. In an attempt to standardize the force of the trauma (Personal communication with Ron Hager, April 2007), a study was conducted using a Master Sports SAM Millennium II tennis ball machine (Master Sports, LLC, Fort Wayne, IN). Using the spin function and a groundstroke shot resulting in a speed approximately 31 m/sec (30.84 ± .32 m/sec), a chilled (9 °C) tennis ball was shot at each anterior quad of 10 subjects (5 male and 5 female). Individuals were instructed to relax as much as possible, having their eyes closed so as not to see the ball coming toward them. Digital photographs were taken of the trauma site daily for one week (Monday – Friday), and then every other day for a second week (Monday – Friday). These digital photos were analyzed using Adobe Photoshop for pixel color content (cyan, yellow, magenta, and black). The specifics of this analysis are discussed in the measurements section. Additionally, pain measurements were taken daily using a 100 mm visual analog scale.

The results from being shot with a tennis ball are encouraging. In every instance, bruises formed. **Figure 3** shows the actual color difference (CD) values computed from the change in cyan, yellow, magenta, black, and luminance. For these data points, there was no difference within the groups ($F_{1,6}$=.007, P=.933), but a significant difference between them ($F_{1,6}$=2.738, P=.02). This difference can be attributed to the difference on Day 2, variance that cannot be explained. Further, using variance component estimates, the reliability coefficient was calculated using both Type I Sum of Squares ANOVA and Restricted Maximum Likelihood Estimation, equaling 1. This means that the variances in the right and left leg did not differ in relationship to each other over the time points studied. Additionally, although pain scores were moderately high initially (58.3 ± 22.1), they dropped considerably in the first 5 minutes (9.3 ±

16.5) and were nearly nonexistent after 10 minutes (1.7 ± 2.7), as reported on a 100 mm visual analog scale. In fact, after the 30-minute reporting period immediately after being hit, only one subject reported feeling any sort of pain for the remainder of the follow-up period. Lastly, in two separate individuals, function was not affected by the bruising protocol. Neither knee flexion range of motion or single-leg leg press repetitions to exhaustion were decreased after being hit with the ball (ROM before – 127°/°126, 3 days post – 131°/133°, 5 days post – 130°/129°; repetitions before – 12/7, 3 days post – 12/11, 5 days post 13/8).

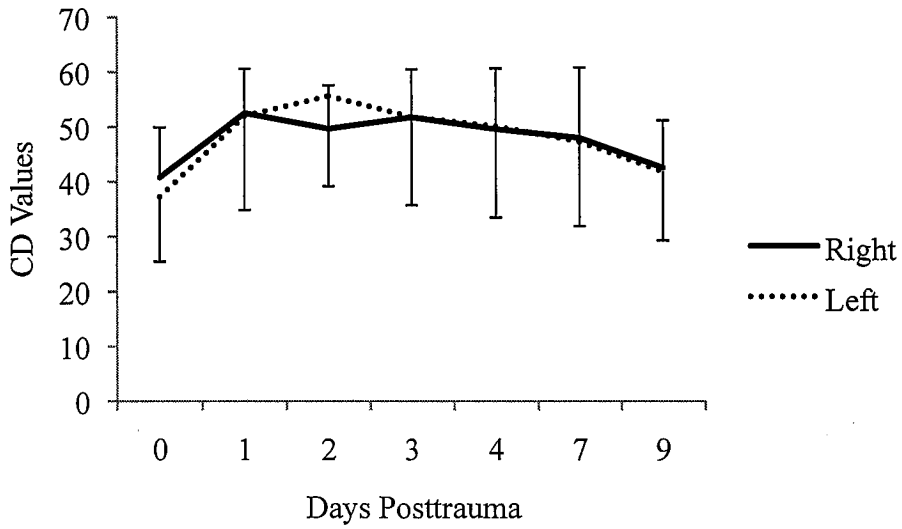

Figure 3. Actual CD values as computed by Photoshop. The legs differed between each other but variances were highly correlated.

This method of bruising is advantageous for 3 reasons. First, the size of the bruise is sufficient to be readily identified and quantified. Second, the pain was minimal. After the initial sting of being hit wore off (less than 5 minutes), subjects felt little pain. Third, a bruise formed in this manner is generalizable to sport.

MEASUREMENTS

Evaluation of bruise healing has traditionally been a subjective process. Researchers of the effects of Vitamin K on bruising resulting from pulsed dye lasers used visual analogue scales, photographs, and percentage scales to rate the color and/or presence of the bruise.[65, 67] The visual analogue scales and percentage scales were filled out by the patient and a medical professional, whereas the photographs were taken only for record purposes.[65, 67] These methods are too subjective, however.

Pixel Analysis

In an attempt to move past the subjective to an objective measure of healing, Hopkins et al.[103] utilized image-measurement software (Professional Version; Bersoft Inc, Ottawa, ON, Canada) to chart the healing of abrasions treated with laser therapy. Healing was computed by a decrease in wound size utilizing the automatic area-measurement component of the software. Wound boundaries were determined by pixels within a specific color range. The total pixels within that range determined wound area. Additionally, chromatic red (changes in wound color as it progresses from dark red to pink) and luminance (homogeneity of the tissue – becoming more smooth and consistent) were calculated to objectively measure wound healing. Chromatic red decreases and luminance increases as a wound heals. Changes in mean red (R), green (G), and blue (B) values as compared to uninjured tissue demonstrated the injured skin was returning to normal.[103, 104] The following formulas were used for this purpose:

$$\text{Chromatic red} = (100 \times R)/(R + G + B)$$

$$\text{Luminance} = (R + G + B)/3$$

Even though considerable time was spent investigating this method, it was determined that it does not work well with bruises. First, the color change as a bruise heals does not follow

the same pattern as an abrasion, i.e., from dark red to pink. Rather, a bruise progresses from red-purple, to blue-black, and gradually changing to yellow-brown or green.[46] This progression more closely aligns with cyan, yellow, and magenta.[34] Second, with a bruise the surface tissue is not disrupted, so luminance has no real value as a dependent variable. It appears that these conclusions correspond well with those of Hopkins et al.[103] Chromatic red and luminance were not good indicators of healing for abrasions either.

A more appropriate and accurate method to objectively measure healing in a bruise is presented by Seeley et al.[34] Using image-measurement software (Adobe Photoshop; Adobe Systems Incorporated, San Jose, CA) similar to previous studies,[103, 104] Seeley et al. analyzed different colors to study bruise treatments. From pre and postsurgery digital images, a control area (unbruised tissue) and the study area (bruised tissue) were outlined. The histogram function within Adobe Photoshop computed the mean values of cyan (C), yellow (Y), magenta (M), black (K), and luminosity (L: degree of lightness of the composite color) for both areas. These values were entered in to a formula for color difference (CD), where:

$$CD = (\Delta C^2 + \Delta Y^2 + \Delta M^2 + \Delta K^2 + \Delta L^2)^{½}$$

The resultant value of CD is unitless, representing a difference in two colors, i.e., the difference between the study area and the control area. It is possible to ascertain the degree of bruising by subtracting the pretrauma value from the posttrauma value. By introducing a treatment this value will give us an indication of treatment effect as well.[34]

Realtime Ultrasound and Laser Doppler Imaging

Additional dependent variables were investigated during pilot work, namely realtime ultrasound and Laser Doppler imaging. Realtime or rehabilitative ultrasound imaging (Logiq P5, GE Medical System, Milwaukee, WI) has been used previously to measure muscle tissue

thickness.[105] If this method can pick up these minute changes in muscle tissue thickness, it was hypothesized that perhaps it could quantify any swelling that resulted from the trauma. Data collection did not support this thought. The "swelling" values obtained from daily measurements at the same location revealed little variation from day to day (SD range from .01 to .07; within legs $F_{1,60}$=.674, P=.415, between legs $F_{6,60}$=.120, P=.994). Although there may be potential to use realtime ultrasound imaging at some future point, it appears that as used we have only obtained very accurate skinfold measurements.

Laser Doppler imaging provided little additional data beyond that of the image measurement software. Bruise boundaries can be identified easily with Laser Doppler, but not any more easily than with the image measurement software. One advantage of the Laser Doppler is the ability to determine blood flow to the area.[106] Using a bruise of unknown origin, we obtained an image with the Laser Doppler, which revealed decreased blood flow to the bruised area. Because blood flow in bruises has not been studied before, the importance or relevance of this needs to be addressed in future research.

Chapter 3

METHODS

This study will be a randomized controlled, blinded study. A 4 x 6 design will be followed. The independent variables are treatment (cryotherapy with compression, the SportsWrap, a tobacco poultice, and compression wrap), which is a within subjects variable, and Day (0, 2, 4, 6, 8, 10), which is a between subjects variable. The dependent variable will be bruise color difference (CD). The bruise color will be determined using image measurement software from pictures taken on the specified days. The CD value will be computed following the formula discussed previously, with the treated leg bruise serving as the bruised area and the non-treated leg bruise serving as the control area.

Subjects and Procedures

Sixty-four apparently healthy college-aged males (18 – 30 years old) will be recruited for participation via classroom announcement, flyer, and via word of mouth. This study will be limited to males due to variations in bruising witnessed in females during prior studies. Before participating in the study, participants will affirm that they can participate by being free from all conditions and medications specified on the exclusion criteria document. Each participant meeting these criteria will be informed of the methods, risks, and benefits of the investigation, and will give informed consent by signing an Institutional Review Board approved consent form.

Each participant will be shot with a tennis ball on both anterior thighs and followed for 10 days as indicated previously. The 64 subjects will be randomly assigned to four, 16-subject groups. Groups will be treated with either cryotherapy and compression, the SportsWrap, a tobacco poultice, or a compression wrap alone immediately posttrauma on a randomly assigned

bruise. The random assignment of treatment bruise will be blocked for leg dominance and for leg hit first. The nontreated bruise will serve as control.

Physical activity will be tracked as a control variable. All individuals will fill out an exercise log each time they report. They will be asked to not perform any activities beyond activities of daily living during the length of study participation as activity affects healing. The logs will serve as a method to ensure compliance with this control.

Bruising Protocol.—Each participant will report to 123 RB on a Tuesday. They will report having shaven their leg hair with hair clippers no less than 24 hours but not greater than 48 hours prior to arrival. During that session they will voluntarily give written informed consent and fill out a preparticipation questionnaire. If the participant answers "no" to all of the questions, they will be cleared for participation. An affirmative answer to any question but the last one will preclude them from participating. Answers to the last question will be cleared through the involved physicians prior to participation. Additionally, they will fill out an exercise log for all exercise they have done for the 24 hours prior to reporting.

The quadriceps on both legs will be used for measurement. In order to ensure the ball is hitting their legs in the correct spot, the participant will stand on a platform, 18 inches directly in front of the ball machine. The spot on the front of the legs where the ball will hit will be marked with a small pen mark. A digital photograph will be taken of the marked spot on each leg. This image will serve as the baseline measurement to quantify the progression of the bruise. Following the taking of the digital picture, the participant will be hit in the mid-thigh by a tennis ball coming from a tennis ball machine at approximately 31 m/sec, one leg after the other. The order of the hits will be determined randomly. Due to the nature of this research, participants will be asked not to treat the bruises in any way other than instructed, including the taking of

pain medications. In the event that pain is unbearable or the formed bruises are believed to be excessive, subjects will be asked to contact researchers immediately for further evaluation and treatment of the injury. Since no previous test subjects suffered from an appreciable amount of pain after the first few minutes, or bruised excessively, it is not believed this will be an issue. If treatment is received, the participant will be removed from the study. Additionally, if treatment is sought and received outside of what is provided, the participant will assume all costs associated with that treatment.

Acute Care Treatment.—The purpose of this study is to determine the efficacy of 4 therapeutic modalities on an acute injury. Five minutes following being hit by the tennis ball in the second leg, the specified bruise will be treated with either a 1 kg crushed-ice bag secured by a double length 4" elastic wrap, a 4" x 24" SportsWrap, a tobacco poultice secured by a double length 4" elastic wrap, or a double length 4" elastic wrap. The time lag is meant to replicate clinical practice—a few minutes are needed to perform an evaluation, remove equipment, etc. prior to beginning the treatment. Following the application of the therapeutic modality, all participants will lie down on a treatment table, with the treated leg elevated for 30 minutes.[3] After 30 minutes, the cryotherapy and compression group will have the ice bag removed, and compression will be reapplied. They will be sent home with 4 additional ice bags and instructed to apply ice and compression for 30 minutes every two hours until they go to bed. Those who are selected to receive the SportsWrap or compression alone, as well as those in the cryotherapy and compression and the tobacco poultice groups who have reached the compression alone phase, will be instructed to wear the SportsWrap or compression at all times, except when bathing,[4] until they return for their next picture on Thursday. The following procedures will be followed for making and applying the tobacco poultice for those assigned to that group:

- Place a handful of leaf tobacco (Red Man Chewing Tobacco, Pinkerton Tobacco Co LP, Owensboro, KY) into a 500 ml beaker
- Add tap water heated in the microwave for 30 seconds on high to just above the tobacco level and let soak for 4 minutes
- Drain water
- Spread the moistened tobacco leaves on piece of Cramer-roll, absorptive side up, about 1 cm thick
- When the tobacco is cool to the touch, apply the poultice to the leg and secure it with a double length 4" elastic wrap
- Leave poultice in place until showering the following morning, but no less than 12 hours
- After removing the tobacco poultice, cleanse the area with soap and water and reapply the elastic wrap until they return for their next picture on Thursday

To ensure compliance with these specific instructions, as well as to ensure compliance with preparticipation questionnaire items, care instructions will be sent home with each participant. Space will be provided to indicate when ice bags were applied, ace wraps and tobacco poultices removed, and the like. These instructions will also specify the individual is not to spend time sunbathing or participating in other outdoor type activities with the bruised area exposed. Doing this could change the color of the surrounding skin, making the CD values obsolete. Additionally, the instructions will reiterate the importance of not participating in activities beyond activities of daily living.

Pictures and Picture Analysis.—All pictures will be taken and analyzed in the same way. Subjects will report to 123 RB for each picture. Standing on the same box they were bruised on, a picture of each bruise will be taken from 18 inches away. The floor location for

both the box and the camera tripod will be marked on the floor to control for variability in the pictures. The bruised area will be illuminated with artificial light (Lowel Omni Light, Brooklyn, NY); pictures will be taken the height of the bruise using a digital camera (Canon Powershot SD600, Lake Success, NY), zoomed to capacity. These images will be downloaded on to a computer (iBook G4, Apple, Cupertino, CA) and analyzed using Adobe Photoshop CS3, Version 10.0.1 (Adobe Systems Inc., San Jose, CA). Specific picture analysis will go as follows:

- Open the picture
- Click on Rectangular Marquee Tool
- Set Style to Fixed Size
- Change Width and Height to 2400 pixels
- Center created box over bruise area
- Under Edit tab, click Copy
- Under File tab, click New
- Change color mode to 16 Bit CMYK, background to Transparent, and name the new picture according to record keeping guidelines
- Click OK
- Under Edit tab, click Paste
- Open the histogram function, clear the history, and record the specific values of cyan, yellow, magenta, black, and luminance in an Excel file (note—history will have to be cleared again for the luminance value)

To blind this analysis, two independent raters will follow the above procedures with each picture, with the exception of the last two bullet points. The values for cyan, yellow, magenta,

black, and luminosity will be averaged for the treated and non-treated bruises and the resultant value of CD will be computed.

Statistical Analysis

To date, no one has investigated the efficacy of different treatments on an induced bruise. The model to be used was developed for this purpose, and the basis for statistical analysis is based off data from the model development. The standard deviation for all of the CD values computed during model development was 10.81. Using this value as our guide, a $\beta = 0.2$ and an alpha = 0.05, it was determined that 16 subjects will be needed per treatment group in order to observe a one standard deviation difference in treatments.

One, 4 x 6 ANOVA will be performed. The independent variable day (0 = before trauma and 2, 4, 6, 8, and 10 days post trauma) will be a repeated measures factor, allowing for a test for trend. The test of trend will determine if the trend for the four modalities is convex curvilinear and if a difference exists between those trends on the specified days. The second independent variable will be treatment (cryotherapy and compression, SportsWrap, tobacco poultice, and compression alone). Tukey post hoc analysis will be employed to determine these differences. In both cases the dependent variable is color difference. Alpha level will be set at 0.05.

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Appendix B

Additional Methods

Table B 2. SPSS command file for the correlations of the four colors and luminosity for each leg

```
GET DATE
        /TYPE=XLS
        /FILE='C:\Documents and Settings\Jeremy Hawkins\My Documents\Dissertation
        2\Normalized\
Correlations.xls'
        /SHEET=name '1-4'
        /CELLRANGE=full
        /READNAMES=on
        /ASSUMEDSTRWIDTH=32767.
DATASET NAME DataSet1 WINDOW=FRONT.
CORRELATIONS
        /VARIABLE=C1 C2
        /PRINT=TWOTAIL NOSIG
        /STATISTICS DESCRIPTIVES
        /MISSING=PAIRWISE.
CORRELATIONS
        /VARIABLE=M1 M2
        /PRINT=TWOTAIL NOSIG
        /STATISTICS DESCRIPTIVES
        /MISSING=PAIRWISE.
CORRELATIONS
        /VARIABLE=Y1 Y2
        /PRINT=TWOTAIL NOSIG
        /STATISTICS DESCRIPTIVES
        /MISSING=PAIRWISE.
CORRELATIONS
        /VARIABLE=K1 K2
        /PRINT=TWOTAIL NOSIG
        /STATISTICS DESCRIPTIVES
        /MISSING=PAIRWISE.
CORRELATIONS
        /VARIABLE=L1 L2
        /PRINT=TWOTAIL NOSIG
        /STATISTICS DESCRIPTIVES
        /MISSING=PAIRWISE.
```

Table B 2. Continued

```
CORRELATIONS
        /VARIABLE=C3 C4
        /PRINT=TWOTAIL NOSIG
        /STATISTICS DESCRIPTIVES
        /MISSING=PAIRWISE.
CORRELATIONS
        /VARIABLE=M3 M4
        /PRINT=TWOTAIL NOSIG
        /STATISTICS DESCRIPTIVES
        /MISSING=PAIRWISE.
CORRELATIONS
        /VARIABLE=Y3 Y4
        /PRINT=TWOTAIL NOSIG
        /STATISTICS DESCRIPTIVES
        /MISSING=PAIRWISE.
CORRELATIONS
        /VARIABLE=K3 K4
        /PRINT=TWOTAIL NOSIG
        /STATISTICS DESCRIPTIVES
        /MISSING=PAIRWISE.
CORRELATIONS
        /VARIABLE=L3 L4
        /PRINT=TWOTAIL NOSIG
        /STATISTICS DESCRIPTIVES
        /MISSING=PAIRWISE.
```

Table B 3. SPSS command file for one way ANOVA of descriptive statistics

```
ONEWAY HTcm Wtkg Age BY Tx
        /STATISTICS DESCRIPTIVES
        /MISSING ANALYSIS.
```

Table B 4. SPSS command file for mixed model ANOVA for color difference with treatment as the dependent variable[a]

```
GLM TCD0 CCD0 TCD2 CCD2 TCD4 CCD4 TCD6 CCD6 TCD8 CCD8 TCD10
CCD10 BY Tx
        /WSFACTOR=Day 6 Polynomial Limb 2 Polynomial
        /METHOD=SSTYPE (3)
        /EMMEANS=TABLES (OVERALL)
        /EMMEANS=TABLES (Tx) COMPARE ADJ (BONFERRONI)
        /EMMEANS=TABLES (Day) COMPARE ADJ (BONFERRONI)
        /EMMEANS=TABLES (Limb) COMPARE ADJ (BONFERRONI)
        /EMMEANS=TABLES (Tx*Day)
        /EMMEANS=TABLES (Tx*Limb)
        /EMMEANS=TABLES (Day*Limb)
        /EMMEANS=TABLES (Tx*Day*Limb)
        /PRINT=DESCRIPTIVES
        /CRITERIA=ALPHA (.05)
        /WSDESIGN=Day Limb Day*Limb
        /DESIGN=Tx.
```

[a]Procedures were completed for each of the colors and luminosity with their respective data sets.

Table B 5. SPSS command file for mixed model ANOVA for color difference with exercise as the dependent variable[a]

```
GLM TCD0 CCD0 TCD2 CCD2 TCD4 CCD4 TCD6 CCD6 TCD8 CCD8 TCD10
CCD10 BY Exer
        /WSFACTOR=Day 6 Polynomial Limb 2 Polynomial
        /METHOD=SSTYPE (3)
        /POSTHOC=Exer (TUKEY)
        /EMMEANS=TABLES (OVERALL)
        /EMMEANS=TABLES (Exer) COMPARE ADJ (BONFERRONI)
        /EMMEANS=TABLES (Day) COMPARE ADJ (BONFERRONI)
        /EMMEANS=TABLES (Limb) COMPARE ADJ (BONFERRONI)
        /EMMEANS=TABLES (Exer*Day)
        /EMMEANS=TABLES (Exer*Limb)
        /EMMEANS=TABLES (Day*Limb)
        /EMMEANS=TABLES (Exer*Day*Limb)
        /PRINT=DESCRIPTIVES
        /CRITERIA=ALPHA (.05)
        /WSDESIGN=Day Limb Day*Limb
        /DESIGN=Exer.
```

[a]Procedures were completed for each of the colors and luminosity with their respective data sets.

Table B 6. SPSS command file for mixed model ANOVA for color difference using area under the curve values[a]

```
GLM TxAUC ConAUC BY Tx
        /WSFACTOR=limb 2 Polynomisl
        /METHOD=SSTYPE (3)
        /POSTHOC=Tx (TUKEY)
        /EMMEANS=TABLES (OVERALL)
        /EMMEANS=TABLES (Tx)
        /EMMEANS=TABLES (limb)
        /EMMEANS=TABLES (Tx*limb)
        /PRINT=DESCRIPTIVE
        /CRITERIA=ALPHA (.05)
        /WSDESIGN=limb
        /DESIGN=Tx.
```

[a]Procedures were completed for each of the colors and luminosity with their respective data sets.

Figure B 1. IRB Application

COMPARISON OF 4 THERAPEUTIC MODALITIES FOR THE ACUTE TREATMENT OF AN INDUCED BRUISE

---

1. **Specific Aims and Hypotheses**

The purpose of this study is to compare four different treatments (ice with compression, compression alone, the SportsWrap, and a tobacco poultice) of an induced bruise to determine the efficacy of their use. Ice with compression represents the gold standard for acute care. The SportsWrap and a tobacco poultice are touted as being effective, yet are unproven. Compression alone serves to balance out the other three treatments, as each of them have compression involved for an extended period of time. Based off of clinical experience and anecdotal evidence, the following hypotheses will be tested:

- The curvilinear trend will not be the same for the various modalities.
  a. The color difference trend for the cryotherapy and compression treatment will greater than the trend for the other modalities.
  b. The color difference trend for the SportsWrap and tobacco poultice will not be significantly different from each other, but will be greater than the trend for compression alone.

2. **Background and Significance**

There is a lack of evidence to support the use of the 4 therapeutic modalities we will evaluate. Cryotherapy, or the therapeutic application of cold, is used clinically as the gold standard for treating acute soft-tissue injury. The best meta-analysis concerning the clinical relevance of cryotherapy included only 22 studies from 1966 to 2002 which used

randomized control trials to evaluate the effectiveness of cryotherapy to treat acute soft-tissue injury in humans.[1] Of these 22 studies, no subjects suffered from contusions or strains, and only 5 had an acute ligament sprain, injuries seen on a daily basis in sports medicine. The remaining studies used subjects recovering from various surgical techniques. Dependent variables included pain, swelling, and range of motion, but nearly half of the studies failed to provide sufficient data to calculate effect size for any of these outcome measures. The following conclusions were made: 1) there was minimal evidence that ice plus exercise was most effective, both after an ankle sprain and post surgery, 2) little evidence to support the use of ice with compression, a mainstay in the commonly prescribed RICES (Rest, Ice, Compression, Elevation, and Stabilization), and 3) there is a lack of evidence of an optimal mode and duration for cryotherapy treatment.[1]

Similarly, the cutaneous applications of the SportsWrap[2] and a tobacco poultice are touted as effective alternatives to intermittent compression devices and manual techniques for the removal of hematomas and edema. Both products remain untested for acute care however. Numerous human case studies support the use of the SportsWrap and its parent product PolyMem QuadraFoam, showing promising evidence for their use to remove bruising and swelling (3-day old grade II ankle sprain[3]), limiting bruising and swelling formation (recovery from arthroscopic knee surgery[3-6]), as well as facilitating wound healing.[7-17] Likewise, many cultures have used tobacco to remove bruising and swelling since the late 1400's.[18-22] Only one controlled study has been conducted studying the effectiveness of a tobacco poultice, and it was conducted on rats.[23]

The non-scientific evidence for using these two products is compelling, but controlled research is needed to add credibility to their use. To date, it is unknown what

is within these two products that leads to the aforementioned benefits. Further, no one knows how the benefits of these two products compare to the gold standard of cryotherapy and compression. It is our hope that by using a reproducible controlled injury model, we can provide evidence to support the use or disuse of the SportsWrap/tobacco poultice, as well as begin to form a hypothesis concerning a potential mechanism of action.

3. **Description of Subjects**

Sixty-four apparently healthy, college aged males (18 – 30 years old) will be recruited for participation via classroom announcement, flyer, and via word of mouth. This study will be limited to males due to variations in bruising witnessed in females during pilot studies. Prior to participating in the study, subjects will affirm that they can participate by being free from all conditions and medications specified on the attached exclusion criteria document. Each subject meeting these criteria will be informed of the methods, risks, and benefits of the investigation, and will give informed consent by signing an Institutional Review Board approved consent form.

4. **Confidentiality**

All information provided will remain confidential and will only be reported as group data with no identifying information. All data will be kept in a locked cabinet and only those directly involved with the research will have access to them.

5. **Method or Procedures**

Subject participation will span 2 weeks, for a total of approximately 1.5 hours. On Tuesday of the first week subjects will report to 123 RB for approximately 45 minutes. Thursday and Saturday of that week and on Monday, Wednesday, and Friday of

the following week they will return to 123 RB for about 5 minutes each day to have a photograph taken of the bruise and to fill out the activity log. Additional time may be needed outside of in lab time to care for the bruise, dependent upon bruise treatment assignment. This additional time should not be more than 15 minutes per day the 2 days the treatment is in place.

Each participant will report to 123 RB on a Tuesday. They will report having shaven their leg hair with hair clippers no less than 24 hours but not greater than 48 hours prior to arriving. This will allow for greater clarity of the photographs and will enhance the ability to pick up color change with bruising. During that session they will voluntarily give written informed consent and fill out a pre-participation questionnaire. If the participant answers "no" to all of the questions, they will be cleared for participation. An affirmative answer to any question but the last one will preclude them from participating. Answers to the last question will be cleared through the involved physicians prior to participation. Additionally, they will fill out an exercise log for all exercise they have done for the 24 hours prior to reporting.

The quadriceps on both legs will be used for measurement. In order to ensure the ball is hitting their legs in the correct spot, the participant will stand on a platform, 18 inches directly in front of the ball machine. The spot on the front of the legs where the ball will hit will be marked with a small pen mark. A digital photograph will be taken of the marked spot on each leg. This image will serve as the baseline measurement to quantify the progression of the bruise. Following the taking of the digital picture, the participant will be hit in the mid-thigh by a tennis ball coming from a tennis ball machine at approximately 31 m/sec, one leg after the other. Protection will be provided to ensure

subjects will not be hit in the groin area by having them hold a 24" tall x 16" W x 4" thick pad. The order of the hits will be determined randomly. On the subsequent days (Thursday and Saturday of week 1 and Monday, Wednesday, and Friday of week 2) the subjects will report to 123 RB at the same time of day for approximately 5 minutes to have a digital photograph taken and to fill out an activity log.

The purpose of this study is to determine the efficacy of 4 therapeutic modalities on an acute injury. Five minutes following being hit by the tennis ball in the second leg, one randomly assigned bruise will be treated with either a 1 kg crushed ice bag secured by a double length 4" elastic wrap, a 4" x 24" SportsWrap, a tobacco poultice secured by a double length 4" elastic wrap, or a double length 4" elastic wrap. The other leg will go untreated, serving as a control. Following the application of the therapeutic modality, subjects will lie down on a treatment table, with the treated leg elevated for 30 minutes. After 30 minutes, the ice and compression group will have the ice bag removed, and compression will be reapplied. This group, as well as the SportsWrap and compression alone groups, will wear the SportsWrap or compression at all times, except when bathing, until they return for their next picture on Thursday. The tobacco poultice group will follow the same procedures, but will keep the poultice on for 12-hours, then reapply the compression.

Because of the nature of this research, subjects will be asked to not treat this injury in any way other than how we treated them or take any medication that will impact the extent of the injury (see attached Follow Up Care Instructions sheet). Additionally, we will ask them to not participate in any activities beyond activities of daily living as increased activity changes healing rates. In the event that they feel that the pain is

unbearable or the bruise excessive, they will be instructed to contact Jeremy Hawkins or Ken Knight immediately for further evaluation and treatment of the injury. If treatment is received, either from the investigators or an outside source, or if a subject fails to make a picture appointment, the subjects will be removed from the study and will not receive the remaining portion of their homorarium. Additionally, if treatment is received outside of what we can provide, subjects will assume all costs associated with that treatment.

6. **Data Analysis**

All pictures will be taken and analyzed in the same way. Subjects will report to 123 RB for each picture. Standing on the same box they were bruised on, pictures will be taken of each bruise from 18 inches away. The floor location for both the box and the camera tripod will be marked on the floor to control for variability in the pictures. Pictures will be taken the height of the bruise using a digital camera, zoomed to capacity. These images will be downloaded on to a computer and analyzed by two independent raters using Adobe Photoshop CS3. The averaged values for cyan, yellow, magenta, black, and luminosity for the bruised and control areas will be used to compute the resultant value of X, the dependent variable.

One, 4 x 6 ANOVA will be performed. The independent variable day (0 = before trauma and 2, 4, 6, 8, and 10 days post trauma) will be a repeated measures factor, allowing for a test for trend. The test of trend will determine if the trend for the four modalities is convex curvilinear and if a difference exists between those trends on the specified days. The second independent variable will be treatment (cryotherapy and compression, SportsWrap, tobacco poultice, and compression alone). Tukey post hoc

analysis will be employed to determine these differences. In both cases the dependent variable is color difference. Alpha level will be set at 0.05.

7. **Risks**

By participating in this study the subject will be hit with a tennis ball and it will hurt initially. No pilot subjects have reported any adverse effects or discomforts, beyond the coldness of the ice, while the therapeutic modalities were applied.

8. **Benefits**

There are no direct benefits to research subjects. Gaining a greater understanding of the therapeutic modalities used to treat acute injuries could have incalculable benefits. If we are better able to treat injuries, the length of time the physically active are out of sport can be decreased. We will also be able to begin to answer questions concerning how these modalities work, not just whether or not they do.

9. **Compensation**

Participants will receive $30 cash for completing the 2-week session. $10 will be paid at the time of bruising and the remaining $20 at the completion of the study. They will only receive the initial $10 if they complete only part of the study.

10. **References**

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8. Benskin L. Activation of a Stalled Traumatic Finger Wound with Silver Polymeric Membrane Dressing. Paper presented at: 20th Annual Clinical Symposium on Advances in Skin & Wound Care, 2005; Las Vegas NV.
9. Benskin L. Crush Injury Treated with Polymeric Membrane Dressings Until Complete Wound Closure. Paper presented at: 21st Annual Clinical Symposium on Advances in Skin & Wound Care, 2006; Orlando FL.
10. Benskin L. Full-Thickness Laceration Treated with Polymeric Membrane Dressings until Complete Wound Closure. Paper presented at: 38th Annual WOCN Society Conference, 2006; Minneapolis MN.
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13. Ricciardo L. Complete Pain Relief Using Polymeric Membrane Dressings to Treat a Category III Skin Tear to Complete Closure. Paper presented at: The WOCN Society's 39th Annual Conference, 2007; Salt Lake City UT.
14. Sessions RC, Barnes L. Full-Thickness Chin Wound Healed in 14 Days Using Only Polymeric Membrane Dressings. Paper presented at: 19th Annual Symposium on Advanced Wound Care (SAWC), 2006; San Antonio TX.
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16. Stamps J. Traumatic Wound with Exposed Tendons Prepared for Grafting with Extra-Thick Polymeric Membrane Dressings. Paper presented at: The WOCN Society's 39th Annual Conference, 2007; Salt Lake City UT.
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22. Valori L. Medicinal Tobacco in the 16th and 17th Centuries. *Minerva Farmaceutica.* 1964;13:41-44.
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11. **Qualifications**

- Jeremy Hawkins, MS, ATC, is a 4th year doctoral student with 7 years of clinical experience, is a licensed athletic trainer in the State of Utah, and has conducted therapeutic modality research for 4 years.
- Kenneth L. Knight, PhD, ATC, LAT, has 25 years of clinical experience, is a licensed athletic trainer in the State of Utah, has 35 years of experience in therapeutic modality research, and is the author of a therapeutic modalities text, and the definitive book on cryotherapy.
- Allen Parcell, PhD, is an exercise physiologist with extensive background in how muscles respond to changes in normal function.
- David Kaiser, PhD, ATC, has several years of clinical experience and is a licensed athletic trainer in the State of Utah.
- Matt Seeley, PhD, ATC, is a biomechanist and athletic trainer with background in how the body motion changes due to various perturbations.
- Richard Sudweeks, PhD, has an extensive background in research design and statistical analysis.
- Brent Rich, MD, ATC is a board certified family physician with an additional certification in Sports Medicine, currently serves as one of BYU's team physicians, and has been practicing medicine for 20 years.

Figure B 2. IRB Approval Letter

INSTITUTIONAL REVIEW BOARD FOR
HUMAN SUBJECTS

May 21, 2008

Jeremy Hawkins
249A SFH
Campus Mail

Re: *Comparison of 4 Therapeutic Modalities for the Acute Treatment of an Induced Bruise*

Dear Jeremy,

This is to inform you that Brigham Young University's IRB has approved the above research study.

The approval period is from **5/21/2008 to 4/30/2009. Your study number is F08-0146. Please be sure to reference this number in any correspondence with the IRB.**

Continued approval is conditional upon your compliance with the following requirements:

- A copy of the **Informed Consent Document**, approved as of **5/21/2008** is enclosed. No other consent form should be used. It must be signed by each subject prior to initiation of any protocol procedures. In addition, each subject must be given a copy of the signed consent form.
- All protocol amendments and changes to approved research must be submitted to the IRB and not be implemented until approved by the IRB.
- **The enclosed recruitment advertisement has been approved.** Advertisements, letters, Internet postings and any other media for subject recruitment must be submitted to IRB and approved prior to use.
- A few months before this date we will send out a continuing review form. There will only be two reminders. Please fill this form out in a timely manner to ensure that there is not a lapse in your approval.

If you have any questions, please do not hesitate to call me.

Sincerely,

Christopher Dromey, PhD, Chair
Sandee M.P. Muñoz, Administrator
Institutional Review Board for Human Subjects
CD/se
Enclosures

BRIGHAM YOUNG UNIVERSITY · A-285 ASB · PROVO, UTAH 84602
(801) 422-3841 / FAX: (801) 422-0620

Figure B 3. Recruitment Flyer

RESEARCH SUBJECTS NEEDED

64 males are needed to take part in a research study testing the effectiveness of various treatments on an acute injury

What do you get to do?

You will be shot by a tennis ball in the front of your leg and get bruised!

What do you get out of it?

$30 plus a really good conversation starter

If interested, contact Jeremy Hawkins
(2-4776, jeremy_hawkins@byu.edu)

APPROVED EXPIRES
MAY 2 1 2008 - APR 0 2 2009

Figure B 4. Informed Consent Form

Informed Consent to be a Research Subject

Title: Comparison of 4 Therapeutic Modalities for the Acute Treatment of an Induced Bruise

INTRODUCTION
Jeremy Hawkins, Ken Knight, Allen Parcell, David Kaiser, Matt Seeley, and Richard Sudweeks of BYU and Dr. Brent Rich of Utah Valley Sports Medicine are conducting this research. Our purpose is to compare four different treatments (ice with compression, compression alone, the SportsWrap, and a tobacco poultice) of an induced bruise to determine the efficacy of their use. Greater understanding of these product's therapeutic application will increase the standard of care following an acute injury. You were asked to participate because you met all inclusion criteria.

PROCEDURES
Your participation in lab will span 2 weeks, for a total of approximately 1.5 hours. On Tuesday of the first week you will report to 123 RB for approximately 45 minutes. Thursday and Saturday of that week and on Monday, Wednesday, and Friday of the following week you will return to 123 RB for about 5 minutes each day to have a photograph of the bruise taken and to fill out the activity log. Additional time may be needed outside of in lab time to care for the bruise, dependent upon bruise treatment assignment. This additional time should not be more than 15 minutes per day the 2 days the treatment is in place.

Your involvement in this study will include being hit with a tennis ball on the front of each leg, thrown from a tennis ball machine. A small pen mark will be placed on your leg where the ball will hit. A digital photograph will be taken of the marked spot, to serve as baseline data. After the photograph has been taken, you will return to the platform 18 inches in front of the ball machine, where you will be hit in the front of each leg by a tennis ball coming from a tennis ball machine at approximately 70 miles per hour. Protection will be provided to ensure you will not be hit in the groin area by having you hold a 24" tall x 16" W x 4" thick pad. On the subsequent days (Thursday and Saturday of week 1 and Monday, Wednesday, and Friday of week 2) you will report to 123 RB at the same time each day for approximately 5 minutes to have a digital photograph taken and to fill out an activity log.

The objective of this study is to determine the efficacy of 4 therapeutic modalities on an acute injury. Five minutes following being hit by the tennis ball in the second leg, one of your bruises will be treated with either a 1 kg crushed ice bag secured by a double length 4" elastic wrap, a 4" x 24" SportsWrap, a tobacco poultice secured by a double length 4" elastic wrap, or a double length 4" elastic wrap. Which modality you will receive will be determined randomly. The other leg will go untreated, serving as a control. Following the application of the therapeutic modality, you will lie down on a treatment table, with the treated leg elevated for 30 minutes. After 30 minutes, the ice and compression group will have the ice bag removed, and compression will be reapplied. If you are in this group, or the SportsWrap or compression alone groups, you will wear the SportsWrap or compression at all times, except when bathing or participating in other water related activities, until you return for your next picture on Thursday. If you are a member of the tobacco poultice group, you will follow the same procedures, but will keep the poultice on for 12-hours. After 12 hours, you will remove the poultice, clean the area with soap and water, and reapply the compression wrap.

Because of the nature of this research, we would ask that you not treat this injury other than how we treat you or take any medication that will impact the extent of the injury (see attached Follow Up Care Instructions sheet). In the event that you feel the pain is unbearable or the bruise is excessive, please contact Jeremy Hawkins or Ken Knight immediately for further evaluation and treatment of the injury. If treatment is received, either from the investigators or an outside source, you will be removed from the study and will not receive the remaining portion of your honorarium. Additionally, if the treatment is received outside of what we can provide, you will assume all costs associated with that treatment.

RISKS/DISCOMFORTS
By participating in this study you will be hit with a tennis ball. The hit will hurt and will result in a bruise.

APPROVED EXPIRES
MAY 0 4 2008 - APR 0 3 2009

Figure B 4. Continued

BENEFITS
There are no direct benefits to you. However, your participation will help us gain a greater understanding of the efficacy of different methods to treat acute sport related injuries.

CONFIDENTIALITY
All information provided will remain confidential and will only be reported as group data with no identifying information. All data will be kept in a locked cabinet and only those directly involved with the research will have access to them.

COMPENSATION
You will receive $30 cash for completing the 2-week session. $10 will be paid at the time of bruising and the remaining $20 at the completion of the study. You will only receive the initial $10 if you complete only part of the study.

PARTICIPATION
Participation in this research study is voluntary. You have the right to withdraw at anytime or refuse to participate entirely without jeopardy to your class status, grade or standing with the university. As investigators, we reserve the right to discontinue your participation if you fail to comply with all procedures discussed herein.

QUESTIONS ABOUT THE RESEARCH
If you have questions regarding this study, you may contact Jeremy Hawkins at 422-4776, 249A SFH, jeremy_hawkins@byu.edu, or Ken Knight, PhD at 422-2984, 271 SFH, ken_knight@byu.edu.

QUESTIONS ABOUT YOUR RIGHTS AS A RESEARCH PARTICIPANT
If you have questions you do not feel comfortable asking the researchers, you may contact Christopher Dromey, PhD, IRB Chair, 133 TLRB, 422-6461, christopher_dromey@byu.edu.

CONSENT

I have read, understood, and received a copy of the above consent and desire of my own free will to participate in this study.

_____ _____
Participant Signature Date

_____ _____
Primary Investigator Date

APPROVED EXPIRES
MAY 2 1 2008 - APR 0 2 2009

Figure B 5. Pre-participation Questionnaire

COMPARISON OF 4 THERAPEUTIC MODALITIES FOR THE ACUTE TREATMENT OF AN INDUCED BRUISE
PRE-PARTICIPATION QUESTIONNAIRE

Name: _____

Answer each of the following questions.

Do you currently have, or have you ever had, any of the following medical conditions that inhibit platelet function or clotting function, including, but not limited to:

- Hemophelia Y☐ N☐
- Protein C or S deficiency Y☐ N☐
- Anti-thrombin III deficiency Y☐ N☐
- Factor V leiden mutation Y☐ N☐
- Prothrombin gene mutation Y☐ N☐
- von Willibrand disease Y☐ N☐

Do you have a history of, or a family history of:

- Deep vein thrombosis Y☐ N☐
- Pulmonary embolism Y☐ N☐
- Coronary artery disease Y☐ N☐

Are you currently using, or have you used during the time period specified with the medication, any of the following medications that affect coagulation?

- Any non-steroidal anti-inflammatory medication within the last 2-3 days
  - eg. Advil, Motrin, Aleve Y☐ N☐
- Aspirin within the last 7-10 days Y☐ N☐
- Coumadin Y☐ N☐
- Lovenox Y☐ N☐
- Heparin Y☐ N☐
- Plavix Y☐ N☐
- Aggrenox Y☐ N☐
- Reopro Y☐ N☐
- Integrilin Y☐ N☐
- Aggrastat Y☐ N☐
- Fragmin Y☐ N☐
- Orgaran Y☐ N☐
- Innohep Y☐ N☐
- Agrylin Y☐ N☐
- Pletal Y☐ N☐
- Ticlid Y☐ N☐
- Arixtra Y☐ N☐
- Any thrombolytic medication Y☐ N☐

Are you currently taking any other medications? Y☐ N☐

If yes, please specify: _____

Figure B 6. Log of Participation

COMPARISON OF 4 THERAPEUTIC MODALITIES FOR THE ACUTE TREATMENT OF AN INDUCED BRUISE
SUBJECT DEMOGRAPHICS AND ACTIVITY LOG

Subject Name: _____ Subject #: _____
Height: _____ Weight: _____ Age: _____ Box Height: _____
Dominant limb: _____ Limb hit first: D ND Treated limb: D ND
Treatment: IC C TP SW

	Cardiovascular Activities								Resistance Training							
	Intensity			Duration					Intensity			Duration				
Day/wk	L	M	H	<30	30-60	60-90	90-120	>120	L	M	H	<30	30-60	60-90	90-120	>120
M1																
T1																
W1																
Th1																
F1																
Sa1																
Su1																
M2																
T2																
W2																
Th2																
F2																

Time modality applied: _____

Ice group: Time 2nd bag applied: _____ 3rd bag: _____ 4th bag: _____ 5th bag: _____

Tobacco poultice group: Time tobacco poultice removed: _____

All groups
Indicate when and for how long the compression wrap was removed

Occurrence 1 From _____ to _____ on _____ (day of the week)
Occurrence 2 From _____ to _____ on _____ (day of the week)
Occurrence 3 From _____ to _____ on _____ (day of the week)
Occurrence 4 From _____ to _____ on _____ (day of the week)
Occurrence 5 From _____ to _____ on _____ (day of the week)

Figure B 7. Follow Up Care Sheet

COMPARISON OF 4 THERAPEUTIC MODALITIES FOR THE ACUTE TREATMENT OF AN INDUCED BRUISE
FOLLOW UP CARE INSTRUCTION SHEET

Because of the nature of this research, we would ask that you not treat this injury with ice or heat, nor take any medication that will impact the extent of the injury, including:

- Any non-steroidal anti-inflammatory medication (e.g. Advil, Aleve, Motrin)
- Aspirin
- Acetaminophen (e.g. Tylenol)
- Coumadin
- Lovenox
- Heparin
- Plavix
- Aggrenox
- Reopro
- Integrilin
- Aggrastat
- Fragmin
- Orgaran
- Innohep
- Agrylin
- Pletal
- Ticlid
- Arixtra
- Any thrombolytic medication

Additionally, do not participate in any outdoor activities with the bruised area exposed. The potential tanning that will occur will make the baseline readings obsolete. Keep the wrap on at all times except when bathing. If you are in the tobacco poultice group, remove the poultice when you shower the next morning, but no less than 12 hours after application, cleanse the area with soap and water, then reapply the wrap until returning on Thursday.

In the event that you feel the pain is unbearable or the bruise is excessive, or you have any questions, please contact Jeremy Hawkins (422-4776, 249A SFH, jeremy_hawkins@byu.edu) or Ken Knight (422-2984, 271 SFH, ken_knight@byu.edu) immediately for an evaluation, treatment, or answers.

Figure B 8. Reimbursement Form

RESEARCH SUBJECT PAYMENT VERIFICATION

Name: _____

BYU ID: _____

Mailing address: _____

_____

Phone number: _____

Amount paid: $30.00

Account #: 20333103-6100-28505

Research Project Name: Comparison of 4 Therapeutic Modalities for the Acute Treatment of an Induced Bruise

Brief Description of what the Research Subject did:

Subject reported to the Therapeutic Modalities Laboratory in 123 RB to be shot twice with a tennis ball. They returned to the modalities lab for 2 weeks every other day to have a picture taken of the resulting bruises. Total participation spanned 2 weeks totaling approximately 1 hour. Subjects were paid $10 on the initial visit and $20 on the last day of data collection.

$10 received: _____ Date: _____

$20 received: _____ Date: _____

Figure B 9. Group Randomization Sheet

1 = cryotherapy and compression 2 = compression alone
3 = tobacco poultice 4 = SportsWrap

Subject #	Treatment	Tx Leg	Hit Order	Ball #
1, 33	1	Dom	Dom	16
2, 34	1	Dom	Non-dom	15
3, 35	1	Non-dom	Dom	14
4, 36	1	Non-dom	Non-dom	13
5, 37	2.1	Dom	Dom	12
6, 38	2.2	Dom	Non-dom	11
7, 39	2.3	Non-dom	Dom	10
8, 40	2.4	Non-dom	Non-dom	9
9, 41	3.1	Dom	Dom	8
10, 42	3.2	Dom	Non-dom	7
11, 43	3.3	Non-dom	Dom	6
12, 44	3.4	Non-dom	Non-dom	5
13, 45	4	Dom	Dom	4
14, 46	4	Dom	Non-dom	3
15, 47	4	Non-dom	Dom	2
16, 48	4	Non-dom	Non-dom	1
17, 49	1	Dom	Dom	16
18, 50	1	Dom	Non-dom	15
19, 51	1	Non-dom	Dom	14
20, 52	1	Non-dom	Non-dom	13
21, 53	2.1	Dom	Dom	12
22, 54	2.2	Dom	Non-dom	11
23, 55	2.3	Non-dom	Dom	10
24, 56	2.4	Non-dom	Non-dom	9
25, 57	3.1	Dom	Dom	8
26, 58	3.2	Dom	Non-dom	7
27, 59	3.3	Non-dom	Dom	6
28, 60	3.4	Non-dom	Non-dom	5
29, 61	4	Dom	Dom	4
30, 62	4	Dom	Non-dom	3
31, 63	4	Non-dom	Dom	2
32, 64	4	Non-dom	Non-dom	1

Figure B 10. Fulton Chair Application for Funding, Supplies

Mary Lou Fulton Chair for the College of Health and Human Performance Application Form

(Please be concise, but use as much space as needed for your answers.)

1. What is the desired outcome of your activity, research, or service? (Purpose)

The purpose of this study is to compare two different treatments of a sport-induced bruise to determine the mechanism of action of the treatments and the efficacy of their use.

2. What category of the funding does this program address? (Refer to Guidelines)

   6. Athletic Training
   16. Mentored Student Learning
   17. Human Performance Research Center

3. Describe project, research, etc.: (What are the activities, methodologies, etc. leading to the intended outcomes)

Background and Significance

In a revelation dated February 27, 1833, Joseph Smith was told, "...tobacco is not for the body neither for the belly, and is not good for man, but is an herb for bruises and all sick cattle, to be used with judgment and skill." The use of tobacco to treat bruises was not a new concept proposed to Smith. Many cultures have used it for this purpose since the late 1400's. Sports and herbal medicine practitioners continue to use tobacco in the form of a poultice to treat bruising and swelling, although the mechanism by which it works is presently unknown. Proposed mechanisms have included the body absorbing vitamin K from the poultice, which influences the clotting mechanisms, as well as nicotine absorption, causing localized vasoconstriction. Initial pilot work has refuted both of these claims, but data was collected in healthy normals. We don't know what happens in an injured population.

The manufacturers of PolyMem QuadraFoam™ dressings, a relatively new product on the market, also claim their product has bruise resolution properties. According to their product brochure, "Human case studies have revealed dramatic reductions in edema, ecchymosis (bruising) and pain in a wide array of athletic injuries." Although currently unproven, the manufacturers claim that the makeup of the Quadrafoam (glycerin, surfactant, starch copolymer, with a semipermeable film backing) leads to these outcomes. We question whether the mechanism of action for the tobacco poultice and the PolyMem QuadraFoam™ dressings are the same, i.e., the vitamin K in the tobacco and the starch copolymer in the PolyMem QuadraFoam™ both absorb fluid at the bruise site, resulting in bruise resolution. If either of these treatments are more effective than

ice alone, we will be learn more about the mechanism of action and the efficacy of the treatments.

Methods and Procedures

Twenty apparently healthy college aged students (18 – 30 years old) will be recruited for participation. Total participation will span 8 weeks, divided in to three, 2-week sessions, separated by one week. During the first week of each session the participant will report to 123 RB on a Monday for approximately 45 minutes. Tuesday through Friday of that week and on Monday, Wednesday, and Friday of the following week the participant will return to 123 RB for about 10 minutes each day. Time commitment for the second and third sessions will be the same as the first.

On Monday of the first week of each session, the participant will report to 123 RB. During session one they will voluntarily give written informed consent and fill out a pre-participation questionnaire. If the participant answers "no" to all of the questions, they will be cleared for participation. All measurements will be taken on the left leg. In order to ensure the ball will hit the lower hamstring, the participant will stand on a platform, 18 inches directly in front of the ball machine, and the spot on the back of the leg where the ball will hit will be marked with a small pen mark.

A digital photograph and an ultrasound image will be taken of the marked spot prior to being hit. These two images will serve as a baseline to quantify the progression of the bruise. After the pre-hit images are taken, the participant will return to the platform where they will be hit in the back of the leg by a tennis ball coming from a tennis ball machine at approximately 70 miles/hour (31 m/s). A second digital photograph and ultrasound image will be taken of the trauma site immediately after being hit. An ice bag will then be applied for 30 minutes with compression.

On the subsequent days (Tuesday – Friday of week 1 and Monday, Wednesday, and Friday of week 2) the participant will report to 123 RB to have a digital photograph and ultrasound image taken. Additionally, 48 hours after being hit with the tennis ball, i.e., Wednesday of week 1, the subjects will receive 1 of 3 treatments, assigned randomly: no additional treatment, a tobacco poultice, or the PolyMem QuadraFoam™ dressing. The tobacco poultice will be worn for 12-hours and then be removed. The same procedures will be repeated 72 hours after being hit, i.e., on Thursday. During this time subjects will also be asked to check nicotine absorption via saliva or urine samples at 6 and 12 hours after poultice application. The PolyMem QuadraFoam™ dressing will likewise be applied 48 hours after being hit, but will be worn continuously, except while bathing, until the subject reports on Friday (for 48 hours). The differences in application reflect current clinical practice. Session two and three will be exactly the same as session one, including being hit in the left leg, except they will receive a treatment not previously received.

Because of the nature of this research, the participants will be asked to not treat this injury with ice beyond what we provide, heat, or take any medication that will impact the extent of the injury. In the event that the pain is unbearable or the formed bruise is believed to be excessive, we will ask them to contact Jeremy Hawkins or Dr. Knight immediately for further evaluation and treatment of the injury. Because no pilot subjects suffered from an appreciable amount of pain after the first few minutes or bruised

excessively, we do not believe this will be an issue. If treatment is received, the participant will be removed from the study and will not be paid for their participation. Additionally, if treatment is sought outside of what we provide, the participant will assume all costs associated with that treatment.

4. How will you measure your outcome(s)? What are the indicators of success?

Our outcomes will be measured using digital pictures and diagnostic ultrasound images. This project will be a success if clarity is added to the mechanism of action and the efficacy of these two products.

5. Who is the target audience? Whom does the program serve?

This project is targeted toward and serves the sports medicine community, the general medical community dealing with acute injury, as well as professional development. Greater understanding of the treatment of acute soft-tissue injuries will enable injured patients to return to physical activity more quickly. Additionally, the three undergraduate students listed in item #6 are interested in future sports medicine careers, medically and academically. Their involvement with this project will help them develop their careers by providing an initial research experience.

6. Names of all participants:

Jeremy Hawkins
Ken Knight – Faculty advisor
David Kaiser – Health Advisement Center
Allen Parcell – Department of Exercise Sciences
Robert Davidson – Department of Nutrition and Dietetics
Richard Sudweeks – Department of Instructional Psychology and Technology
Brent Rich, MD – IHC
David Cassat, MD – IHC
Christian Millward, MD – IHC
Adam Foster – Undergraduate student
Kelby Hofheins – Undergraduate student
Clayton Pratt – Undergraduate student

7. Detail of budget and how the funds will be used: Please be specific.

Payment of subjects for bruising: $100/subject x 20 subjects =	$2,000
NicAlert Nicotine test strips: $11/strip x 50 strips =	$550
RedMan leaf tobacco: $3.50/package x 12 packages/case x 4 cases =	$168
Total	$2,718

8. List other possible or confirmed sources of funding and specify whether other pending applications overlap, duplicate, or supplement this request.

No other sources of funding are currently being sought.

9. Person responsible for disbursement and accountability of funds:

   Ken Knight

10. Provide a timeline for the completion of the program:

    Data collection will begin around December 1, 2007 and will be completed by June 15, 2008.

11. What is the intended impact of this program?
    a. Please describe the significance of the research, service or activity.

    In order for these products to enjoy a more widespread usage, clinical evidence must support the relevance and efficacy of such. Anecdotally we have observed the positive effects of both a tobacco poultice and the PolyMem QuadraFoam™ dressing. Determining how these products work will potentially translate in to more effective care of acute soft-tissue injury and quicker return to physical activity.

    b. Because the Fultons have asked us to give them feedback in terms of the number of people whose lives are being touched by their gift, we also ask that you provide in the spaces below your best estimate of the numbers of people who will be directly and indirectly impacted by your project—numerals only (i.e., "10,000"—not "thousands").

Direct:	25,000	Indirect:	50,000,000

12. Who will be responsible to submit the final report immediately after completion? (Due date is one month after the end of your timeline specified above.)

    Jeremy Hawkins

13. Who will write a thank you letter to the donor immediately after completion?

    Jeremy Hawkins

Figure B 11. Fulton Chair Application for Funding, Subjects

Mary Lou Fulton Chair for the College of Health and Human Performance Application Form

(Please be concise, but use as much space as needed for your answers.)

1. What is the desired outcome of your activity, research, or service? (Purpose)

The purpose of this study is to compare four different treatments (ice with compression, compression alone, the SportsWrap, and a tobacco poultice) of an induced bruise to determine the efficacy of their use.

2. Explain how this project correlates with the expected learning outcomes of the participating students' academic program(s).

This project is the culminating project of my doctoral program. As such, this project fulfills the following expected learning outcomes (*italics*) for a PhD in Physical Medicine and Rehabilitation:

- *Students will be engaged in ongoing clinically related research. Students will be prepared to present their data at professional meetings and publish their findings in professional journals.* I plan on submitting the outcome of my dissertation for consideration in the Journal of Athletic Training and for presentation at the National Athletic Trainers' Association annual meeting.
- *Students will be prepared to mentor students in clinically related research.* Two undergraduate students will serve as research assistants for this project, one from exercise science and on from athletic training. In that way, additional expected learning outcomes are fulfilled for them as well.
- *Students will be prepared to develop internal and external grants for research funding.* By applying for this grant as well as the grant previously obtained from the Fulton Endowment and Ferris Mfg. Corp., I have/am fulfilling this expected learning outcome.

3. Describe your project, research, etc.: (What are the activities, methodologies, etc. leading to the intended results?)

Each participant will report to 123 RB on a Tuesday. They will report having shaven their leg hair with hair clippers no less than 24 hours but not greater than 48 hours prior to arriving. This will allow for greater clarity of the photographs and will enhance the ability to pick up color change with bruising. During that session they will voluntarily give written informed consent and fill out a pre-participation questionnaire. Additionally, they will fill out an exercise log for all exercise they have done for the 24 hours prior to reporting.

The quadriceps on both legs will be used for measurement. In order to ensure the ball is hitting their legs in the correct spot, the participant will stand on a platform, 18 inches directly in front of the ball machine. The spot on the front of the legs where the ball will hit will be marked with a small pen mark. A digital photograph will be taken of the marked spot on each leg. This image will serve as the baseline measurement to quantify the progression of the bruise. Following the taking of the digital picture, the participant will be hit in the mid-thigh by a tennis ball coming from a tennis ball machine at approximately 70 mph, one leg after the other. The order of the hits will be determined randomly. On the subsequent days (Thursday and Saturday of week 1 and Monday, Wednesday, and Friday of week 2) the subjects will report to 123 RB at the same time of day for approximately 5 minutes to have a digital photograph taken and to fill out an activity log.
The purpose of this study is to determine the efficacy of 4 therapeutic modalities on an acute injury. Five minutes following being hit by the tennis ball in the second leg, a randomly assigned bruise will be treated with either a 1 kg crushed ice bag secured by a double length 4" elastic wrap, a 4" x 24" SportsWrap, a tobacco poultice secured by a double length 4" elastic wrap, or a double length 4" elastic wrap. Following the application of the therapeutic modality, subjects will lie down on a treatment table, with the treated leg elevated for 30 minutes. After 30 minutes, the ice and compression group will have the ice bag removed, and compression will be reapplied. This group, as well as the SportsWrap and compression alone groups, will wear the SportsWrap or compression at all times, except when bathing, until they return for their next picture on Thursday. The tobacco poultice group will follow the same procedures, but will keep the poultice on for 12-hours, then reapply the compression.

4. How will you measure your results? What are the indicators of success?

Digital pictures of the resultant bruises will all be taken and analyzed in the same way. Subjects will report to 123 RB for each picture. Standing on the same box they were bruised on, pictures will be taken of each bruise from 18 inches away. Pictures will be taken the height of the bruise using a digital camera, zoomed to capacity. These images will be downloaded on to a computer and analyzed by two independent raters using Adobe Photoshop CS3. The averaged values for cyan, yellow, magenta, black, and luminosity for the bruised and control areas will be used to compute color difference (CD), the dependent variable. This project will be considered a success if we are able to see a difference in bruising color dependent upon the treatment the participant received.

5. Who will benefit from this project?

I will benefit the most from this project as it will enable me to graduate. Other beneficiaries will be the two undergraduate students who will help with the research project as well as future clinicians and patients whose practice habits will change as a result of the studies findings.

a. List the names of all direct participants.

Jeremy Hawkins, Lacey Lyman, Joe Shurtz – Data collection involvement
Ken Knight, Allen Parcel, Matt Seeley, David Kaiser, Richard Sudweeks – doctoral committee

b. Enter here your best estimate of the number of people who will be indirectly affected by your project (numerals only, i.e., 10,000—not thousands).

15,000

6. Budget detail: Please list budget items in priority order, in case only partial funding is available.

80 subjects x $30 per subject = $2,400.00

7. List all other sources of funding for which you have applied and the status of those requests. If pending, how will a successful outcome affect your need for Fulton funds?

I was previously awarded $1,359 from the Fulton Endowment. I will use this money to pay for two independent raters ($500 each) to evaluate the pictures taken. The remaining $359 will be used to purchase supplies—ace wraps, tobacco, lighting needs, etc. Additionally, I wrote a grant for funding to the Ferris Mfg. Corp. requesting them to cover part of the expenses. They are the maker of the SportsWrap. I have received $500 in funding from them. This money will be used for transportation costs associated with the collection and presentation of the data. Lastly, I have obtained verbal commitment from the Department of Exercise Sciences to cover the cost of paying research subjects in the event this grant is not funded.

8. Provide a timeline for the completion of the project:

Obtain Institutional Board Approval – May 1, 2008
Begin data collection – May 13, 2008
End data collection – August 31, 2008

Figure B 12. Agreement to Conduct Research – Ferris Mfg. Corp.

2 April 2008

Memo: Agreement to conduct research

Ferris Mfg. Corp.—

In accordance to prior arrangements, please accept this memo as documentation concerning research that I will perform at Brigham Young University using the SportsWrap. As part of this agreement, Ferris Mfg. Corp. agrees to contribute $1,000 for procurement of supplies and to pay research subjects. This contribution will be paid via a check made out to Brigham Young University, sent to the address below. Additionally, they will provide 16, 4" x 24" SportsWraps to use for data collection. I will conduct the research using the bruise injury model that I have developed and retain rights to publish the data regardless of the outcome of the study.

Jeremy Hawkins, MS, ATC
249A Smith Field House
Provo UT 84602

Appendix C

Additional Results

Table C 1. Table of Tables and Figures of Additional Methods

Figures

Table C 2. Overview of activities performed by the 20 participants who exercised. The intensity and duration values go hand in hand (e.g. on T1 (Tuesday of Week 1), two individuals performed cardiovascular activities at a low intensity, one for < 30 minutes and the other for 30 – 60 minutes).

	Cardiovascular Activities								Resistance Training							
	Intensity			Duration					Intensity			Duration				
Day/wk	L	M	H	<30	30-60	60-90	90-120	>120	L	M	H	<30	30-60	60-90	90-120	>120
M1																
T1	2			1	1				1			1				
W1	1	1			2				1			1				
Th1	1			1					1			1				
F1	1				1					1		1				
Sa1	2	4		2	1	2		1	1			1				
Su1																
M2	2			2					1			1				
T2	2			1	1											
W2	1	2		1	2				1			1				
Th2	2	2		3	1											
F2																

Table C 3. Raw data

Subject 1 Right

	Lacey					Joe					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	195.88	98.81	33.95	232.61	110.63	195.56	97.29	31.61	231.43	109.04	203.56	108.99	35.14	239.48	122.14	194.45	98.99	37.52	232.55	110.26	9.11	10.00	-2.38	6.93	11.88	19.43
3.1	201.10	90.55	34.79	236.18	109.16	201.14	91.85	36.40	236.52	110.20	201.12	91.20	35.60	236.35	109.68	208.92	106.67	53.22	246.4	127.19	-7.80	-15.47	-17.63	-10.05	-17.51	31.91
5.1	196.83	93.08	30.54	232.25	107.09	197.28	93.69	30.97	233.32	107.95	197.06	93.39	30.76	232.79	107.52	202.65	105.44	46.45	242.2	121.74	-5.60	-12.06	-15.70	-9.41	-14.22	26.72
7.1	199.66	111.95	43.83	240.67	123.62	199.12	108.75	40.54	238.97	120.60	199.39	110.35	42.19	239.82	122.11	203.11	115.21	51.09	244.66	129.13	-3.72	-4.86	-8.91	-4.84	-7.02	13.76
9.1	197.92	101.27	36.10	236.09	114.18	195.93	94.97	29.66	231.42	107.58	196.93	98.12	32.88	233.76	110.88	199.56	104.26	39.52	238.86	117.83	-2.63	-6.14	-6.64	-5.11	-6.95	12.77
11.1	198.16	100.93	37.76	236.28	114.28	198.52	100.93	37.34	236.74	114.51	198.34	100.93	37.55	236.51	114.40	200.86	104.93	42.04	240.37	119.54	-2.52	-4.00	-4.49	-3.86	-5.15	9.16

Subject 1 Left

	Lacey					Joe					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	195.44	90.33	30.07	230.08	104.11	194.74	88.39	27.92	228.41	101.99	204.51	109.66	40.58	239.72	123.65	198.7	89.47	30.7	233.95	106.16	5.81	20.19	9.88	5.77	17.49	29.63
3.2	206.49	120.61	55.28	245.73	134.59	206.50	120.95	55.65	245.87	134.89	206.50	120.78	55.47	245.80	134.74	211.38	123.52	63.95	250.63	140.92	-4.88	-2.74	-8.49	-4.83	-6.18	12.84
5.2	198.60	102.09	35.61	235.97	115.01	197.91	100.85	34.64	234.68	113.51	198.26	101.47	35.13	235.33	114.26	199.94	99.16	36.6	237.89	114.32	-1.69	2.31	-1.48	-2.57	-0.06	4.12
7.2	199.46	106.42	38.60	239.01	119.09	199.70	107.10	39.56	239.49	119.84	199.58	106.76	39.08	239.25	119.47	204.58	109.67	49.61	244.73	126.24	-5.00	-2.91	-10.53	-5.48	-6.77	14.84
9.2	199.15	100.10	34.39	236.02	113.89	199.59	101.07	35.27	236.77	114.99	199.37	100.59	34.83	236.40	114.44	206.58	111.77	50.68	246.21	128.92	-7.21	-11.19	-15.85	-9.82	-14.48	27.10
11.2	197.69	99.21	35.43	235.45	112.52	196.85	96.30	32.42	233.37	109.53	197.27	97.76	33.93	234.41	111.03	201.09	98.85	39.6	238.96	115.32	-3.82	-1.10	-5.68	-4.55	-4.29	9.34

Subject 2 Right

	Lacey					Joe					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	211.55	120.69	38.67	247.53	135.23	212.84	125.19	42.79	248.78	139.44	212.20	122.94	40.73	248.16	137.34	215.34	134.69	52.39	252.29	148.30	-3.15	-11.75	-11.66	-4.13	-10.97	20.52
3.1	213.79	121.94	42.84	249.07	137.89	212.72	116.67	37.87	247.71	133.38	213.26	119.31	40.36	248.39	135.64	215.17	127.7	50.75	251.77	143.66	-1.91	-8.40	-10.40	-3.38	-8.03	16.06
5.1	204.96	119.17	31.21	244.36	130.00	206.40	123.80	35.11	246.40	134.61	205.68	121.49	33.16	245.38	132.31	207.24	125.76	40.73	248.5	137.28	-1.56	-4.28	-7.57	-3.12	-4.97	10.61
7.1	205.93	120.02	34.38	245.63	131.62	205.96	118.97	33.32	245.37	130.82	205.95	119.50	33.85	245.50	131.22	207.44	122.06	39.14	248	134.76	-1.50	-2.57	-5.29	-2.50	-3.54	7.46
9.1	196.81	97.79	17.32	233.01	108.73	196.97	98.26	17.75	233.34	109.22	196.89	98.03	17.54	233.18	108.98	198.04	96.33	16.49	234.76	108.77	-1.15	1.70	1.05	-1.58	0.20	2.80
11.1	199.99	100.57	20.83	236.82	113.30	201.20	103.92	23.78	238.90	116.77	200.60	102.25	22.31	237.86	115.04	201.8	100.91	23.55	239.54	115.34	-1.21	1.34	-1.25	-1.68	-0.31	2.77

Subject 2 Left

	Lacey					Joe					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	214.28	130.92	53.24	251.03	145.30	211.73	121.19	44.82	248.56	136.80	213.01	126.06	49.03	249.80	141.05	214.28	127.69	50.17	251.3	143.11	-1.28	-1.64	-1.14	-1.51	-2.06	3.48
3.2	211.20	119.74	42.13	249.05	135.56	212.30	122.41	43.38	249.75	137.88	211.75	121.08	42.76	249.40	136.72	214.42	121.15	47.73	250.96	138.86	-2.67	-0.08	-4.97	-1.56	-2.14	6.24
5.2	201.56	105.50	23.24	240.07	118.12	201.65	105.70	23.49	240.21	118.35	201.61	105.60	23.37	240.14	118.24	202.98	106.48	31.7	242.07	120.77	-1.37	-0.88	-8.34	-1.93	-2.54	9.07
7.2	201.55	100.73	24.56	239.19	115.14	201.54	100.71	24.51	239.17	115.28	201.55	100.72	24.54	239.18	115.21	203.33	103.78	32.15	241.76	119.30	-1.79	-3.06	-7.62	-2.58	-4.09	9.69
9.2	198.32	99.02	21.49	235.63	111.28	198.58	99.61	22.03	236.07	111.93	198.45	99.32	21.76	235.85	111.61	201.19	106.24	31.3	240.52	119.34	-2.74	-6.93	-9.54	-4.67	-7.74	15.10
11.2	198.24	97.72	21.00	235.11	110.29	198.49	98.03	21.15	235.45	110.70	198.37	97.88	21.08	235.28	110.50	201.24	97.99	24.96	238.43	113.16	-2.88	-0.11	-3.89	-3.15	-2.66	6.36

Table C 3. Continued

Subject 3 Right

	Lacey					Joe					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	204.04	98.27	30.36	239.36	115.62	203.88	97.41	29.50	239.03	114.85	203.96	97.84	29.93	239.20	115.24	210.32	113.73	45.02	248.22	131.66	-6.36	-15.89	-15.09	-9.03	-16.43	29.53
3.1	204.13	94.78	23.84	238.95	112.72	205.25	98.19	27.07	240.69	116.06	204.69	96.49	25.46	239.82	114.39	208.48	104.98	37.76	245.92	124.1	-3.79	-8.50	-12.31	-6.10	-9.71	19.22
5.1	200.69	95.83	20.03	236.29	110.44	198.89	90.90	15.55	232.87	105.51	199.79	93.37	17.79	234.58	107.98	203.86	104.13	31.71	241.97	119.79	-4.07	-10.77	-13.92	-7.39	-11.82	22.81
7.1	202.78	84.40	17.85	234.32	104.21	203.20	85.70	18.87	235.14	105.48	202.99	85.05	18.36	234.73	104.85	207.14	91.42	27.39	242.43	113.22	-4.15	-6.37	-9.03	-7.70	-8.38	16.39
9.1	205.64	92.88	22.73	239.99	112.31	206.52	94.75	24.68	241.23	114.48	206.08	93.82	23.71	240.61	113.40	208.29	98.07	30.51	244.42	118.63	-2.21	-4.26	-6.81	-3.81	-5.23	10.55
11.1	202.07	100.68	24.26	237.67	115.10	202.80	102.73	26.15	238.93	117.19	202.44	101.71	25.21	238.30	116.15	203.47	102.58	27.6	241.36	118.06	-1.04	-0.87	-2.40	-3.06	-1.92	4.54

Subject 3 Left

	Lacey					Joe					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	198.29	85.74	18.84	231.87	102.14	198.21	85.54	18.38	231.71	101.90	198.25	85.64	18.61	231.79	102.02	199.49	81.12	13.02	232.4	99.5	-1.24	4.52	5.59	-0.61	2.52	7.74
3.2	206.30	85.56	24.38	240.24	108.59	206.00	84.96	23.04	239.87	107.86	206.15	85.26	23.71	240.06	108.23	206.25	81.6	20.05	239.83	105.62	-0.10	3.66	3.66	0.22	2.60	5.80
5.2	201.09	97.05	18.24	237.82	111.67	200.83	96.76	18.25	237.49	111.29	200.96	96.91	18.25	237.66	111.48	202.7	95.86	20.64	239.27	112.35	-1.74	1.05	-2.40	-1.62	-0.87	3.64
7.2	201.46	83.89	12.32	234.84	102.70	201.49	84.97	13.43	235.20	103.55	201.48	84.43	12.88	235.02	103.13	204.05	81.97	13.22	237.74	103.57	-2.57	2.46	-0.35	-2.72	-0.44	4.52
9.2	204.44	88.07	20.39	239.29	108.52	204.04	87.37	19.39	238.71	107.67	204.24	87.72	19.89	239.00	108.10	205.66	93	25.01	241.5	113.05	-1.42	-5.28	-5.12	-2.50	-4.96	9.32
11.2	201.01	91.44	17.37	236.14	107.79	201.57	92.91	18.88	237.27	109.38	201.29	92.18	18.13	236.71	108.59	203.77	94.86	20.77	239.88	112.43	-2.48	-2.69	-2.65	-3.18	-3.85	6.72

Subject 4 Right

	Lacey					JOE					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	203.18	107.85	29.73	239.57	120.97	202.02	104.74	27.34	237.44	117.76	202.60	106.30	28.54	238.51	119.37	209.01	126.52	44.98	249.18	139.14	-6.41	-20.23	-16.45	-10.68	-19.78	35.01
3.1	199.39	101.17	23.43	235.46	113.41	198.96	100.44	23.09	234.84	112.57	199.18	100.81	23.26	235.15	112.99	203.67	119.07	36.57	245.12	130.19	-4.49	-18.27	-13.31	-9.97	-17.20	30.43
5.1	195.25	91.46	9.17	228.29	102.21	196.96	96.99	12.31	232.73	107.74	196.11	94.23	10.74	230.51	104.98	204.04	118.26	33.71	245.25	129.52	-7.93	-24.04	-22.97	-14.74	-24.55	44.59
7.1	202.73	109.18	23.57	239.56	120.85	201.89	107.43	22.62	238.16	118.94	202.31	108.31	23.10	238.86	119.90	212.92	135.58	50.81	251.46	147.45	-10.61	-27.28	-27.72	-12.60	-27.56	50.42
9.1	198.60	95.28	12.99	232.67	107.66	200.34	99.99	15.78	236.27	112.50	199.47	97.64	14.39	234.47	110.08	208.67	121.89	37.58	248.12	134.98	-9.20	-24.26	-23.20	-13.65	-24.90	44.91
11.1	198.98	99.15	19.17	233.44	111.12	200.08	102.23	20.77	236.01	114.29	199.53	100.69	19.97	234.73	112.71	208.19	121.3	38.69	248.06	134.59	-8.66	-20.61	-18.72	-13.34	-21.89	38.82

Subject 4 Left

	Lacey					JOE					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	200.89	104.31	27.31	239.13	117.30	200.11	101.95	24.46	237.56	114.79	200.50	103.13	25.89	238.35	116.05	203.21	111.72	33.86	243.42	124.68	-2.71	-8.59	-7.98	-5.07	-8.64	15.65
3.2	199.19	91.18	17.73	234.57	106.33	198.83	90.51	16.85	233.91	105.50	199.01	90.85	17.29	234.24	105.92	200.78	95.36	22.53	237.46	110.84	-1.77	-4.52	-5.24	-3.22	-4.93	9.25
5.2	198.18	91.52	8.26	233.09	104.70	197.49	91.01	7.77	232.19	103.78	197.84	91.27	8.02	232.64	104.24	201.01	96.23	14.93	237.65	110.75	-3.17	-4.97	-6.92	-5.01	-6.51	12.25
7.2	198.54	96.58	11.68	234.45	108.64	198.84	96.88	12.11	234.87	109.12	198.69	96.73	11.90	234.66	108.88	203.38	102.55	21.9	241.09	117.31	-4.69	-5.82	-10.01	-6.43	-8.43	16.38
9.2	199.39	94.53	11.46	235.29	107.98	199.41	94.07	11.59	235.15	107.68	199.40	94.30	11.53	235.22	107.83	204.5	98.8	21.45	241.39	115.6	-5.10	-4.50	-9.93	-6.17	-7.77	15.60
11.2	197.63	91.76	11.89	231.60	104.67	199.14	94.24	13.17	234.78	107.77	198.39	93.00	12.53	233.19	106.22	205.08	100.41	22.68	242.09	117.17	-6.70	-7.41	-10.15	-8.90	-10.95	20.05

Table C 3. Continued

Subject 5 Right

	Lacey				Joe					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	205.12	105.16	35.36	242.97	121.73	204.04	99.14	23.93	240.64	116.40	204.58	102.15	29.65	241.81	119.07	205.39	101.35	34.92	243.02	119.41	-0.81	0.80	-5.28	-1.22	-0.34	5.54
3.1	205.32	88.05	17.81	239.66	108.78	205.33	88.74	18.71	239.79	109.33	205.33	88.40	18.26	239.73	109.06	206.71	93.38	24.65	242.33	113.93	-1.39	-4.99	-6.39	-2.61	-4.88	9.91
5.1	199.89	82.40	11.25	232.13	100.38	200.47	85.49	13.36	233.68	103.07	200.18	83.95	12.31	232.91	101.73	201.57	87.73	14.97	236.28	105.62	-1.39	-3.79	-2.67	-3.38	-3.90	7.07
7.1	203.25	85.07	16.16	235.86	104.98	205.27	91.47	21.20	239.49	111.14	204.26	88.27	18.68	237.68	108.06	205.66	94.6	24.76	241.73	114	-1.40	-6.33	-6.08	-4.05	-5.94	11.43
9.1	202.47	90.92	24.56	237.35	109.30	202.86	91.80	25.19	237.92	110.23	202.67	91.36	24.88	237.64	109.77	205.43	97.05	33.21	242.11	116.45	-2.76	-5.69	-8.34	-4.48	-6.69	13.20
11.1	203.60	83.03	16.50	236.24	104.07	204.30	86.24	19.35	237.75	106.97	203.95	84.64	17.93	237.00	105.52	206.58	88.43	21.17	241.24	110.27	-2.63	-3.80	-3.25	-4.25	-4.75	8.51

Subject 5 Left

	Lacey				Joe					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	202.26	97.29	28.42	239.15	113.79	202.26	96.87	28.17	239.03	113.49	202.26	97.08	28.30	239.09	113.64	203.89	97.92	33	241.1	115.97	-1.63	-0.84	-4.71	-2.01	-2.33	5.91
3.2	198.41	87.99	18.13	232.85	103.67	197.95	87.76	17.69	232.20	103.09	198.18	87.88	17.91	232.53	103.38	200.74	88.73	22.89	235.97	106.54	-2.56	-0.86	-4.98	-3.45	-3.16	7.34
5.2	197.73	83.95	12.94	229.25	99.65	201.13	91.38	18.67	236.22	107.97	199.43	87.67	15.81	232.74	103.81	206.44	98.77	29.81	243.13	117.81	-7.01	-11.11	-14.01	-10.40	-14.00	25.94
7.2	201.27	89.79	18.70	236.15	107.06	201.90	90.91	20.08	237.12	108.42	201.59	90.35	19.39	236.64	107.74	204.42	89.41	22.54	239.67	109.59	-2.83	0.94	-3.15	-3.04	-1.85	5.61
9.2	198.48	90.14	23.09	233.28	105.64	198.54	89.93	22.97	233.36	105.55	198.51	90.04	23.03	233.32	105.60	200.19	88.63	25.57	235.33	106.32	-1.68	1.41	-2.54	-2.01	-0.72	3.98
11.2	203.08	90.28	23.74	238.10	109.27	203.57	91.52	25.18	238.89	110.60	203.33	90.90	24.46	238.50	109.94	205.31	91.07	25.28	240.79	111.58	-1.99	-0.17	-0.82	-2.29	-1.65	3.55

Subject 6 Right

	Lacey				Joe					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	206.67	118.65	45.56	244.68	132.08	207.11	120.49	47.35	245.49	133.81	206.89	119.57	46.46	245.09	132.95	212.22	135.77	59.36	251.43	148.28	-5.33	-16.20	-12.91	-6.35	-15.34	27.07
3.1	202.31	94.69	24.51	238.31	111.68	202.16	94.43	24.47	238.13	111.14	202.24	94.56	24.49	238.22	111.41	207.15	103.83	37.77	244.47	122.44	-4.91	-9.27	-13.28	-6.25	-11.03	21.15
5.1	196.83	103.53	24.21	234.68	113.46	196.64	103.07	23.96	234.36	113.13	196.74	103.30	24.09	234.52	113.30	202.58	121.93	43.81	245.27	132.38	-5.85	-18.63	-19.73	-10.75	-19.09	35.36
7.1	197.17	96.16	23.44	232.85	108.63	196.28	93.16	21.39	230.72	105.66	196.73	94.66	22.42	231.79	107.15	203.94	117.3	45.71	244.46	130.08	-7.22	-22.64	-23.30	-12.68	-22.94	42.36
9.1	212.77	115.20	49.40	247.41	133.73	213.09	116.23	50.25	247.88	134.54	212.93	115.72	49.83	247.65	134.14	221.54	132.13	70.36	253.16	151.13	-8.61	-16.42	-20.54	-5.52	-17.00	32.93
11.1	208.67	100.88	36.57	242.89	120.85	211.41	109.90	44.51	246.91	129.37	210.04	105.39	40.54	244.90	125.11	205.94	85.29	18.32	240.08	107.54	4.10	20.10	22.22	4.82	17.57	35.31

Subject 6 Left

	Lacey				Joe					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	199.73	92.16	29.01	235.43	108.65	199.33	91.86	28.41	234.85	108.08	199.53	92.01	28.71	235.14	108.37	201.23	99.48	35.95	239.12	115.47	-1.70	-7.47	-7.24	-3.98	-7.10	13.32
3.2	200.15	94.37	24.45	236.45	109.92	200.01	94.02	23.93	236.28	109.66	200.08	94.20	24.19	236.37	109.79	205.59	102.16	39.94	243.8	120.84	-5.51	-7.97	-15.75	-7.44	-11.05	22.79
5.2	197.40	97.18	18.09	233.90	108.98	196.91	96.82	17.61	233.31	108.32	197.16	97.00	17.85	233.61	108.65	202.25	105.8	37.36	241.49	120.56	-5.10	-8.80	-19.51	-7.88	-11.91	26.23
7.2	197.58	91.79	13.22	232.49	104.98	197.51	91.76	13.17	232.40	104.90	197.55	91.78	13.20	232.45	104.94	202.63	102.78	36.82	241.20	118.79	-5.08	-11.01	-23.63	-8.76	-13.85	31.20
9.2	200.89	88.83	16.31	235.56	105.95	200.08	89.03	16.42	235.52	106.03	200.49	88.93	16.37	235.54	105.99	205.9	102.07	41.09	243.81	121.01	-5.41	-13.14	-24.73	-8.27	-15.02	33.28
11.2	200.72	86.77	15.15	234.92	104.37	200.51	86.44	14.45	234.55	103.91	200.62	86.61	14.80	234.74	104.14	204.14	93.67	30.11	240.26	113.04	-3.52	-7.07	-15.31	-5.52	-8.90	20.16

Table C 3. Continued

Subject 7 Right

	Lacey				Joe				Average				Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	215.74	148.32	69.65	252.09	158.37	205.09	145.69	67.25	251.29	156.00	210.42	147.01	68.45	251.69	157.19	216.95	150.03	70.28	253.88	160.62	-6.53	-3.03	-1.83	-2.19	-3.44	8.47
3.1	208.83	133.40	48.98	247.57	143.07	208.03	130.28	46.00	246.63	140.26	208.43	131.84	47.49	247.10	141.67	212.7	144.73	63.18	252.86	154.81	-4.27	-12.89	-15.69	-5.76	-13.15	25.23
5.1	209.94	135.24	48.38	249.73	145.23	214.80	154.02	63.90	252.65	161.00	212.37	144.63	56.14	251.19	153.12	220.94	167.83	81.43	254.88	174.17	-8.57	-23.20	-25.29	-3.69	-21.06	41.33
7.1	196.11	117.07	33.79	237.25	123.11	198.33	125.53	40.06	241.85	131.33	197.22	121.30	36.93	239.55	127.22	202.89	133.09	49.35	247.8	140.79	-5.67	-11.79	-12.43	-8.25	-13.57	24.04
9.1	195.46	110.75	28.90	234.61	117.72	198.00	122.22	37.65	240.46	128.49	196.73	116.49	33.28	237.54	123.11	203.33	133.96	49.84	248.17	141.67	-6.60	-17.48	-16.57	-10.64	-18.57	32.88
11.1	196.53	108.75	28.97	236.04	117.36	196.53	107.96	28.04	235.53	116.66	196.53	108.36	28.51	235.79	117.01	201.71	116.98	40.21	243.5	127.98	-5.18	-8.63	-11.71	-7.72	-10.97	20.45

Subject 7 Left

	Lacey				Joe				Average				Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	206.24	119.53	46.19	244.85	132.47	208.34	125.38	51.97	248.09	138.63	207.29	122.46	49.08	246.47	135.55	208.68	125.67	52.46	249.22	139.38	-1.39	-3.22	-3.38	-2.75	-3.83	6.78
3.2	208.13	121.78	40.84	246.95	134.75	214.06	152.16	62.11	252.32	159.31	211.10	136.97	51.48	249.64	147.03	212.24	126.37	49.14	250.8	141.3	-1.15	10.60	2.34	-1.17	5.73	12.38
5.2	214.95	136.08	57.35	251.36	149.13	213.61	132.18	52.89	250.06	145.35	214.28	134.13	55.12	250.71	147.24	213.15	132.92	57.19	251.79	146.8	1.13	1.21	-2.07	-1.08	0.44	2.90
7.2	200.22	121.96	39.46	241.16	129.63	203.67	130.93	47.65	245.93	138.89	201.95	126.45	43.56	243.55	134.26	199.79	121.36	46.42	243.37	130.54	2.16	5.08	-2.87	0.18	3.72	7.25
9.2	198.56	110.47	32.87	237.68	120.20	200.78	115.24	38.95	241.90	125.91	199.67	112.86	35.91	239.79	123.06	199.63	116.8	41.13	242.14	126.67	0.04	-3.95	-5.22	-2.35	-3.61	7.84
11.2	196.47	103.74	28.66	234.14	113.72	196.49	103.58	28.84	234.27	113.67	196.48	103.66	28.75	234.21	113.70	197.1	107.99	33.53	237.39	117.9	-0.62	-4.33	-4.78	-3.19	-4.21	8.36

Subject 8 Right

	Lacey				Joe				Average				Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	211.05	99.22	19.60	242.02	118.66	212.62	102.82	22.38	243.70	122.17	211.84	101.02	20.99	242.86	120.42	218.44	108.41	19.79	250.06	129.3	-6.60	-7.39	1.20	-7.20	-8.89	15.18
3.1	210.31	102.14	25.56	242.28	120.83	213.44	107.92	29.98	245.66	126.90	211.88	105.03	27.77	243.97	123.87	215.98	114.33	34.39	249.38	133.33	-4.10	-9.30	-6.62	-5.41	-9.47	16.31
5.1	212.19	100.15	18.72	244.07	120.14	209.91	95.20	15.71	241.48	115.26	211.05	97.68	17.22	242.78	117.70	216.8	106	19.26	249.24	126.96	-5.75	-8.32	-2.05	-6.47	-9.26	15.30
7.1	212.52	107.81	22.23	245.15	125.43	213.55	109.95	23.81	246.14	127.56	213.04	108.88	23.02	245.65	126.50	216.99	113.09	22.18	250.24	131.88	-3.95	-4.21	0.84	-4.60	-5.38	9.18
9.1	209.97	107.70	27.13	243.76	124.54	211.40	110.76	29.64	245.20	127.62	210.69	109.23	28.39	244.48	126.08	212.58	107.68	23.06	247.62	126.28	-1.90	1.55	5.33	-3.14	-0.20	6.65
11.1	205.63	98.70	19.16	239.62	115.44	208.44	104.15	23.53	242.54	121.11	207.04	101.43	21.35	241.08	118.28	208.29	99.24	16.15	243.71	117.65	-1.26	2.19	5.20	-2.63	0.63	6.38

Subject 8 Left

	Lacey				Joe				Average				Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	213.85	118.29	35.51	248.14	134.57	212.86	116.73	34.04	247.51	132.91	213.36	117.51	34.78	247.83	133.74	209.08	112.55	27.94	246.12	127.94	4.28	4.96	6.84	1.70	5.80	11.23
3.2	213.80	109.83	32.14	247.19	128.87	212.41	107.85	30.32	246.23	126.68	213.11	108.84	31.23	246.71	127.78	208.34	102.51	24.75	242.57	120.32	4.77	6.33	6.48	4.14	7.46	13.32
5.2	209.87	99.58	19.75	244.55	119.15	210.20	101.08	20.73	244.76	120.26	210.04	100.33	20.24	244.66	119.71	210.05	102.94	22.98	243.86	121.4	-0.02	-2.61	-2.74	0.79	-1.69	4.22
7.2	209.09	103.14	23.51	244.62	121.32	209.19	102.98	23.25	244.75	121.23	209.14	103.06	23.38	244.69	121.28	206.15	103.27	22.48	242.67	119.61	2.99	-0.21	0.90	2.02	1.67	4.08
9.2	207.01	99.68	22.03	242.69	117.73	206.83	98.66	21.17	242.43	116.88	206.92	99.17	21.60	242.56	117.31	210.39	110.26	30.37	244.78	126.93	-3.47	-11.09	-8.77	-2.22	-9.63	17.59
11.2	205.50	99.85	22.19	241.51	116.86	205.50	99.85	22.18	241.51	116.86	205.50	99.85	22.19	241.51	116.86	207.09	109.26	27.95	244.29	124.64	-1.59	-9.41	-5.77	-2.78	-7.78	13.88

Table C 3. Continued

Subject 9 Right

	Lacey					Joe					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	197.75	100.53	32.77	235.31	113.09	199.03	103.74	36.49	237.75	116.67	198.39	102.14	34.63	236.53	114.88	201.85	110	41.4	242.31	123.57	-3.46	-7.87	-6.77	-5.78	-8.69	15.12
3.1	200.81	93.84	27.08	236.05	110.23	200.87	92.00	25.45	235.55	108.88	200.84	92.92	26.27	235.80	109.56	206.11	106.4	42.67	244.83	124.15	-5.27	-13.48	-16.41	-9.03	-14.60	27.81
5.1	198.05	100.80	28.16	234.31	112.82	197.73	98.85	26.68	233.12	111.06	197.89	99.83	27.42	233.72	111.94	202.99	114.27	44.23	244.11	127.57	-5.10	-14.45	-16.81	-10.40	-15.63	29.49
7.1	202.86	117.51	40.69	243.34	128.89	200.95	110.84	34.30	238.78	122.30	201.91	114.18	37.50	241.06	125.60	203.86	117	43.04	245.23	129.77	-1.96	-2.82	-5.55	-4.17	-4.18	8.80
9.1	200.60	107.12	33.33	237.39	119.19	201.92	109.84	35.61	239.45	122.20	201.26	108.48	34.47	238.42	120.70	206.49	118.66	47.62	247.14	133.03	-5.23	-10.18	-13.15	-8.72	-12.34	23.07
11.1	199.97	104.47	27.60	236.42	116.43	201.31	109.04	31.30	239.25	120.93	200.64	106.76	29.45	237.84	118.68	206.55	115.82	41.4	246.45	130.42	-5.91	-9.07	-11.95	-8.62	-11.74	21.72

Subject 9 Left

	Lacey					Joe					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	201.46	103.69	37.85	239.24	118.40	202.70	106.95	41.38	241.31	122.06	202.08	105.32	39.62	240.28	120.23	205.06	108.62	43.66	244.41	125.04	-2.98	-3.30	-4.04	-4.13	-4.81	8.74
3.2	200.75	102.15	33.56	238.44	116.45	201.90	103.05	34.57	239.03	117.42	201.33	102.60	34.07	238.74	116.94	205.27	109.49	43.75	244.42	125.7	-3.95	-6.89	-9.69	-5.68	-8.77	16.31
5.2	198.31	100.79	28.53	235.51	113.81	198.82	101.88	29.81	236.43	114.44	198.57	101.34	29.17	235.97	114.13	203.12	109.96	40.14	243.16	124.27	-4.56	-8.62	-10.97	-7.19	-10.15	19.24
7.2	198.83	106.20	31.26	237.69	117.56	198.13	103.26	28.53	235.78	114.68	198.48	104.73	29.90	236.74	116.12	204.30	116.34	43.22	244.91	129.55	-5.82	-11.61	-13.33	-8.17	-13.43	24.36
9.2	197.58	98.56	26.85	234.02	110.91	198.29	100.08	28.53	235.45	112.71	197.94	99.32	27.69	234.74	111.81	203.7	111.92	42.18	243.87	126.18	-5.76	-12.60	-14.49	-9.13	-14.37	26.30
11.2	199.55	105.90	28.54	237.77	117.45	199.25	105.11	27.82	237.25	116.61	199.40	105.51	28.18	237.51	117.03	206.13	124.92	45.96	247.4	136.62	-6.73	-19.42	-17.78	-9.89	-19.59	34.93

Subject 10 Right

	Lacey					Joe					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	200.02	99.34	37.56	237.29	114.55	199.57	96.56	35.33	235.79	112.05	199.80	97.95	36.45	236.54	113.30	200.96	97.42	39.94	238.62	114.31	-1.16	0.53	-3.50	-2.08	-1.01	4.38
3.1	198.68	100.60	26.65	236.45	113.24	198.78	101.27	27.54	236.79	113.38	198.73	100.94	27.10	236.62	113.31	200.52	97.17	33.25	237.91	113.08	-1.79	3.77	-6.16	-1.29	0.23	7.55
5.1	198.67	99.03	20.14	235.20	111.35	199.03	99.69	19.97	235.76	112.05	198.85	99.36	20.06	235.48	111.70	202.42	105.22	36.03	241.51	120.19	-3.57	-5.86	-15.98	-6.03	-8.49	20.27
7.1	208.75	122.03	37.16	247.83	135.07	208.08	119.13	34.40	246.81	132.44	208.42	120.58	35.78	247.32	133.76	210.18	118.58	47.83	249.01	135.15	-1.76	2.00	-12.05	-1.69	-1.40	12.53
9.1	209.67	134.24	48.72	248.92	144.36	209.38	133.38	48.02	248.63	143.55	209.53	133.81	48.37	248.78	143.96	209.7	129.14	52.22	250.21	142.19	-0.18	4.67	-3.85	-1.44	1.77	6.47
11.1	211.14	142.02	59.40	250.14	151.09	211.90	144.04	61.28	250.70	152.98	211.52	143.03	60.34	250.42	152.04	213.73	145.06	67.38	252.9	155.85	-2.21	-2.03	-7.04	-2.48	-3.82	8.90

Subject 10 Left

	Lacey					Joe					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	198.45	91.66	31.68	233.91	107.59	198.36	91.49	31.44	233.74	107.38	198.41	91.58	31.56	233.83	107.49	200.33	95.62	34.9	237.44	112.06	-1.93	-4.05	-3.34	-3.62	-4.58	8.08
3.2	198.81	100.24	31.82	236.87	113.70	198.29	99.86	29.84	236.11	112.82	198.55	100.05	30.83	236.49	113.26	200.81	103.77	36.9	239.97	118.19	-2.26	-3.72	-6.07	-3.48	-4.93	9.60
5.2	198.86	102.23	23.35	236.97	114.13	199.05	102.36	23.44	237.18	114.36	198.96	102.30	23.40	237.08	114.25	201.23	113.55	39.68	242.57	125.41	-2.27	-11.26	-16.29	-5.50	-11.17	23.49
7.2	209.59	122.20	42.14	248.70	136.31	209.67	122.41	42.43	248.78	136.53	209.63	122.31	42.29	248.74	136.42	211.87	128.18	54.59	251.00	142.94	-2.24	-5.88	-12.31	-2.26	-6.52	15.45
9.2	206.63	128.44	50.35	248.08	139.61	207.13	129.20	50.70	248.45	140.42	206.88	128.82	50.53	248.27	140.02	209.19	133.25	57.56	250.74	145.28	-2.31	-4.43	-7.04	-2.48	-5.27	10.41
11.2	204.71	118.08	43.67	245.67	131.05	205.01	118.19	44.74	245.97	131.46	204.86	118.14	44.21	245.82	131.26	207.4	124.46	50.19	248.61	137.71	-2.54	-6.33	-5.99	-2.79	-6.46	11.48

Table C 3. Continued

Subject 11 Right

	Lacey				Joe				Average				Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	201.97	91.09	12.65	237.07	107.81	202.05	90.75	12.36	237.08	107.62	202.01	90.92	12.51	237.08	107.72	203.42	95.16	17.04	239.68	112.01	-1.41	-4.24	-4.54	-2.61	-4.30	8.11
3.1	200.90	89.40	12.87	235.80	105.98	200.87	89.35	12.79	235.76	105.92	200.89	89.38	12.83	235.78	105.95	203.41	91.47	14.93	238.95	109.39	-2.53	-2.10	-2.10	-3.17	-3.44	6.09
5.1	201.84	93.60	9.96	237.19	108.96	201.67	92.95	9.44	236.84	108.35	201.76	93.28	9.70	237.02	108.66	203.3	95.64	10.81	239.43	111.47	-1.55	-2.36	-1.11	-2.42	-2.82	4.79
7.1	200.07	94.92	13.97	235.91	108.98	200.51	96.07	14.90	236.71	110.18	200.29	95.50	14.44	236.31	109.58	200.61	95.75	14.21	237.14	110.05	-0.32	-0.25	0.23	-0.83	-0.47	1.06
9.1	200.69	100.47	16.41	237.48	113.27	198.79	95.42	12.64	234.02	108.06	199.74	97.95	14.53	235.75	110.67	202.35	102.6	18.43	240.16	116.19	-2.61	-4.66	-3.91	-4.41	-5.53	9.68
11.1	204.26	97.15	17.42	239.94	113.70	204.93	98.74	18.80	240.96	115.37	204.60	97.95	18.11	240.45	114.54	206.56	101.78	22.49	243.4	118.93	-1.97	-3.84	-4.38	-2.95	-4.40	8.11

Subject 11 Left

	Lacey				Joe				Average				Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	204.17	94.66	21.74	239.82	112.63	204.31	93.98	20.80	239.81	112.20	204.24	94.32	21.27	239.82	112.42	205.17	91.12	18.86	240.53	110.82	-0.93	3.20	2.41	-0.72	1.60	4.47
3.2	207.32	96.88	22.51	242.38	116.11	207.12	96.39	22.14	242.09	115.62	207.22	96.64	22.33	242.24	115.87	207.3	99.94	26.58	243.78	118.75	-0.08	-3.31	-4.26	-1.54	-2.88	6.30
5.2	199.59	86.95	8.36	233.62	102.88	199.39	86.67	8.17	233.38	102.52	199.49	86.81	8.27	233.50	102.70	201.94	93.53	14.02	237.88	109.53	-2.45	-6.72	-5.76	-4.38	-6.83	12.25
7.2	200.75	93.04	15.73	236.48	108.55	200.16	92.30	14.66	235.58	107.48	200.46	92.67	15.20	236.03	108.02	203.45	100.9	25.18	241.02	116.68	-3.00	-8.23	-9.99	-4.99	-8.67	16.62
9.2	200.47	93.26	15.96	236.15	108.48	200.46	93.29	16.01	236.15	108.50	200.47	93.28	15.99	236.15	108.49	204.24	102.6	27.03	242.11	118.56	-3.78	-9.32	-11.05	-5.96	-10.07	18.98
11.2	203.21	84.10	12.70	236.25	104.03	204.19	85.69	14.17	237.84	105.97	203.70	84.90	13.44	237.05	105.00	208.03	89.77	20.86	242.77	112.07	-4.33	-4.88	-7.43	-5.72	-7.07	13.43

Subject 12 Right

	Lacey				Joe				Average				Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	209.44	114.31	34.38	246.27	129.93	211.38	121.61	40.24	248.41	136.36	210.41	117.96	37.31	247.34	133.15	211.01	119.69	38.97	249.42	135.21	-0.60	-1.73	-1.66	-2.08	-2.07	3.83
3.1	215.44	133.60	50.68	251.67	147.23	213.03	124.78	43.81	250.06	139.75	214.24	129.19	47.25	250.87	143.49	213.54	128.78	46.33	251.44	143.13	0.70	0.41	0.92	-0.57	0.36	1.40
5.1	213.06	115.39	38.76	249.25	133.32	212.19	112.17	36.00	248.47	130.50	212.63	113.78	37.38	248.86	131.91	214.07	113.54	36.98	249.88	132.61	-1.44	0.24	0.40	-1.02	-0.70	1.96
7.1	198.95	104.23	23.85	237.28	115.41	198.59	103.13	22.78	236.65	114.29	198.77	103.68	23.32	236.97	114.85	199.71	106.09	24.83	238.86	117.37	-0.94	-2.41	-1.52	-1.90	-2.52	4.35
9.1	202.99	97.93	24.52	239.56	114.23	202.29	95.21	21.91	238.34	111.66	202.64	96.57	23.22	238.95	112.95	204.52	98.39	23.45	241.37	115.55	-1.88	-1.82	-0.23	-2.42	-2.61	4.42
11.1	198.21	93.21	15.31	233.39	106.59	198.08	92.75	14.86	233.10	106.13	198.15	92.98	15.09	233.25	106.36	198.84	92.9	12.25	234.77	106.73	-0.69	0.08	2.84	-1.53	-0.37	3.31

Subject 12 Left

	Lacey				Joe				Average				Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	211.67	120.81	41.78	248.70	136.29	211.11	117.96	39.50	248.11	133.92	211.39	119.39	40.64	248.41	135.11	210.89	110.12	34.7	247.96	128.48	0.50	9.26	5.94	0.44	6.63	12.86
3.2	209.82	105.80	30.41	246.45	124.53	209.38	103.86	28.79	245.86	122.82	209.60	104.83	29.60	246.16	123.68	211.13	112.14	37.69	248.44	130.29	-1.53	-7.31	-8.09	-2.29	-6.61	13.05
5.2	214.87	122.36	46.43	251.10	139.65	214.96	122.48	46.58	251.14	139.79	214.92	122.42	46.51	251.12	139.72	216.33	124.09	48.85	251.72	141.69	-1.41	-1.67	-2.35	-0.60	-1.97	3.81
7.2	198.16	93.90	15.59	234.10	107.15	197.69	92.00	13.68	233.07	105.32	197.93	92.95	14.64	233.59	106.24	198.98	97	18.41	235.86	110.08	-1.05	-4.05	-3.78	-2.28	-3.85	7.19
9.2	199.06	88.00	15.01	233.31	103.81	199.33	89.31	16.21	234.05	105.03	199.20	88.66	15.61	233.68	104.42	199.84	97.1	23.2	236.89	111.31	-0.65	-8.44	-7.59	-3.21	-6.89	13.68
11.2	199.73	93.36	19.79	235.61	108.40	199.25	91.75	18.32	234.66	106.81	199.49	92.56	19.06	235.14	107.61	199.9	97.24	21.38	236.93	111.25	-0.41	-4.68	-2.33	-1.80	-3.65	6.64

Table C 3. Continued

Subject 13 Right

	Lacey				Joe					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	214.64	136.29	60.80	250.45	149.19	214.95	137.31	61.77	250.68	150.10	214.80	136.80	61.29	250.57	149.65	218.28	147.26	70.12	253.89	159.38	-3.49	-10.46	-8.84	-3.32	-9.74	17.48
3.1	208.91	123.69	39.26	245.42	135.44	208.62	123.14	38.72	245.24	134.89	208.77	123.42	38.99	245.33	135.17	216.26	137.12	63.87	252.73	151.48	-7.50	-13.71	-24.88	-7.40	-16.32	34.41
5.1	212.86	124.10	41.55	248.74	138.62	211.66	119.86	36.66	247.40	134.66	212.26	121.98	39.11	248.07	136.64	215.02	121.57	56.04	251.38	140.44	-2.76	0.41	-16.94	-3.31	-3.80	17.89
7.1	213.44	128.66	43.81	248.45	141.65	214.10	130.61	45.87	248.99	143.45	213.77	129.64	44.84	248.72	142.55	218.42	137.58	64.97	253.3	152.82	-4.65	-7.95	-20.13	-4.58	-10.27	24.83
9.1	196.84	108.42	25.10	234.60	116.55	197.34	110.42	26.63	235.86	118.49	197.09	109.42	25.87	235.23	117.52	200.82	108.01	35.2	240.73	120.75	-3.73	1.41	-9.34	-5.50	-3.23	11.99
11.1	201.69	115.13	38.76	239.70	125.65	201.91	115.78	39.16	239.98	126.26	201.80	115.46	38.96	239.84	125.96	204.61	119.53	46.74	246.14	132.37	-2.81	-4.08	-7.78	-6.30	-6.41	12.88

Subject 13 Left

	Lacey				Joe					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	207.92	119.64	44.37	247.49	133.99	208.14	120.31	45.16	247.82	134.67	208.03	119.98	44.77	247.66	134.33	209.59	129.74	52.62	250.31	142.59	-1.56	-9.77	-7.86	-2.66	-8.26	15.32
3.2	204.89	115.39	36.91	244.67	128.41	205.36	116.94	38.15	245.31	129.88	205.13	116.17	37.53	244.99	129.15	210.04	131.4	58.91	250.92	144.64	-4.91	-15.24	-21.38	-5.93	-15.50	31.44
5.2	213.66	124.43	40.14	250.47	139.55	213.53	124.12	39.68	250.37	139.23	213.60	124.28	39.91	250.42	139.39	217.11	141.45	69.9	253.47	155.32	-3.52	-17.18	-29.99	-3.05	-15.93	38.34
7.2	211.77	121.02	39.27	248.98	136.21	211.27	119.38	38.13	248.32	134.71	211.52	120.20	38.70	248.65	135.46	216.21	141.4	65.73	253.22	154.44	-4.69	-21.20	-27.03	-4.57	-18.98	39.79
9.2	196.52	107.13	28.06	236.03	116.19	196.23	106.03	27.50	235.36	115.15	196.38	106.58	27.78	235.70	115.67	200.83	121.29	43.4	243.92	130.77	-4.46	-14.71	-15.62	-8.22	-15.10	27.85
11.2	197.92	100.90	29.25	235.52	113.08	197.77	100.40	28.65	235.19	112.55	197.85	100.65	28.95	235.36	112.82	202.28	113.16	41.51	243.14	125.98	-4.44	-12.51	-12.56	-7.78	-13.17	23.83

Subject 14 Right

	Lacey				Joe					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	214.62	138.46	64.78	250.52	151.04	213.58	134.10	60.76	249.25	147.18	214.10	136.28	62.77	249.89	149.11	215.22	135.62	64.45	252.51	150.24	-1.12	0.66	-1.68	-2.63	-1.13	3.56
3.1	203.98	125.87	46.66	246.37	136.02	207.13	126.27	50.07	247.92	138.41	205.56	126.07	48.37	247.15	137.22	209.66	134.7	59.93	250.89	146.61	-4.10	-8.63	-11.57	-3.75	-9.40	18.09
5.1	204.89	113.29	32.85	243.73	126.52	205.21	117.52	35.82	245.21	129.92	205.05	115.41	34.34	244.47	128.22	208.41	129.23	49.77	249.73	141.31	-3.36	-13.83	-15.44	-5.26	-13.09	25.29
7.1	197.91	108.07	28.56	236.45	117.71	199.60	115.40	32.94	240.84	124.55	198.76	111.74	30.75	238.65	121.13	202.27	118.24	40.59	244.36	129.27	-3.52	-6.51	-9.84	-5.72	-8.14	15.82
9.1	200.66	95.63	28.34	235.81	111.32	201.10	97.20	29.63	236.94	112.87	200.88	96.42	28.99	236.38	112.10	204.84	109.41	42.87	244.19	125.3	-3.96	-13.00	-13.89	-7.82	-13.21	24.75
11.1	202.42	118.43	42.72	242.96	129.40	200.79	112.65	38.61	239.80	123.85	201.61	115.54	40.67	241.38	126.63	206.85	125.1	50.67	248.07	137.74	-5.25	-9.56	-10.01	-6.69	-11.12	19.68

Subject 14 Left

	Lacey				Joe					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	206.06	106.73	39.48	244.13	123.88	206.17	104.98	38.77	243.80	122.69	206.12	105.86	39.13	243.97	123.29	209.31	116.76	50.56	248.55	133.78	-3.19	-10.91	-11.44	-4.59	-10.50	19.78
3.2	206.56	123.07	47.26	246.58	135.52	204.91	128.95	48.18	247.54	138.82	205.74	126.01	47.72	247.06	137.17	210.16	138.83	60.99	251.76	149.74	-4.42	-12.82	-13.27	-4.70	-12.57	23.24
5.2	208.46	136.88	54.69	249.95	146.52	208.35	136.99	54.16	249.99	146.50	208.41	136.94	54.43	249.97	146.51	213.24	145.53	68.43	253.05	156.12	-4.84	-8.60	-14.01	-3.08	-9.61	19.88
7.2	198.38	104.36	27.54	237.25	115.59	197.56	104.21	26.23	236.36	114.73	197.97	104.29	26.89	236.81	115.16	201.59	109.23	38.13	241.91	122.52	-3.62	-4.95	-11.25	-5.10	-7.36	15.63
9.2	199.31	98.20	30.77	236.34	112.48	198.84	97.72	30.18	235.70	111.73	199.08	97.96	30.48	236.02	112.11	201.77	104.75	39.25	241.01	119.79	-2.70	-6.79	-8.78	-4.99	-7.69	14.64
11.2	198.88	97.59	31.09	235.92	111.80	198.74	96.93	30.96	235.51	111.22	198.81	97.26	31.03	235.72	111.51	201.33	100.18	34.98	239.35	115.9	-2.52	-2.92	-3.96	-3.64	-4.39	7.94

Table C 3. Continued

Subject 15 Right

	Lacey					Joe					Average					Control					Difference					
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	196.22	99.69	25.30	232.58	110.43	197.12	102.26	27.80	234.52	113.19	196.67	100.98	26.55	233.55	111.81	201.21	109.44	35.91	241.19	122.05	-4.54	-8.47	-9.36	-7.64	-10.24	18.52
3.1	195.38	104.36	24.00	233.00	112.82	194.27	100.18	19.81	230.32	108.58	194.83	102.27	21.91	231.66	110.70	199.76	102.87	27.81	238.31	115.64	-4.94	-0.60	-5.91	-6.65	-4.94	11.32
5.1	196.24	98.44	14.79	231.80	108.33	197.41	101.99	17.96	234.30	112.01	196.83	100.22	16.38	233.05	110.17	203.59	112.37	36.15	243.56	125.59	-6.77	-12.16	-19.78	-10.51	-15.42	30.54
7.1	199.70	106.15	27.05	236.87	117.40	198.52	103.06	24.01	234.64	114.07	199.11	104.61	25.53	235.76	115.74	201.52	110.51	33.93	241.71	122.72	-2.41	-5.91	-8.40	-5.96	-6.99	13.98
9.1	199.49	105.19	25.91	237.55	116.60	199.75	106.29	27.09	238.16	117.68	199.62	105.74	26.50	237.86	117.14	206.2	121.38	43.19	247.36	134.14	-6.58	-15.64	-16.69	-9.51	-17.00	30.75
11.1	199.26	107.35	28.23	237.98	118.20	197.94	103.71	24.70	235.24	114.29	198.60	105.53	26.47	236.61	116.25	201.88	104.06	27.08	240.21	117.82	-3.28	1.47	-0.61	-3.60	-1.57	5.36

Subject 15 Left

	Lacey					Joe					Average					Control					Difference					
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	198.87	103.16	26.00	235.51	114.58	202.58	113.17	34.48	242.33	125.13	200.73	108.17	30.24	238.92	119.86	207.88	123.49	44.67	248.56	136.68	-7.15	-15.33	-14.43	-9.64	-16.83	29.50
3.2	195.80	98.17	18.16	232.25	108.36	195.05	96.72	16.27	231.02	106.60	195.43	97.45	17.22	231.64	107.48	199.68	102.43	29.59	237.94	115.46	-4.26	-4.99	-12.38	-6.31	-7.98	17.31
5.2	198.85	105.63	20.19	237.54	115.91	198.36	104.17	17.80	236.61	114.29	198.61	104.90	19.00	237.08	115.10	200.8	105.96	28.89	239.93	118.58	-2.19	-1.06	-9.90	-2.86	-3.48	11.14
7.2	199.70	106.15	27.05	236.87	117.40	198.34	99.25	20.59	234.80	111.22	199.02	102.70	23.82	235.84	114.31	202.95	107.44	35.61	242.38	121.89	-3.93	-4.74	-11.79	-6.54	-7.58	16.65
9.2	198.16	98.35	19.50	234.90	110.47	196.87	94.62	15.50	232.27	106.50	197.52	96.49	17.50	233.59	108.49	200.37	98.57	22.43	237.74	112.63	-2.86	-2.08	-4.93	-4.16	-4.15	8.44
11.2	198.12	107.02	24.56	237.10	116.81	196.43	102.26	20.05	233.66	111.75	197.28	104.64	22.31	235.38	114.28	201.68	114.15	32.03	242.79	125.07	-4.41	-9.51	-9.73	-7.41	-10.79	19.38

Subject 16 Right

	Lacey					Joe					Average					Control					Difference					
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	200.09	115.11	31.29	240.10	124.19	199.77	114.07	30.30	239.50	123.13	199.93	114.59	30.80	239.80	123.66	200.08	107.25	26.26	239.48	118.55	-0.15	7.34	4.54	0.32	5.11	10.03
3.1	199.93	112.47	28.22	239.31	121.97	199.11	110.27	26.10	237.87	119.62	199.52	111.37	27.16	238.59	120.80	202.15	113.38	31.75	242.72	124.78	-2.63	-2.01	-4.59	-4.13	-3.99	8.06
5.1	200.08	104.14	24.44	237.57	116.11	199.02	101.30	21.78	235.78	113.12	199.55	102.72	23.11	236.68	114.62	205.73	109.52	34.61	244.74	124.98	-6.18	-6.80	-11.50	-8.07	-10.37	19.73
7.1	203.68	106.04	27.89	239.82	119.94	203.40	105.43	27.41	239.45	119.30	203.54	105.74	27.65	239.64	119.62	211.29	121.13	42.61	249.58	136.66	-7.75	-15.40	-14.96	-9.95	-17.04	30.17
9.1	199.77	97.88	21.68	235.95	111.50	198.85	93.37	17.15	233.64	107.29	199.31	95.63	19.42	234.80	109.40	203.11	98.94	25.08	240.35	115.14	-3.80	-3.32	-5.67	-5.56	-5.74	11.02
11.1	198.11	99.69	19.83	234.25	111.21	197.27	96.77	17.40	232.35	108.32	197.69	98.23	18.62	233.30	109.77	200.61	100.42	22.09	238.22	113.98	-2.92	-2.19	-3.48	-4.92	-4.22	8.21

Subject 16 Left

	Lacey					Joe					Average					Control					Difference					
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	194.78	105.31	20.87	233.13	112.73	196.15	108.79	23.60	235.86	116.51	195.47	107.05	22.24	234.50	114.62	198.27	109.88	24.47	238.66	118.93	-2.81	-2.83	-2.24	-4.16	-4.31	7.54
3.2	198.63	91.14	17.35	233.84	105.84	198.89	91.47	17.66	234.23	106.29	198.76	91.31	17.51	234.04	106.07	200.49	99.48	27.54	238.27	113.9	-1.73	-8.18	-10.04	-4.24	-7.84	15.81
5.2	196.51	98.01	18.73	233.29	108.90	196.24	97.56	18.43	232.82	108.35	196.38	97.79	18.58	233.06	108.63	199.48	107.87	30.29	239.43	119.11	-3.10	-10.09	-11.71	-6.38	-10.49	19.98
7.2	199.88	107.22	28.55	239.02	118.68	199.08	105.16	26.55	237.54	116.45	199.48	106.19	27.55	238.28	117.57	203.13	121.94	41.5	245.45	132.40	-3.65	-15.75	-13.95	-7.17	-14.84	26.97
9.2	195.17	91.45	14.50	229.53	102.94	195.87	92.88	16.18	230.93	104.66	195.52	92.17	15.34	230.23	103.80	199.72	100.56	26.73	237.67	113.95	-4.20	-8.40	-11.39	-7.44	-10.15	19.40
11.2	196.38	99.54	18.55	233.71	109.82	196.57	99.73	18.99	233.99	110.14	196.48	99.64	18.77	233.85	109.98	200.11	107.01	28.51	239.48	118.72	-3.64	-7.38	-9.74	-5.63	-8.74	16.45

Table C 3. Continued

Subject 17 Right

	Lacey				Joe				Average				Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	208.26	97.21	31.72	243.45	118.02	208.36	97.20	31.41	243.57	118.06	208.31	97.21	31.57	243.51	118.04	213.76	104.55	40.36	248.6	127.1	-5.45	-7.35	-8.80	-5.09	-9.06	16.40
3.1	204.37	88.47	20.42	238.83	108.61	204.34	88.68	20.15	238.89	108.70	204.36	88.58	20.29	238.86	108.66	208.36	96.35	31.82	244.3	117.71	-4.01	-7.77	-11.54	-5.44	-9.05	17.92
5.1	208.43	109.84	30.12	245.62	126.11	208.46	110.31	30.38	245.76	126.48	208.45	110.08	30.25	245.69	126.30	213.56	127.14	51.12	251.39	142.67	-5.12	-17.07	-20.87	-5.70	-16.38	32.46
7.1	205.05	96.99	20.83	240.79	114.56	204.38	95.15	18.54	239.57	112.60	204.72	96.07	19.69	240.18	113.58	209.06	109.47	36.74	246.6	127.17	-4.35	-13.40	-17.06	-6.42	-13.59	26.74
9.1	207.12	111.92	28.58	245.43	126.57	206.95	112.80	29.54	245.52	127.15	207.04	112.36	29.06	245.48	126.86	210.54	125.05	44.17	249.77	138.96	-3.51	-12.69	-15.11	-4.29	-12.10	23.80
11.1	203.70	94.29	24.29	239.63	112.38	203.82	96.08	26.12	240.27	113.86	203.76	95.19	25.21	239.95	113.12	206.29	101.27	35.08	243.76	119.93	-2.53	-6.08	-9.88	-3.81	-6.81	14.21

Subject 17 Left

	Lacey				Joe				Average				Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	205.29	93.29	26.75	240.58	113.04	205.37	94.13	27.50	240.87	113.74	205.33	93.71	27.13	240.73	113.39	209.64	97.85	33.41	245.49	119.7	-4.31	-4.14	-6.29	-4.76	-6.31	11.74
3.2	206.55	84.92	20.23	239.91	107.80	206.48	84.89	20.25	239.80	107.73	206.52	84.91	20.24	239.86	107.77	211.49	95.01	34.61	246.11	119.11	-4.98	-10.11	-14.37	-6.26	-11.35	22.39
5.2	207.50	99.01	26.05	243.31	118.10	207.41	98.68	25.90	243.13	117.80	207.46	98.85	25.98	243.22	117.95	212.4	106.69	40.69	248.31	127.81	-4.95	-7.85	-14.72	-5.09	-9.86	20.63
7.2	205.50	96.76	20.26	241.28	114.69	205.52	96.85	20.30	241.33	114.77	205.51	96.81	20.28	241.31	114.73	209.99	107.9	36.3	247.02	126.70	-4.48	-11.10	-16.02	-5.72	-11.97	23.99
9.2	202.37	96.09	18.58	238.77	112.00	202.33	95.77	18.46	238.62	111.74	202.35	95.93	18.52	238.70	111.87	205.51	102.93	29.66	243.3	119.96	-3.16	-7.00	-11.14	-4.61	-8.09	16.42
11.2	201.50	90.83	22.18	237.15	108.41	201.47	90.95	22.22	237.15	108.47	201.49	90.89	22.20	237.15	108.44	202.61	90.82	27.23	238.44	109.83	-1.13	0.07	-5.03	-1.29	-1.39	5.49

Subject 18 Right

	Lacey				Joe				Average				Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	197.60	107.88	32.87	237.24	118.06	197.40	107.37	32.60	236.91	117.53	197.50	107.63	32.74	237.08	117.80	199.91	115.69	41.75	242.14	126.19	-2.41	-8.07	-9.02	-5.07	-8.40	15.76
3.1	196.08	93.61	29.01	232.27	106.89	197.75	92.56	21.77	232.95	106.57	196.92	93.09	25.39	232.61	106.73	202.61	101.65	34.7	240.73	117.75	-5.69	-8.57	-9.31	-8.12	-11.02	19.49
5.1	197.19	102.07	24.49	234.80	112.82	197.56	104.16	26.25	235.92	114.75	197.38	103.12	25.37	235.36	113.79	201.15	114.65	42.47	242.65	126.35	-3.78	-11.54	-17.10	-7.29	-12.57	25.51
7.1	198.34	104.14	31.50	236.81	115.90	197.93	102.25	29.87	235.76	114.12	198.14	103.20	30.69	236.29	115.01	202.73	113.17	45.48	243.88	126.87	-4.60	-9.98	-14.80	-7.60	-11.86	23.19
9.1	201.71	106.26	39.27	239.77	120.48	202.13	108.31	41.07	240.69	122.35	201.92	107.29	40.17	240.23	121.42	207.01	115.35	48.63	246.99	131.28	-5.09	-8.07	-8.46	-6.76	-9.87	17.48
11.1	196.32	97.29	31.48	232.26	109.71	196.02	95.56	29.77	231.25	108.10	196.17	96.43	30.63	231.76	108.91	201.17	109.12	45.21	241.64	123.02	-5.00	-12.70	-14.59	-9.88	-14.12	26.38

Subject 18 Left

	Lacey				Joe				Average				Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	196.20	95.55	25.80	231.94	107.69	196.50	95.80	26.34	232.46	108.18	196.35	95.68	26.07	232.20	107.94	199.69	103.98	32.78	238.65	116.86	-3.34	-8.31	-6.71	-6.45	-8.93	15.70
3.2	196.23	95.84	19.58	232.28	107.33	196.29	96.41	19.92	232.56	107.80	196.26	96.13	19.75	232.42	107.57	201.01	98.24	28.08	238.48	113.55	-4.75	-2.11	-8.33	-6.06	-5.99	13.00
5.2	198.99	104.63	25.99	237.54	115.99	198.92	104.84	26.01	237.52	116.09	198.96	104.74	26.00	237.53	116.04	204.84	116.99	42.95	245.67	130.33	-5.89	-12.26	-16.95	-8.14	-14.29	27.25
7.2	199.28	101.12	28.77	237.22	114.21	199.10	101.10	28.85	237.02	114.07	199.19	101.11	28.81	237.12	114.14	204.70	106.74	39.97	243.64	123.14	-5.51	-5.63	-11.16	-6.52	-9.00	17.61
9.2	199.31	98.66	29.86	236.46	112.67	198.55	97.77	28.50	235.28	111.32	198.93	98.22	29.18	235.87	112.00	205.84	109.81	44.35	245.34	126.44	-6.91	-11.60	-15.17	-9.47	-14.45	26.66
11.2	197.24	94.42	29.14	232.81	108.12	196.33	92.59	27.37	231.08	105.96	196.79	93.51	28.26	231.95	107.04	204.29	107.78	44.37	243.81	124.11	-7.50	-14.28	-16.12	-11.87	-17.07	30.85

Table C 3. Continued

Subject 19 Right

	Lacey				Joe					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	206.89	113.91	27.94	243.03	127.00	205.89	110.12	25.48	241.00	123.50	206.39	112.02	26.71	242.02	125.25	212.18	124.07	34.72	250.14	138.01	-5.79	-12.06	-8.01	-8.13	-12.76	21.72
3.1	199.18	93.82	7.96	234.53	106.88	199.28	93.58	7.79	234.60	106.79	199.23	93.70	7.88	234.57	106.84	203.3	100.5	12.37	240.36	114.77	-4.07	-6.80	-4.50	-5.80	-7.93	13.40
5.1	195.24	92.67	9.52	229.61	103.27	195.62	94.33	10.46	230.77	104.82	195.43	93.50	9.99	230.19	104.05	198.57	104.04	21.03	237.18	114.72	-3.14	-10.54	-11.04	-6.99	-10.68	20.14
7.1	197.76	96.53	13.27	234.01	108.31	197.42	95.01	12.16	233.07	106.90	197.59	95.77	12.72	233.54	107.61	200.03	103.03	20.87	238.39	115.17	-2.44	-7.26	-8.16	-4.85	-7.57	14.35
9.1	201.87	104.10	20.15	239.15	117.00	201.01	100.82	17.94	237.17	113.91	201.44	102.46	19.05	238.16	115.46	204.76	106.5	26.82	243.14	121.41	-3.32	-4.04	-7.78	-4.98	-5.96	12.17
11.1	198.05	99.80	16.39	234.84	110.99	197.22	96.43	13.34	232.82	107.73	197.64	98.12	14.87	233.83	109.36	199.3	97.1	12.2	236.01	109.71	-1.67	1.02	2.67	-2.18	-0.35	3.97

Subject 19 Left

	Lacey				Joe					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	200.30	94.60	9.09	235.92	108.37	200.54	94.52	8.95	236.13	108.47	200.42	94.56	9.02	236.03	108.42	202.83	94.44	10.72	238.64	110.34	-2.41	0.12	-1.70	-2.62	-1.92	4.39
3.2	203.06	98.71	13.42	238.12	113.24	203.57	100.63	14.55	239.24	115.03	203.32	99.67	13.99	238.68	114.14	208.75	107.69	20.81	245.43	123.84	-5.44	-8.02	-6.83	-6.75	-9.71	16.74
5.2	199.21	96.11	11.67	234.91	108.85	199.18	96.30	11.80	234.94	108.97	199.20	96.21	11.74	234.93	108.91	201.93	90.75	8.59	236.97	107.1	-2.74	5.46	3.15	-2.04	1.81	7.39
7.2	201.57	101.58	17.64	238.01	114.76	202.10	104.31	19.64	239.33	117.20	201.84	102.95	18.64	238.67	115.98	200.98	84.4	5.45	234.87	102.05	0.85	18.55	13.19	3.80	13.93	26.96
9.2	198.68	93.53	11.54	234.26	106.79	201.01	100.82	17.94	237.17	113.91	199.85	97.18	14.74	235.72	110.35	199.1	94.65	13.69	235.07	108.14	0.75	2.52	1.05	0.64	2.21	3.65
11.2	198.56	101.02	20.49	236.19	112.66	198.57	101.18	20.62	236.25	112.79	198.57	101.10	20.56	236.22	112.73	200.57	105.71	25.43	239.4	117.81	-2.01	-4.61	-4.88	-3.18	-5.09	9.22

Subject 20 Right

	Lacey				Joe					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	203.29	102.43	25.18	239.93	117.35	203.65	102.84	25.36	240.31	117.90	203.47	102.64	25.27	240.12	117.63	207.47	114.04	37.93	246.32	129.3	-4.00	-11.41	-12.66	-6.20	-11.68	21.93
3.1	202.37	113.15	26.49	240.64	123.68	201.89	111.72	25.51	239.70	122.25	202.13	112.44	26.00	240.17	122.97	206.83	123.01	34.02	247.23	134.24	-4.70	-10.58	-8.02	-7.06	-11.28	19.37
5.1	198.75	97.45	18.48	233.14	109.80	196.84	93.73	15.93	229.45	105.48	197.80	95.59	17.21	231.30	107.64	206.87	120.18	37.28	246.71	132.79	-9.07	-24.59	-20.08	-15.42	-25.15	44.27
7.1	204.78	108.41	27.81	239.78	121.85	205.56	110.90	29.90	241.01	124.25	205.17	109.66	28.86	240.40	123.05	211.47	122.49	39.56	249.57	137.15	-6.30	-12.84	-10.71	-9.18	-14.10	24.54
9.1	199.74	90.18	15.57	233.46	105.67	199.06	88.22	13.83	232.18	103.66	199.40	89.20	14.70	232.82	104.67	199.74	89.46	13.69	234.42	105.21	-0.34	-0.26	1.01	-1.60	-0.55	2.02
11.1	198.88	88.56	13.27	232.30	103.72	199.48	90.16	14.82	233.45	105.42	199.18	89.36	14.05	232.88	104.57	201.67	92.38	15.34	237.25	108.76	-2.49	-3.02	-1.30	-4.38	-4.19	7.33

Subject 20 Left

	Lacey				Joe					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	198.01	95.17	21.02	233.72	108.34	198.46	96.05	21.70	234.52	109.37	198.24	95.61	21.36	234.12	108.86	198.68	94.29	19.88	234.93	108.25	-0.44	1.32	1.48	-0.81	0.61	2.27
3.2	198.31	97.39	19.91	234.18	109.90	199.73	101.57	24.14	237.40	114.32	199.02	99.48	22.03	235.79	112.11	201.66	98.09	21.06	238.68	113.11	-2.64	1.39	0.97	-2.89	-1.00	4.38
5.2	196.85	97.92	19.64	232.68	109.11	197.23	99.39	21.05	233.72	110.59	197.04	98.66	20.35	233.20	109.85	198.22	95.67	17.91	234.72	108.63	-1.18	2.99	2.44	-1.52	1.22	4.48
7.2	197.87	95.03	18.88	233.10	107.87	198.27	95.98	19.74	233.94	108.92	198.07	95.51	19.31	233.52	108.40	198.41	91.63	16.23	233.89	105.91	-0.34	3.88	3.08	-0.37	2.49	5.56
9.2	200.25	94.03	21.62	236.37	109.44	200.46	94.63	22.58	236.79	110.11	200.36	94.33	22.10	236.58	109.78	201.08	93.8	21.12	237.32	109.89	-0.72	0.53	0.98	-0.74	-0.11	1.53
11.2	199.65	90.82	18.35	234.60	106.47	199.46	90.18	17.51	234.19	105.80	199.56	90.50	17.93	234.40	106.14	200.26	85.79	7.89	234.5	103.22	-0.70	4.71	10.04	-0.11	2.91	11.49

Table C 3. Continued

Subject 21 Right

Picture	Lacey C	Lacey M	Lacey Y	Lacey K	Lacey L	JOE C	JOE M	JOE Y	JOE K	JOE L	Average C	Average M	Average Y	Average K	Average L	Control C	Control M	Control Y	Control K	Control L	Difference C	Difference M	Difference Y	Difference K	Difference L	CD
1.1	196.04	110.17	39.55	236.76	119.31	195.58	107.22	35.96	235.17	116.51	195.81	108.70	37.76	235.97	117.91	197.51	118.11	44.77	241.07	126.62	-1.70	-9.42	-7.02	-5.11	-8.71	15.58
3.1	196.73	106.06	30.98	236.57	116.02	196.58	106.71	31.64	236.61	116.43	196.66	106.39	31.31	236.59	116.23	197.25	106.88	34.22	237.21	117.19	-0.59	-0.50	-2.91	-0.62	-0.97	3.22
5.1	195.09	100.24	31.06	232.89	110.78	195.31	100.23	31.09	233.15	110.95	195.20	100.24	31.08	233.02	110.87	199.5	104.84	39.93	239.03	118.24	-4.30	-4.61	-8.86	-6.01	-7.37	14.44
7.1	199.82	100.86	45.31	238.22	116.46	199.37	101.35	45.66	237.91	116.51	199.60	101.11	45.49	238.07	116.49	204.72	111.19	60.2	245.56	128.75	-5.13	-10.09	-14.72	-7.50	-12.27	23.48
9.1	197.21	100.73	33.12	235.19	112.94	197.30	101.22	33.58	235.46	113.40	197.26	100.98	33.35	235.33	113.17	202.18	111.28	47.07	242.85	125.35	-4.93	-10.31	-13.72	-7.53	-12.18	22.88
11.1	196.77	104.08	31.13	235.73	114.65	197.19	104.64	31.31	236.30	115.37	196.98	104.36	31.22	236.02	115.01	202.07	107.15	39.7	241.66	121.6	-5.09	-2.79	-8.48	-5.65	-6.59	13.45

Subject 21 Left

Picture	Lacey C	Lacey M	Lacey Y	Lacey K	Lacey L	JOE C	JOE M	JOE Y	JOE K	JOE L	Average C	Average M	Average Y	Average K	Average L	Control C	Control M	Control Y	Control K	Control L	Difference C	Difference M	Difference Y	Difference K	Difference L	CD
1.2	196.84	106.61	36.82	236.61	117.08	196.61	105.90	36.34	236.16	116.37	196.73	106.26	36.58	236.39	116.73	196.01	101.73	33.82	234.62	112.79	0.72	4.52	2.76	1.76	3.93	6.87
3.2	198.39	111.29	38.77	238.96	121.59	197.81	110.23	37.84	238.12	120.34	198.10	110.76	38.31	238.54	120.97	200.34	110.54	41.07	241.31	122.88	-2.24	0.22	-2.76	-2.77	-1.91	4.90
5.2	197.35	104.26	33.76	236.20	115.50	197.11	106.23	34.05	236.67	116.74	197.23	105.25	33.91	236.44	116.12	200.7	106.41	42.18	240.54	120.44	-3.47	-1.16	-8.28	-4.10	-4.32	10.83
7.2	198.18	106.91	37.08	237.74	118.32	197.78	106.45	36.47	237.16	117.63	197.98	106.68	36.78	237.45	117.98	201.25	106.86	44.42	241.23	121.44	-3.27	-0.18	-7.65	-3.78	-3.47	9.77
9.2	197.60	105.65	35.21	237.09	116.83	196.97	104.65	33.63	236.00	115.46	197.29	105.15	34.42	236.55	116.15	198.75	104.66	39.27	238.27	117.45	-1.47	0.49	-4.85	-1.72	-1.31	5.53
11.2	196.38	97.96	28.04	233.60	109.83	196.17	96.75	27.63	232.97	108.80	196.28	97.36	27.84	233.29	109.32	198.92	99.38	33.83	236.88	113.35	-2.65	-2.03	-6.00	-3.60	-4.04	8.73

Subject 22 Right

Picture	Lacey C	Lacey M	Lacey Y	Lacey K	Lacey L	JOE C	JOE M	JOE Y	JOE K	JOE L	Average C	Average M	Average Y	Average K	Average L	Control C	Control M	Control Y	Control K	Control L	Difference C	Difference M	Difference Y	Difference K	Difference L	CD
1.1	197.11	99.85	38.91	234.88	112.88	197.87	100.60	39.19	235.95	114.02	197.49	100.23	39.05	235.42	113.45	201.74	113.27	50.02	243.5	126.88	-4.25	-13.05	-10.97	-8.09	-13.43	23.54
3.1	201.26	104.19	31.40	239.35	117.87	202.24	106.78	33.65	240.93	120.57	201.75	105.49	32.53	240.14	119.22	207.93	114.1	44.08	247.23	130.5	-6.18	-8.61	-11.56	-7.09	-11.28	20.58
5.1	200.97	108.12	33.99	239.96	120.59	200.75	107.46	33.08	239.51	119.87	200.86	107.79	33.54	239.74	120.23	207.6	118.6	47.89	247.93	133.74	-6.74	-10.81	-14.36	-8.19	-13.51	24.86
7.1	200.13	111.11	36.98	240.36	122.41	200.47	111.89	37.54	240.89	123.26	200.30	111.50	37.26	240.63	122.84	206.33	124.92	51	248.32	137.53	-6.03	-13.42	-13.74	-7.69	-14.70	26.08
9.1	200.85	114.39	43.37	240.76	125.66	201.03	114.35	43.28	240.84	125.73	200.94	114.37	43.33	240.80	125.70	207.62	128.06	57.92	249.18	141.01	-6.68	-13.69	-14.60	-8.38	-15.32	27.38
11.1	200.02	110.59	46.59	240.05	123.11	199.97	110.62	46.70	240.04	123.11	200.00	110.61	46.65	240.05	123.11	204.84	124.65	57.08	247.2	137.08	-4.85	-14.05	-10.44	-7.15	-13.97	24.00

Subject 22 Left

Picture	Lacey C	Lacey M	Lacey Y	Lacey K	Lacey L	JOE C	JOE M	JOE Y	JOE K	JOE L	Average C	Average M	Average Y	Average K	Average L	Control C	Control M	Control Y	Control K	Control L	Difference C	Difference M	Difference Y	Difference K	Difference L	CD
1.2	195.92	98.41	36.04	233.39	110.68	195.66	97.63	35.01	232.76	109.83	195.79	98.02	35.53	233.08	110.26	196.53	104.37	41.06	236.12	115.78	-0.74	-6.35	-5.54	-3.05	-5.53	10.55
3.2	195.89	101.63	28.28	233.96	112.00	195.92	101.91	29.23	234.09	112.33	195.91	101.77	28.76	234.03	112.17	198.77	105.1	40.78	238.41	117.91	-2.87	-3.33	-12.03	-4.38	-5.75	14.70
5.2	195.31	104.77	25.90	234.10	113.44	196.07	106.02	25.64	235.35	114.86	195.69	105.40	25.77	234.73	114.15	198.75	108.11	37.14	239.02	119.51	-3.06	-2.72	-11.37	-4.30	-5.36	13.90
7.2	196.95	104.36	30.79	235.89	114.93	197.44	104.98	30.60	236.61	115.70	197.20	104.67	30.70	236.25	115.32	200.49	112.35	42.98	242.09	124.47	-3.30	-7.68	-12.29	-5.84	-9.16	18.40
9.2	197.02	103.49	37.14	235.60	115.08	196.23	101.95	35.61	234.22	113.24	196.63	102.72	36.38	234.91	114.16	201.16	112.55	47.91	242.79	125.69	-4.54	-9.83	-11.54	-7.88	-11.53	21.10
11.2	196.25	101.46	37.15	234.66	113.20	195.60	99.95	35.61	233.38	111.47	195.93	100.71	36.38	234.02	112.34	196.46	101.67	37.07	235.2	113.45	-0.53	-0.97	-0.69	-1.18	-1.11	2.08

Table C 3. Continued

Subject 23 Right

	Lacey				JOE				Average				Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	205.07	95.05	30.26	240.35	114.33	205.00	94.23	29.44	240.04	113.65	205.04	94.64	29.85	240.20	113.99	211.06	103	40.79	247.39	124.72	-6.03	-8.36	-10.94	-7.19	-10.73	19.82
3.1	205.18	101.85	30.64	242.54	119.06	205.12	101.53	30.31	242.39	118.76	205.15	101.69	30.48	242.47	118.91	211.04	106.92	41.42	247.78	127.3	-5.89	-5.23	-10.95	-5.32	-8.39	16.75
5.1	213.20	103.49	33.24	247.23	125.01	213.19	103.36	33.07	247.21	124.90	213.20	103.43	33.16	247.22	124.96	220.88	119.94	52.42	252.65	141.52	-7.69	-16.52	-19.27	-5.43	-16.57	31.73
7.1	206.68	92.30	24.79	241.74	113.24	206.72	92.54	25.04	241.85	113.46	206.70	92.42	24.92	241.80	113.35	213.49	97.48	38.22	248.11	122.41	-6.79	-5.06	-13.31	-6.32	-9.06	19.25
9.1	199.91	84.81	15.30	233.74	102.56	200.21	84.80	15.04	234.15	102.78	200.06	84.81	15.17	233.95	102.67	203.63	83.42	18.58	237.79	104.87	-3.57	1.39	-3.41	-3.85	-2.20	6.78
11.1	200.78	91.07	18.60	236.29	107.64	200.70	91.48	19.23	236.29	107.91	200.74	91.28	18.92	236.29	107.78	203.42	92.73	25.77	239.55	111.45	-2.68	-1.46	-6.86	-3.26	-3.68	8.97

Subject 23 Left

	Lacey				JOE				Average				Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	211.97	102.84	36.90	246.83	124.43	214.31	112.15	45.37	249.15	132.57	213.14	107.50	41.14	247.99	128.50	217.16	126.15	55.83	252.32	144.21	-4.02	-18.66	-14.70	-4.33	-15.71	29.08
3.2	203.02	103.71	33.74	241.08	119.13	203.24	103.32	32.96	241.23	118.95	203.13	103.52	33.35	241.16	119.04	208.08	105.01	38.33	245.75	123.94	-4.95	-1.50	-4.98	-4.60	-4.90	9.83
5.2	205.65	99.01	26.23	242.15	116.98	205.79	99.96	26.78	242.48	117.76	205.72	99.49	26.51	242.32	117.37	209.28	106.5	38.57	246.68	125.68	-3.56	-7.02	-12.07	-4.37	-8.31	17.19
7.2	205.00	100.38	29.83	241.84	117.81	205.21	99.89	28.92	241.98	117.56	205.11	100.14	29.38	241.91	117.69	208.01	105.18	36.26	245.64	123.77	-2.90	-5.05	-6.89	-3.73	-6.08	11.50
9.2	204.90	106.10	34.21	243.15	122.03	205.04	107.12	34.91	243.54	122.89	204.97	106.61	34.56	243.35	122.46	208.41	111.16	39.42	246.9	128.32	-3.44	-4.55	-4.86	-3.56	-5.86	10.16
11.2	199.41	94.20	24.25	235.69	109.22	199.76	95.42	24.19	236.44	110.31	199.59	94.81	24.22	236.07	109.77	202.05	93.43	26.12	238.32	110.93	-2.47	1.38	-1.90	-2.26	-1.17	4.25

Subject 24 Right

	Lacey				JOE				Average				Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	196.15	95.93	23.88	232.04	107.72	197.63	99.06	25.44	234.83	111.18	196.89	97.50	24.66	233.44	109.45	198.25	104.38	30.94	237.16	115.85	-1.36	-6.88	-6.28	-3.72	-6.40	11.98
3.1	197.63	100.99	28.03	235.58	112.79	197.69	101.67	28.15	235.89	113.31	197.66	101.33	28.09	235.74	113.05	198.72	99.3	28.17	236.3	112.44	-1.06	2.03	-0.08	-0.56	0.61	2.44
5.1	195.41	99.48	20.94	232.03	109.24	196.04	100.93	22.11	233.26	110.87	195.73	100.21	21.53	232.65	110.06	195.73	94.93	19.44	231.98	106.4	0.00	5.28	2.09	0.66	3.66	6.78
7.1	196.80	99.83	25.74	234.25	111.10	196.65	99.53	25.19	233.99	110.72	196.73	99.68	25.47	234.12	110.91	198.15	100.82	28.91	236.1	113.1	-1.42	-1.14	-3.45	-1.98	-2.19	4.89
9.1	198.03	95.70	22.90	234.35	108.97	198.91	97.23	25.48	235.79	110.96	198.47	96.47	24.19	235.07	109.97	200.36	100.35	31.05	238.23	114.8	-1.89	-3.88	-6.86	-3.16	-4.83	9.95
11.1	198.46	103.59	30.00	236.88	115.39	198.35	103.22	29.56	236.66	115.01	198.41	103.41	29.78	236.77	115.20	199.65	107.59	35.35	239.61	119.66	-1.25	-4.19	-5.57	-2.84	-4.46	8.83

Subject 24 Left

	Lacey				JOE				Average				Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	201.31	106.82	35.95	240.28	120.28	200.51	103.55	33.44	238.67	117.21	200.91	105.19	34.70	239.48	118.75	200.8	105.7	34.41	240.16	119.1	0.11	-0.52	0.29	-0.69	-0.35	0.98
3.2	198.02	100.63	23.36	235.59	112.31	199.01	103.11	25.98	237.45	115.05	198.52	101.87	24.67	236.52	113.68	201.85	115.54	37.17	243.46	126.78	-3.34	-13.67	-12.50	-6.94	-13.10	23.96
5.2	194.03	96.86	17.18	229.53	105.91	196.02	101.85	21.86	233.81	111.46	195.03	99.36	19.52	231.67	108.69	199.64	111.69	34.38	240.58	122.3	-4.61	-12.34	-14.86	-8.91	-13.62	25.67
7.2	195.32	97.46	23.50	232.08	108.13	195.57	97.88	23.87	232.52	108.66	195.45	97.67	23.69	232.30	108.40	197.56	101.57	28.68	235.79	113.13	-2.12	-3.90	-5.00	-3.49	-4.74	8.90
9.2	198.03	98.92	25.67	235.09	111.42	198.51	100.28	27.00	236.09	112.87	198.27	99.60	26.34	235.59	112.15	202.34	109.5	38.57	242.56	123.25	-4.07	-9.90	-12.24	-6.97	-11.11	20.88
11.2	197.93	102.69	29.03	236.15	114.27	197.81	102.55	28.96	235.98	114.08	197.87	102.62	29.00	236.07	114.18	198.49	106.28	33.28	238.03	117.58	-0.62	-3.66	-4.29	-1.97	-3.41	6.90

Table C 3. Continued

Subject 25 Right

	Lacey					Joe					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	195.94	80.45	27.60	227.68	97.68	196.05	80.75	27.71	227.94	97.98	196.00	80.60	27.66	227.81	97.83	196.88	82.99	30.79	229.88	100.5	-0.88	-2.39	-3.14	-2.07	-2.67	5.27
3.1	198.60	93.86	26.74	234.45	108.62	198.59	93.98	26.76	234.45	108.64	198.60	93.92	26.75	234.45	108.63	200.03	96.08	29.33	236.83	111.5	-1.44	-2.16	-2.58	-2.38	-2.87	5.22
5.1	198.37	99.09	27.57	235.69	112.07	198.41	99.57	28.02	235.91	112.48	198.39	99.33	27.80	235.80	112.28	202.36	111.51	39.89	242.93	124.81	-3.97	-12.18	-12.10	-7.13	-12.54	22.77
7.1	199.08	100.51	33.51	236.73	114.20	199.41	101.09	33.93	237.35	114.90	199.25	100.80	33.72	237.04	114.55	201.32	108.85	40.46	241.57	122.36	-2.07	-8.05	-6.74	-4.53	-7.81	14.00
9.1	197.83	98.56	27.06	234.62	111.15	198.01	98.85	27.28	234.97	111.52	197.92	98.71	27.17	234.80	111.34	199.66	102.95	31.38	237.92	116.03	-1.74	-4.25	-4.21	-3.12	-4.69	8.40
11.1	197.34	101.30	27.19	234.93	112.66	197.74	101.63	27.52	235.57	113.24	197.54	101.47	27.36	235.25	112.95	199.67	104.63	30.18	238.68	117.07	-2.13	-3.16	-2.83	-3.43	-4.12	7.16

Subject 25 Left

	Lacey					Joe					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	196.49	91.20	28.92	231.58	105.49	196.40	90.60	28.13	231.21	104.91	196.45	90.90	28.53	231.40	105.20	198.47	95.23	35.56	235.21	110.53	-2.03	-4.33	-7.04	-3.82	-5.33	10.74
3.2	196.24	95.89	22.48	232.23	107.69	196.48	96.16	23.04	232.67	108.13	196.36	96.03	22.76	232.45	107.91	199.83	104.11	30.03	238.56	116.77	-3.47	-8.08	-7.27	-6.11	-8.86	15.69
5.2	197.22	98.79	25.99	234.26	110.80	197.21	99.00	26.57	234.34	111.00	197.22	98.90	26.28	234.30	110.90	197.58	104.57	26.42	236.35	115	-0.37	-5.67	-0.14	-2.05	-4.10	7.31
7.2	197.11	98.08	27.67	233.89	110.39	197.11	97.98	27.43	233.86	110.30	197.11	98.03	27.55	233.88	110.35	199.96	107.94	31.61	239.69	119.69	-2.85	-9.91	-4.06	-5.82	-9.35	15.62
9.2	199.00	100.03	25.90	236.02	113.01	198.92	99.21	25.36	235.63	112.17	198.96	99.62	25.63	235.83	112.59	202.03	109.99	36.07	241.61	122.95	-3.07	-10.37	-10.44	-5.79	-10.36	19.15
11.2	199.26	105.45	30.13	237.79	117.22	198.72	101.69	28.31	236.34	114.08	198.99	103.57	29.22	237.07	115.65	201.74	109.05	33.46	241.47	121.87	-2.75	-5.48	-4.24	-4.41	-6.22	10.66

Subject 26 Right

	Lacey					Joe					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	196.21	86.25	22.26	229.88	101.29	196.14	84.99	21.19	229.36	100.26	196.18	85.62	21.73	229.62	100.78	195.99	90.62	23.14	231.1	104.08	0.19	-5.00	-1.42	-1.48	-3.30	6.34
3.1	193.32	86.12	14.72	225.84	97.96	193.13	85.45	13.61	225.32	97.23	193.23	85.79	14.17	225.58	97.60	194.76	92.57	20.06	230.21	104.07	-1.54	-6.79	-5.90	-4.63	-6.47	12.10
5.1	193.21	92.01	13.23	227.55	101.69	192.68	90.62	11.07	226.35	100.05	192.95	91.32	12.15	226.95	100.87	194.39	94.08	17.59	230.24	104.55	-1.44	-2.77	-5.44	-3.29	-3.68	7.98
7.1	192.71	90.20	15.36	226.56	100.29	192.18	89.34	15.43	225.51	99.28	192.45	89.77	15.40	226.04	99.79	195.49	94.09	20.32	231.45	105.71	-3.05	-4.32	-4.93	-5.41	-5.93	10.80
9.1	199.26	108.77	29.74	238.94	119.44	199.51	109.30	29.96	239.37	120.02	199.39	109.04	29.85	239.16	119.73	202.28	119.05	37.43	244.27	129.41	-2.90	-10.02	-7.58	-5.12	-9.68	16.91
11.1	200.15	101.54	26.82	237.94	114.85	200.32	101.59	26.65	238.13	114.99	200.24	101.57	26.74	238.04	114.92	201.55	108.21	33.62	241.17	121.18	-1.32	-6.65	-6.89	-3.13	-6.26	11.93

Subject 26 Left

	Lacey					Joe					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	195.53	86.11	22.51	228.85	100.67	195.51	86.00	22.43	228.80	100.58	195.52	86.06	22.47	228.83	100.63	198.53	77.33	18.54	230.16	96.88	-3.01	8.73	3.93	-1.34	3.75	10.79
3.2	193.51	88.17	18.42	227.00	99.90	193.59	88.26	18.42	227.15	100.03	193.55	88.22	18.42	227.08	99.97	195.28	89.06	23.31	229.83	102.47	-1.73	-0.84	-4.89	-2.76	-2.51	6.44
5.2	197.71	104.96	25.41	236.41	115.26	198.15	105.90	26.07	237.14	116.30	197.93	105.43	25.74	236.78	115.78	199.45	101.66	33.87	237.78	115.35	-1.52	3.77	-8.13	-1.01	0.43	9.16
7.2	194.37	91.43	19.00	229.24	102.91	194.18	91.31	19.18	228.92	102.69	194.28	91.37	19.09	229.08	102.80	195.07	96.17	26.94	231.79	107.52	-0.79	-4.80	-7.85	-2.71	-4.72	10.72
9.2	194.54	92.85	19.71	229.94	104.06	194.57	93.11	19.96	230.09	104.29	194.56	92.98	19.84	230.02	104.18	196.04	96.9	28.88	233.17	108.95	-1.48	-3.92	-9.05	-3.16	-4.77	11.50
11.2	197.31	97.39	23.95	233.98	109.69	197.28	97.99	24.29	234.17	110.12	197.30	97.69	24.12	234.08	109.91	200.01	107.49	36.94	239.45	119.98	-2.71	-9.80	-12.82	-5.38	-10.08	19.95

Table C 3. Continued

Subject 27 Right

	Lacey				Joe				Average				Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	203.61	96.89	29.68	238.52	114.22	202.77	94.50	27.52	237.13	111.81	203.19	95.70	28.60	237.83	113.02	209.63	108.48	44.27	247.38	127.82	-6.44	-12.79	-15.67	-9.56	-14.81	27.59
3.1	199.63	98.95	27.25	234.76	112.47	200.54	102.70	29.89	236.90	115.97	200.09	100.83	28.57	235.83	114.22	204.69	104.95	37.7	243.3	121.73	-4.61	-4.13	-9.13	-7.47	-7.51	15.29
5.1	203.22	106.35	33.70	239.14	120.41	204.29	109.58	36.31	240.93	123.57	203.76	107.97	35.01	240.04	121.99	210.11	116.09	47.82	248.73	133.49	-6.36	-8.13	-12.82	-8.69	-11.50	21.87
7.1	206.77	107.56	36.29	243.55	124.14	206.70	107.50	36.32	243.53	124.07	206.74	107.53	36.31	243.54	124.11	212.97	114.38	50.22	249.67	134.13	-6.23	-6.85	-13.92	-6.13	-10.03	20.43
9.1	198.03	97.40	20.87	234.42	109.87	197.82	96.21	20.20	233.79	108.82	197.93	96.81	20.54	234.11	109.35	201.71	107.95	33.22	241.53	121.14	-3.79	-11.15	-12.69	-7.43	-11.80	22.22
11.1	201.07	93.50	26.21	235.95	109.99	200.10	90.43	23.48	234.01	106.92	200.59	91.97	24.85	234.98	108.46	205.4	95.98	33.82	241.89	115.8	-4.82	-4.02	-8.98	-6.91	-7.35	14.88

Subject 27 Left

	Lacey				Joe				Average				Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	196.58	83.34	15.44	228.48	98.76	196.76	83.99	16.02	229.04	99.42	196.67	83.67	15.73	228.76	99.09	200.52	88.35	19.58	235.39	105.76	-3.85	-4.69	-3.85	-6.63	-6.67	11.83
3.2	197.84	80.34	16.44	229.73	97.99	197.87	80.36	16.81	229.82	98.07	197.86	80.35	16.63	229.78	98.03	201.45	84.15	20.67	235.68	103.9	-3.59	-3.80	-4.05	-5.91	-5.87	10.63
5.2	195.57	90.52	18.22	230.19	130.10	195.35	90.09	17.61	229.74	102.56	195.46	90.31	17.92	229.97	116.33	197.88	94.2	23.54	234.23	107.94	-2.42	-3.90	-5.63	-4.26	8.39	11.88
7.2	200.44	88.91	19.84	235.18	106.02	200.18	88.64	18.79	234.73	105.51	200.31	88.78	19.32	234.96	105.77	202.60	89.47	22.93	237.85	108.38	-2.29	-0.69	-3.62	-2.90	-2.61	5.83
9.2	203.19	106.09	32.73	240.35	120.41	203.98	108.67	34.49	241.79	122.90	203.59	107.38	33.61	241.07	121.66	209.73	121.26	47.18	249.31	136.63	-6.15	-13.88	-13.57	-8.24	-14.98	26.58
11.2	202.92	95.48	31.95	239.34	113.42	203.01	95.75	32.13	239.50	113.69	202.97	95.62	32.04	239.42	113.56	206.49	102.92	39.26	244.33	121.67	-3.53	-7.30	-7.22	-4.91	-8.11	14.42

Subject 28 Right

	Lacey				Joe				Average				Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	198.49	104.38	14.35	236.56	114.08	198.98	106.80	16.28	237.67	116.28	198.74	105.59	15.32	237.12	115.18	202.34	116.06	24.31	243.35	125.82	-3.60	-10.47	-9.00	-6.23	-10.64	18.86
3.1	201.61	100.40	16.74	238.61	113.97	202.24	102.03	18.93	239.65	115.75	201.93	101.22	17.84	239.13	114.86	206.46	105.15	25.31	244.06	121.4	-4.54	-3.94	-7.48	-4.93	-6.54	12.61
5.1	200.55	101.44	11.49	237.82	113.28	200.65	102.13	12.55	238.13	113.94	200.60	101.79	12.02	237.98	113.61	205.64	113.83	25.41	245.18	126.59	-5.04	-12.05	-13.39	-7.21	-12.98	23.88
7.1	202.00	102.45	13.28	239.23	115.16	197.79	96.01	5.51	233.69	106.98	199.90	99.23	9.40	236.46	111.07	206.35	112.36	25.2	245.13	125.98	-6.46	-13.13	-15.81	-8.67	-14.91	27.59
9.1	198.12	99.41	14.28	234.76	110.47	199.22	104.56	18.89	237.45	115.26	198.67	101.99	16.59	236.11	112.87	201.58	108.37	22	240.8	119.84	-2.91	-6.39	-5.42	-4.70	-6.97	12.22
11.1	198.60	96.29	12.53	234.48	108.58	199.07	99.06	14.98	235.73	111.05	198.84	97.68	13.76	235.11	109.82	201.95	103.79	21.13	240.01	117	-3.12	-6.11	-7.38	-4.91	-7.19	13.31

Subject 28 Left

	Lacey				Joe				Average				Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	195.12	104.32	13.73	233.41	111.49	195.55	105.39	14.89	234.22	112.68	195.34	104.86	14.31	233.82	112.09	200.56	114.64	22.32	241.61	123.44	-5.22	-9.79	-8.01	-7.80	-11.36	19.41
3.2	200.97	102.19	14.42	238.35	114.39	201.36	102.83	15.04	238.87	115.16	201.17	102.51	14.73	238.61	114.78	204.51	109.56	22.07	243.39	122.62	-3.34	-7.05	-7.34	-4.78	-7.85	14.11
5.2	197.99	95.87	5.16	233.87	107.01	197.79	96.01	5.51	233.69	106.98	197.89	95.94	5.34	233.78	107.00	201.77	103.48	11.35	239.68	115.5	-3.88	-7.54	-6.02	-5.90	-8.51	14.67
7.2	198.30	94.22	6.53	233.47	106.28	195.92	90.21	4.67	229.42	101.52	197.11	92.22	5.60	231.45	103.90	202.21	102.51	12.16	239.84	115.28	-5.10	-10.30	-6.56	-8.40	-11.38	19.37
9.2	197.22	90.86	8.63	231.51	103.51	196.73	91.40	7.88	231.26	103.43	196.98	91.13	8.26	231.39	103.47	201.15	97.91	14.33	238.03	111.82	-4.18	-6.78	-6.08	-6.65	-8.35	14.63
11.2	198.28	97.67	12.50	234.71	109.27	198.22	97.61	12.39	234.65	109.17	198.25	97.64	12.45	234.68	109.22	202.71	108.04	23.18	241.65	120.54	-4.46	-10.40	-10.74	-6.97	-11.32	20.49

Table C 3. Continued

Subject 29 Right

Picture	Lacey C	Lacey M	Lacey Y	Lacey K	Lacey L	JOE C	JOE M	JOE Y	JOE K	JOE L	Average C	Average M	Average Y	Average K	Average L	Control C	Control M	Control Y	Control K	Control L	Difference C	Difference M	Difference Y	Difference K	Difference L	Difference CD
1.1	197.79	99.81	33.25	233.77	112.44	198.74	102.12	35.28	235.50	114.95	198.27	100.97	34.27	234.64	113.70	199.63	96.91	32.28	236.88	112.06	-1.37	4.06	1.99	-2.25	1.63	5.47
3.1	201.98	110.26	39.00	240.08	122.96	203.05	113.52	42.12	241.60	126.15	202.52	111.89	40.56	240.84	124.56	205.71	116.27	48.98	246.3	131.13	-3.20	-4.38	-8.42	-5.46	-6.57	13.17
5.1	201.88	104.89	33.35	239.82	118.98	202.13	105.79	34.21	240.22	119.83	202.01	105.34	33.78	240.02	119.41	205.05	103.99	42.77	243.59	121.87	-3.05	1.35	-8.99	-3.57	-2.47	10.52
7.1	204.07	105.78	40.53	240.31	121.43	203.54	104.35	39.16	239.56	119.98	203.81	105.07	39.85	239.94	120.71	208.06	102.25	44.58	245.23	122.82	-4.26	2.82	-4.74	-5.29	-2.11	9.00
9.1	202.16	103.94	40.89	240.34	119.43	201.72	102.13	39.26	239.50	117.71	201.94	103.04	40.08	239.92	118.57	206.84	105.05	46.97	245.23	124.24	-4.90	-2.02	-6.90	-5.31	-5.67	11.66
11.1	197.56	103.59	34.74	236.17	115.30	197.94	104.81	35.79	236.90	116.53	197.75	104.20	35.27	236.54	115.92	202.4	110.72	42.33	242.87	124.54	-4.65	-6.52	-7.07	-6.34	-8.63	15.12

Subject 29 Left

Picture	Lacey C	Lacey M	Lacey Y	Lacey K	Lacey L	JOE C	JOE M	JOE Y	JOE K	JOE L	Average C	Average M	Average Y	Average K	Average L	Control C	Control M	Control Y	Control K	Control L	Difference C	Difference M	Difference Y	Difference K	Difference L	Difference CD
1.2	194.87	93.55	28.96	230.32	105.71	195.91	94.49	28.18	231.90	107.11	195.39	94.02	28.57	231.11	106.41	198.34	95.86	28.23	235.26	109.89	-2.95	-1.84	0.34	-4.15	-3.48	6.44
3.2	199.92	90.26	29.78	235.29	107.69	200.00	90.42	29.67	235.38	107.82	199.96	90.34	29.73	235.34	107.76	201.18	93.11	35.46	237.77	111.15	-1.22	-2.77	-5.74	-2.44	-3.40	7.71
5.2	199.37	100.74	34.75	237.47	114.74	199.69	101.40	35.40	237.95	115.48	199.53	101.07	35.08	237.71	115.11	202.47	108.25	42.15	242.59	122.97	-2.94	-7.18	-7.08	-4.88	-7.86	13.99
7.2	199.21	100.19	34.11	236.95	114.16	198.59	98.94	32.94	235.83	112.70	198.90	99.57	33.53	236.39	113.43	202.16	109.84	42.46	242.81	123.90	-3.26	-10.28	-8.94	-6.42	-10.47	18.62
9.2	199.41	92.90	31.65	235.25	109.13	201.72	102.13	39.26	239.50	117.71	200.57	97.52	35.46	237.38	113.42	201.77	102.45	37.36	240.33	117.98	-1.21	-4.94	-1.91	-2.96	-4.56	7.68
11.2	199.74	100.16	34.23	237.47	114.58	199.95	100.83	34.87	237.95	115.28	199.85	100.50	34.55	237.71	114.93	202.11	102.48	36.69	240.85	118.23	-2.27	-1.99	-2.14	-3.14	-3.30	5.87

Subject 30 Right

Picture	Lacey C	Lacey M	Lacey Y	Lacey K	Lacey L	JOE C	JOE M	JOE Y	JOE K	JOE L	Average C	Average M	Average Y	Average K	Average L	Control C	Control M	Control Y	Control K	Control L	Difference C	Difference M	Difference Y	Difference K	Difference L	Difference CD
1.1	201.89	103.20	13.16	238.59	115.41	201.64	102.22	12.44	237.96	114.46	201.77	102.71	12.80	238.28	114.94	199.8	98.99	6.6	236.67	110.64	1.96	3.72	6.20	1.61	4.30	8.78
3.1	199.08	90.35	7.19	233.17	104.41	198.67	89.16	6.42	232.37	103.22	198.88	89.76	6.81	232.77	103.82	198.3	89.3	3.26	233	102.87	0.57	0.45	3.55	-0.23	0.94	3.75
5.1	202.50	94.64	7.61	237.58	109.69	203.49	96.83	9.25	238.95	112.00	203.00	95.74	8.43	238.27	110.85	205.38	98.32	8.84	241.68	114.39	-2.38	-2.58	-0.41	-3.42	-3.55	6.06
7.1	199.31	98.50	7.01	234.76	109.71	199.38	99.05	7.34	234.97	110.17	199.35	98.78	7.18	234.87	109.94	198.53	96.27	3.46	234.63	107.52	0.81	2.51	3.72	0.24	2.42	5.16
9.1	202.96	99.86	11.55	239.34	113.94	203.06	100.37	11.90	239.55	114.39	203.01	100.12	11.73	239.45	114.17	205.76	106.1	15.5	243.55	120.47	-2.75	-5.98	-3.78	-4.11	-6.31	10.69
11.1	199.19	102.94	13.61	236.60	113.52	196.81	98.08	9.78	232.61	108.05	198.00	100.51	11.70	234.61	110.79	194.55	88.94	2.92	228.09	99.54	3.45	11.57	8.78	6.52	11.25	19.79

Subject 30 Left

Picture	Lacey C	Lacey M	Lacey Y	Lacey K	Lacey L	JOE C	JOE M	JOE Y	JOE K	JOE L	Average C	Average M	Average Y	Average K	Average L	Control C	Control M	Control Y	Control K	Control L	Difference C	Difference M	Difference Y	Difference K	Difference L	Difference CD
1.2	202.94	103.99	12.75	240.34	116.77	204.21	107.16	14.35	242.32	119.95	203.58	105.58	13.55	241.33	118.36	205.7	116.69	19.26	245.67	127.86	-2.13	-11.12	-5.71	-4.34	-9.50	16.42
3.2	198.19	91.88	4.36	233.10	104.50	198.67	89.16	6.42	232.37	103.22	198.43	90.52	5.39	232.74	103.86	200.96	96.63	8.34	237.45	110.19	-2.53	-6.11	-2.95	-4.71	-6.33	10.71
5.2	199.36	99.72	5.89	235.48	110.54	200.88	102.23	7.23	237.83	113.51	200.12	100.98	6.56	236.66	112.03	202.95	102.89	8.92	240.39	115.71	-2.83	-1.92	-2.36	-3.73	-3.68	6.69
7.2	196.53	96.13	8.99	231.47	106.39	200.94	106.94	9.05	239.22	116.94	198.74	101.54	9.02	235.35	111.67	202.98	109.72	9.98	242.12	120.42	-4.24	-8.19	-0.96	-6.78	-8.76	14.44
9.2	198.33	93.56	7.67	233.54	106.04	197.90	93.26	7.30	232.96	105.47	198.12	93.41	7.49	233.25	105.76	200.77	94.38	7.52	236.85	108.52	-2.66	-0.97	-0.04	-3.60	-2.77	5.35
11.2	200.02	105.24	7.95	237.86	115.00	198.44	101.14	12.42	235.33	111.61	199.23	103.19	10.19	236.60	113.31	202.35	107	17.43	241.04	118.96	-3.12	-3.81	-7.25	-4.44	-5.65	11.33

Table C 3. Continued

Subject 31 Right

	Lacey				JOE					Average						Control					Difference					
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	216.79	140.40	61.25	251.39	152.76	216.84	140.45	61.25	251.41	152.82	216.82	140.43	61.25	251.40	152.79	217.35	144.24	64.87	253.46	156.51	-0.53	-3.82	-3.62	-2.06	-3.72	6.78
3.1	214.51	133.61	54.74	250.24	146.78	216.18	139.28	60.11	251.23	151.67	215.35	136.45	57.43	250.74	149.23	215.95	139.59	59.05	253.02	152.47	-0.60	-3.15	-1.63	-2.29	-3.25	5.35
5.1	212.31	125.83	40.66	248.34	139.19	212.42	125.37	40.29	248.31	138.91	212.37	125.60	40.48	248.33	139.05	211.2	125.19	44.9	250.21	139.54	1.17	0.41	-4.43	-1.89	-0.49	4.99
7.1	206.74	107.87	27.15	243.69	123.31	205.45	105.54	24.82	242.22	120.66	206.10	106.71	25.99	242.96	121.99	208.26	101.71	30.9	245.12	121.07	-2.16	5.00	-4.92	-2.17	0.92	7.70
9.1	199.59	92.58	17.05	233.57	107.19	199.74	92.97	17.38	233.83	107.59	199.67	92.78	17.22	233.70	107.39	200.77	91.42	21.24	236.41	108.13	-1.10	1.36	-4.03	-2.71	-0.74	5.21
11.1	202.20	103.30	23.94	238.45	116.81	202.48	103.79	24.28	238.81	117.36	202.34	103.55	24.11	238.63	117.09	204.5	100.6	27.81	241.94	117.5	-2.16	2.95	-3.70	-3.31	-0.41	6.18

Subject 31 Left

	Lacey				JOE					Average						Control					Difference					
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	208.85	114.99	39.67	247.09	130.90	216.84	140.45	61.25	251.41	152.82	212.85	127.72	50.46	249.25	141.86	210.65	115.44	40.95	248.71	132.55	2.19	12.28	9.51	0.54	9.31	18.25
3.2	208.20	112.73	38.82	246.56	128.97	208.23	112.80	38.87	246.59	129.05	208.22	112.77	38.85	246.58	129.01	212.12	116.6	43.1	249.45	134.29	-3.91	-3.83	-4.26	-2.88	-5.28	9.18
5.2	207.98	109.04	29.18	245.55	125.30	207.97	108.88	29.09	245.51	125.18	207.98	108.96	29.14	245.53	125.24	211.51	118.89	42.38	249.22	135.25	-3.54	-9.93	-13.25	-3.69	-10.01	20.01
7.2	200.31	102.84	21.29	238.28	115.21	200.15	102.27	20.84	237.95	114.66	200.23	102.56	21.07	238.12	114.94	204.87	110.67	32.59	244.19	124.93	-4.64	-8.11	-11.53	-6.07	-10.00	18.89
9.2	200.93	96.48	23.24	237.62	111.71	199.74	92.97	17.38	233.83	107.59	200.34	94.73	20.31	235.73	109.65	204.71	100.72	30.01	242.23	117.97	-4.38	-6.00	-9.70	-6.50	-8.32	16.15
11.2	201.90	95.61	21.48	238.13	111.63	201.90	96.07	21.99	238.30	112.00	201.90	95.84	21.74	238.22	111.82	207.19	104.14	34.73	244.77	122.39	-5.29	-8.30	-13.00	-6.56	-10.58	20.51

Subject 32 Right

	Lacey				JOE					Average						Control					Difference					
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	198.74	108.13	35.48	236.26	118.93	200.71	113.84	40.72	240.30	124.92	199.73	110.99	38.10	238.28	121.93	203.31	115.81	45.73	244.74	129.01	-3.58	-4.83	-7.63	-6.46	-7.08	13.65
3.1	201.50	119.29	43.15	242.29	129.42	200.72	116.70	40.72	240.53	126.75	201.11	118.00	41.94	241.41	128.09	205.25	121.41	50.11	247.05	134.45	-4.14	-3.41	-8.18	-5.64	-6.37	12.96
5.1	206.75	123.17	49.47	244.72	135.36	205.97	120.63	46.83	243.10	132.76	206.36	121.90	48.15	243.91	134.06	214.91	135.65	67.84	252.53	150.54	-8.55	-13.75	-19.69	-8.62	-16.48	31.56
7.1	201.28	117.30	39.90	240.11	127.20	200.73	115.50	38.06	238.60	125.27	201.01	116.40	38.98	239.36	126.24	204.98	117.68	48.34	246.08	131.56	-3.97	-1.28	-9.36	-6.72	-5.33	13.37
9.1	197.01	102.71	28.34	234.75	113.51	197.34	104.03	30.31	235.80	114.91	197.18	103.37	29.33	235.28	114.21	201.58	107.84	39.4	241.56	121.72	-4.41	-4.47	-10.08	-6.29	-7.51	15.39
11.1	199.23	104.56	31.07	236.31	116.49	200.27	106.98	33.36	238.59	119.23	199.75	105.77	32.22	237.45	117.86	204.89	111.36	41.33	244.75	126.48	-5.14	-5.59	-9.11	-7.30	-8.62	16.38

Subject 32 Left

	Lacey				JOE					Average						Control					Difference					
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	194.87	95.99	26.92	230.74	107.18	195.34	97.19	27.95	231.75	108.49	195.11	96.59	27.44	231.25	107.84	197.59	108.15	38.53	238.15	118.96	-2.48	-11.56	-11.10	-6.91	-11.13	20.84
3.2	200.18	97.80	32.09	237.17	113.07	200.08	97.53	31.65	236.96	112.76	200.13	97.67	31.87	237.07	112.92	204.79	112.34	49.22	245.24	128.1	-4.66	-14.68	-17.35	-8.18	-15.19	28.91
5.2	198.19	96.39	27.09	233.89	109.95	197.94	95.74	25.98	233.21	109.16	198.07	96.07	26.54	233.55	109.56	205.05	117.51	50.44	245.94	131.67	-6.99	-21.45	-23.91	-12.39	-22.12	41.51
7.2	201.63	110.38	32.48	240.83	122.38	201.72	110.66	32.86	241.02	122.68	201.68	110.52	32.67	240.93	122.53	207.33	130.73	56.43	249.22	142.36	-5.66	-20.21	-23.76	-8.29	-19.83	38.30
9.2	198.60	101.52	25.93	236.23	113.57	198.50	101.49	25.57	236.26	113.47	198.55	101.51	25.75	236.25	113.52	201.66	111.71	39.87	242.37	124.41	-3.11	-10.21	-14.12	-6.13	-10.89	21.66
11.2	200.87	101.75	28.90	238.64	115.77	200.86	101.43	28.31	238.47	115.47	200.87	101.59	28.61	238.56	115.62	205.98	114.85	44.51	246.18	129.84	-5.11	-13.26	-15.91	-7.63	-14.22	26.75

Table C 3. Continued

Subject 33 Right

	Lacey					JOE					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	196.98	86.87	33.08	230.00	103.29	197.68	87.78	33.73	231.52	104.60	197.33	87.33	33.41	230.76	103.95	200.42	88.74	37.19	235.96	107.94	-3.09	-1.41	-3.79	-5.20	-4.00	8.30
3.1	199.12	85.36	18.14	232.71	102.48	200.35	86.17	18.42	234.61	104.07	199.74	85.77	18.28	233.66	103.28	202.49	84.54	20.05	236.64	104.85	-2.76	1.22	-1.77	-2.98	-1.57	4.86
5.1	198.66	97.71	23.52	235.86	110.92	198.75	97.32	22.96	235.83	110.67	198.71	97.52	23.24	235.85	110.80	201.68	105.59	36.23	241.1	119.92	-2.98	-8.08	-12.99	-5.25	-9.13	18.81
7.1	197.36	101.31	21.11	234.81	111.95	198.02	101.87	21.37	235.86	112.89	197.69	101.59	21.24	235.34	112.42	202.05	108.29	30.84	241.54	121.24	-4.36	-6.70	-9.60	-6.20	-8.82	16.50
9.1	197.09	97.46	20.65	233.88	109.22	196.69	97.00	20.47	233.17	108.54	196.89	97.23	20.56	233.53	108.88	199.8	102.43	28.23	238.17	115.4	-2.91	-5.20	-7.67	-4.65	-6.52	12.59
11.1	198.33	97.79	21.75	234.94	110.42	198.32	97.82	21.86	234.90	110.44	198.33	97.81	21.81	234.92	110.43	202.75	103.2	28.63	241.08	118.12	-4.43	-5.40	-6.83	-6.16	-7.69	13.87

Subject 33 Left

	Lacey					JOE					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	199.03	90.80	35.67	234.43	107.99	199.20	90.55	35.53	234.59	107.94	199.12	90.68	35.60	234.51	107.97	201.25	98.27	41.16	239	115.31	-2.13	-7.60	-5.56	-4.49	-7.35	12.93
3.2	196.07	91.75	23.87	230.72	104.87	196.96	94.25	26.52	232.91	107.62	196.52	93.00	25.20	231.82	106.25	199.45	102.24	36.1	237.83	115.92	-2.94	-9.24	-10.91	-6.02	-9.68	18.51
5.2	200.11	101.26	29.98	237.91	115.05	200.30	101.25	30.21	238.09	115.21	200.21	101.26	30.10	238.00	115.13	202.49	111.84	44.2	242.84	125.48	-2.29	-10.59	-14.11	-4.84	-10.35	21.14
7.2	199.38	97.86	24.44	235.98	111.55	199.60	98.02	24.74	236.26	111.86	199.49	97.94	24.59	236.12	111.71	203.52	113.07	40.87	243.78	126.59	-4.03	-15.13	-16.28	-7.66	-14.89	28.11
9.2	200.47	103.78	31.23	238.67	117.08	199.75	100.74	28.85	237.00	114.21	200.11	102.26	30.04	237.84	115.65	204.49	116.81	43.05	245.36	130.01	-4.38	-14.55	-13.01	-7.53	-14.37	25.75
11.2	198.01	95.69	24.50	234.25	109.13	197.77	95.03	24.02	233.77	108.44	197.89	95.36	24.26	234.01	108.79	201.1	104.71	35.02	240.33	118.77	-3.21	-9.35	-10.76	-6.32	-9.99	18.79

Subject 34 Right

	Lacey					JOE					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	194.91	114.20	38.76	236.62	121.14	195.53	115.96	40.10	237.85	123.01	195.22	115.08	39.43	237.24	122.08	200.14	129.56	50.23	245.83	136.92	-4.92	-14.48	-10.80	-8.60	-14.85	25.39
3.1	193.36	104.86	29.43	232.25	112.47	194.10	107.09	31.04	233.86	114.78	193.73	105.98	30.24	233.06	113.63	198.22	118.07	44	241.66	127.02	-4.49	-12.10	-13.77	-8.60	-13.40	24.69
5.1	199.07	115.76	27.83	239.87	123.76	199.22	115.94	27.49	239.96	123.93	199.15	115.85	27.66	239.92	123.85	203.08	132.77	48.6	247.82	140.57	-3.94	-16.92	-20.94	-7.90	-16.73	32.90
7.1	193.11	120.55	26.26	236.78	122.92	194.22	123.47	29.07	238.91	126.16	193.67	122.01	27.67	237.85	124.54	197.09	137.34	46.12	245.72	140.01	-3.42	-15.33	-18.46	-7.88	-15.47	29.81
9.1	190.99	108.08	27.41	230.76	112.70	192.24	112.17	29.45	233.67	116.81	191.62	110.13	28.43	232.22	114.76	195.12	127.96	47.72	242.17	132.38	-3.51	-17.84	-19.29	-9.96	-17.63	33.35
11.1	194.96	113.03	33.60	235.66	119.67	193.51	108.84	30.31	232.41	115.22	194.24	110.94	31.96	234.04	117.45	198.07	121.45	45.15	242.47	129.41	-3.83	-10.52	-13.20	-8.44	-11.97	22.66

Subject 34 Left

	Lacey					JOE					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	192.08	110.85	36.38	233.55	116.60	192.53	112.27	37.17	234.49	118.05	192.31	111.56	36.78	234.02	117.33	190.85	113.31	34.24	233.78	117.29	1.46	-1.75	2.54	0.24	0.03	3.42
3.2	194.58	107.55	32.99	234.43	115.69	194.20	107.04	31.85	233.67	114.87	194.39	107.30	32.42	234.05	115.28	197.94	116.31	44.57	241.05	125.67	-3.55	-9.02	-12.15	-7.00	-10.39	19.96
5.2	196.81	107.81	25.58	236.13	116.55	197.71	110.35	28.22	237.77	119.26	197.26	109.08	26.90	236.95	117.91	202.04	116.56	43.48	243.89	128.38	-4.78	-7.48	-16.58	-6.94	-10.48	22.62
7.2	191.52	115.23	28.05	233.42	118.18	192.26	117.71	29.55	234.93	120.31	191.89	116.47	28.80	234.18	119.25	196.07	124.15	41.11	241.63	129.5	-4.18	-7.68	-12.31	-7.45	-10.26	19.72
9.2	191.81	103.69	28.54	230.23	110.36	192.19	104.77	28.90	231.01	111.46	192.00	104.23	28.72	230.62	110.91	195.89	111.84	39.41	237.8	120.43	-3.89	-7.61	-10.69	-7.18	-9.52	18.15
11.2	192.86	109.56	34.25	233.27	115.96	192.74	109.36	34.52	233.19	115.78	192.80	109.46	34.39	233.23	115.87	196.68	114.9	41.35	239.56	123.4	-3.88	-5.44	-6.97	-6.33	-7.53	13.78

Table C 3. Continued

Subject 35 Right

	Lacey				JOE				Average						Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	208.58	116.67	33.65	246.64	130.97	208.35	113.53	30.91	245.97	128.49	208.47	115.10	32.28	246.31	129.73	207.54	103.37	23.4	244.44	120.69	0.93	11.73	8.88	1.87	9.04	17.39
3.1	211.43	127.19	38.46	248.58	139.46	210.08	122.88	33.77	247.44	135.48	210.76	125.04	36.12	248.01	137.47	210.55	120.94	36.54	249.14	135.38	0.20	4.10	-0.42	-1.13	2.09	4.76
5.1	207.41	112.94	21.16	245.31	126.47	208.31	115.80	23.87	246.44	129.20	207.86	114.37	22.52	245.88	127.84	211.78	120.99	39.56	249.9	136.5	-3.92	-6.62	-17.05	-4.03	-8.67	21.00
7.1	208.97	116.93	23.36	246.83	130.21	209.53	118.46	24.40	247.49	131.67	209.25	117.70	23.88	247.16	130.94	210.68	120.2	37.25	249.25	135.11	-1.43	-2.51	-13.37	-2.09	-4.17	14.45
9.1	200.34	107.06	20.14	238.78	117.81	201.32	109.32	23.14	240.17	120.34	200.83	108.19	21.64	239.48	119.08	204.21	105.11	30.84	242.52	120.59	-3.38	3.08	-9.20	-3.05	-1.52	10.82
11.1	197.62	94.23	11.21	232.56	106.26	198.13	95.15	12.35	233.35	107.39	197.88	94.69	11.78	232.96	106.83	200.66	94.02	17.45	236.7	109.3	-2.79	0.67	-5.67	-3.75	-2.47	7.78

Subject 35 Left

	Lacey				JOE				Average						Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	208.11	116.21	33.54	246.19	130.32	209.32	119.45	36.68	247.45	133.50	208.72	117.83	35.11	246.82	131.91	207.08	112.33	29.03	245.74	126.87	1.63	5.50	6.08	1.08	5.04	9.82
3.2	213.11	115.02	35.10	248.70	132.54	213.44	116.15	36.34	249.02	133.57	213.28	115.59	35.72	248.86	133.06	214.03	110.85	32.98	249.39	130.38	-0.75	4.74	2.74	-0.53	2.68	6.16
5.2	211.54	126.87	36.40	249.61	139.52	211.79	127.62	36.57	249.80	140.15	211.67	127.25	36.49	249.71	139.84	215.26	133.43	51.89	252.24	147.44	-3.60	-6.19	-15.41	-2.54	-7.60	18.78
7.2	216.48	142.78	42.50	252.53	152.50	216.62	143.20	42.69	252.59	152.84	216.55	142.99	42.60	252.56	152.67	221.88	154.39	63.64	254.46	164.34	-5.33	-11.40	-21.05	-1.90	-11.67	27.22
9.2	200.34	101.90	20.33	237.72	114.45	199.07	99.36	17.19	235.50	111.42	199.71	100.63	18.76	236.61	112.94	201.98	99.62	21.9	239.29	114.42	-2.28	1.01	-3.14	-2.68	-1.49	5.04
11.2	202.16	106.95	24.96	240.69	119.62	201.21	105.50	21.04	239.23	117.49	201.69	106.23	23.00	239.96	118.56	206.26	111.15	33.3	245.35	126.22	-4.57	-4.93	-10.30	-5.39	-7.66	15.46

Subject 36 Right

	Lacey				JOE				Average						Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	197.16	94.78	31.81	232.50	108.56	198.75	98.96	35.10	235.73	112.84	197.96	96.87	33.46	234.12	110.70	200.24	99.65	35.58	238.29	114.75	-2.29	-2.78	-2.13	-4.17	-4.05	7.16
3.1	196.73	95.90	29.45	233.40	108.94	196.93	95.58	29.25	233.51	108.85	196.83	95.74	29.35	233.46	108.90	195.48	94.17	28.71	231.71	106.68	1.35	1.57	0.64	1.74	2.21	3.56
5.1	200.40	98.31	34.58	237.68	113.81	201.43	99.84	36.33	239.07	115.78	200.92	99.08	35.46	238.38	114.80	201.29	94.97	33.03	238.26	112.23	-0.37	4.11	2.43	0.12	2.57	5.43
7.1	198.72	95.16	28.01	234.57	109.64	200.97	99.88	32.78	238.37	115.07	199.85	97.52	30.40	236.47	112.36	201.54	99.84	31.04	239.33	115.37	-1.69	-2.32	-0.64	-2.86	-3.02	5.09
9.1	199.97	92.51	31.53	234.97	109.27	199.59	92.55	31.53	234.59	109.00	199.78	92.53	31.53	234.78	109.14	199.37	88.24	29.44	234.41	105.78	0.41	4.29	2.09	0.37	3.35	5.86
11.1	202.18	99.27	34.75	238.67	115.58	201.64	98.31	33.90	237.93	114.46	201.91	98.79	34.33	238.30	115.02	200.36	93.51	29.91	236.78	110.16	1.55	5.28	4.42	1.52	4.86	8.70

Subject 36 Left

	Lacey				JOE				Average						Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	200.93	93.95	33.87	237.14	111.27	201.10	94.28	34.19	237.47	111.66	201.02	94.12	34.03	237.31	111.47	202.08	97.72	36.18	239.67	114.95	-1.07	-3.60	-2.15	-2.36	-3.49	6.04
3.2	201.83	90.49	28.72	237.36	109.10	202.08	91.12	29.41	237.78	109.79	201.96	90.81	29.07	237.57	109.45	202.19	94.7	31.19	238.94	112.48	-0.23	-3.90	-2.13	-1.37	-3.04	5.55
5.2	200.84	93.86	29.14	237.16	110.64	201.22	95.09	30.48	237.91	111.91	201.03	94.48	29.81	237.54	111.28	203.81	94.08	31.05	240.29	113.25	-2.78	0.39	-1.24	-2.76	-1.97	4.57
7.2	200.16	94.08	30.63	236.52	110.45	200.19	95.34	32.08	236.95	111.48	200.18	94.71	31.36	236.74	110.97	202.64	92.56	29.58	238.88	111.27	-2.46	2.15	1.78	-2.14	-0.30	4.31
9.2	199.20	100.73	39.03	237.13	115.08	198.80	100.24	38.54	236.56	114.39	199.00	100.49	38.79	236.85	114.74	199.8	100.65	38.41	238.25	115.45	-0.80	-0.17	0.38	-1.41	-0.72	1.81
11.2	199.64	96.33	34.05	236.38	111.91	199.55	95.88	33.61	236.13	111.48	199.60	96.11	33.83	236.26	111.70	200.25	93.27	31.33	236.48	110.05	-0.66	2.83	2.50	-0.22	1.65	4.18

Table C 3. Continued

Subject 37 Right

	Lacey				JOE					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	200.51	72.44	12.62	231.38	94.82	200.58	72.33	12.23	231.46	94.76	200.55	72.39	12.43	231.42	94.79	201.64	73.2	13.85	233.27	96.36	-1.095	-0.815	-1.425	-1.850	-1.570	3.13
3.1	198.72	81.48	23.56	231.43	100.31	198.67	81.41	23.46	231.33	100.21	198.70	81.45	23.51	231.38	100.26	199.93	83.1	25.45	233.46	102.48	-1.235	-1.655	-1.940	-2.080	-2.220	4.16
5.1	199.14	84.33	21.96	232.54	102.33	199.13	84.14	21.72	232.47	102.16	199.14	84.24	21.84	232.51	102.25	201.35	83.1	22.24	235.22	103.33	-2.215	1.135	-0.400	-2.715	-1.085	3.86
7.1	203.63	87.87	22.73	238.24	108.05	203.65	87.90	22.77	238.27	108.09	203.64	87.89	22.75	238.26	108.07	205.11	89.69	22.43	240.33	110.23	-1.470	-1.805	0.320	-2.075	-2.160	3.81
9.1	200.03	79.92	17.36	232.54	99.75	200.17	80.41	17.79	232.88	100.23	200.10	80.17	17.58	232.71	99.99	201.14	80.23	15.98	234.37	100.69	-1.040	-0.065	1.595	-1.660	-0.700	2.62
11.1	197.39	78.82	12.95	228.84	96.39	197.30	78.52	12.72	228.60	96.10	197.35	78.67	12.84	228.72	96.25	198.94	76.99	8.21	230.67	96.03	-1.595	1.680	4.625	-1.950	0.215	5.53

Subject 37 Left

	Lacey				JOE					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	199.58	72.22	13.99	230.08	94.06	199.57	71.90	13.52	229.97	93.80	199.58	72.06	13.76	230.03	93.93	202	77.14	19.11	234.6	99.67	-2.425	-5.080	-5.355	-4.575	-5.740	10.69
3.2	203.61	96.08	38.39	240.67	115.20	203.49	95.60	37.69	240.39	114.71	203.55	95.84	38.04	240.53	114.96	205.29	100.64	42.87	243.21	119.87	-1.740	-4.800	-4.830	-2.680	-4.915	8.99
5.2	197.70	78.89	19.54	229.47	97.30	197.68	79.08	19.88	229.50	97.44	197.69	78.99	19.71	229.49	97.37	199.82	79.29	23.13	232.56	99.72	-2.130	-0.305	-3.420	-3.075	-2.350	5.60
7.2	202.04	79.71	21.72	235.19	101.58	202.02	79.71	21.69	235.17	101.56	202.03	79.71	21.71	235.18	101.57	205.2	80.03	21.35	238.74	104.08	-3.170	-0.320	0.355	-3.560	-2.510	5.41
9.2	204.22	78.59	19.66	236.62	102.17	204.88	79.84	21.37	237.91	103.68	204.55	79.22	20.52	237.27	102.93	207.93	78.28	19.06	240.81	104.61	-3.380	0.935	1.455	-3.545	-1.685	5.46
11.2	200.46	81.75	16.58	233.42	101.06	200.47	81.96	16.52	233.48	101.20	200.47	81.86	16.55	233.45	101.13	203.67	82.59	14.03	237.5	103.78	-3.205	-0.735	2.520	-4.050	-2.650	6.37

Subject 38 Right

	Lacey				JOE					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	199.92	100.16	22.72	235.81	113.09	200.35	101.16	23.87	236.22	114.16	200.14	100.66	23.30	236.02	113.63	206.46	119.42	44.54	247.07	133.12	-6.325	-18.760	-21.245	-11.055	-19.495	36.68
3.1	201.27	83.96	8.72	234.28	102.13	200.84	82.32	7.45	233.43	100.62	201.06	83.14	8.09	233.86	101.38	212.9	98.39	30.58	247.46	121.68	-11.845	-15.250	-22.495	-13.605	-20.305	38.42
5.1	197.73	93.56	12.51	231.88	105.95	196.86	90.62	10.82	229.83	103.10	197.30	92.09	11.67	230.86	104.53	205.29	115.01	35.23	245.08	128.29	-7.995	-22.920	-23.565	-14.225	-23.765	43.72
7.1	196.95	98.20	12.47	232.71	108.50	195.65	92.73	8.70	229.68	103.43	196.30	95.47	10.59	231.20	105.97	204.43	121.32	35.58	246.03	131.99	-8.130	-25.855	-24.995	-14.835	-26.025	47.50
9.1	199.18	99.20	18.10	235.85	111.58	199.39	100.00	19.08	236.21	112.35	199.29	99.60	18.59	236.03	111.97	206.92	123.8	43.95	247.66	136.04	-7.635	-24.200	-25.360	-11.630	-24.075	44.74
11.1	196.28	92.62	10.84	231.18	104.25	196.24	93.31	11.68	231.26	104.75	196.26	92.97	11.26	231.22	104.50	202.52	115.24	35.42	243.25	126.68	-6.260	-22.275	-24.160	-12.030	-22.180	41.90

Subject 38 Left

	Lacey				JOE					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	198.61	93.05	19.69	233.70	107.17	200.14	96.44	23.03	236.46	111.00	199.38	94.75	21.36	235.08	109.09	204.12	106.31	34.68	243.05	121.83	-4.745	-11.565	-13.320	-7.970	-12.745	23.66
3.2	198.96	94.16	13.13	234.77	107.60	199.45	94.76	13.77	235.48	108.45	199.21	94.46	13.45	235.13	108.03	203.76	102.58	24.83	241.55	117.92	-4.555	-8.120	-11.380	-6.425	-9.895	18.85
5.2	196.47	89.02	8.19	230.07	101.62	197.55	90.87	9.73	231.95	103.88	197.01	89.95	8.96	231.01	102.75	202.05	101.91	24.25	239.97	116.22	-5.040	-11.965	-15.290	-8.960	-13.470	25.77
7.2	194.65	86.35	6.54	227.00	98.23	195.25	87.38	7.27	228.14	99.49	194.95	86.87	6.91	227.57	98.86	201.24	98.97	19.74	238.53	113.25	-6.290	-12.105	-12.835	-10.960	-14.390	26.04
9.2	199.20	94.95	18.47	235.28	108.89	199.69	95.70	19.09	236.01	109.83	199.45	95.33	18.78	235.65	109.36	205.14	102.67	27.47	242.68	119.21	-5.695	-7.345	-8.690	-7.035	-9.850	17.56
11.2	198.28	90.02	12.08	232.85	104.21	198.75	90.29	12.59	233.35	104.81	198.52	90.16	12.34	233.10	104.51	204.42	100.28	24.57	241.6	116.83	-5.905	-10.125	-12.235	-8.500	-12.320	22.61

Table C 3. Continued

Subject 39 Right

	Lacey				JOE				Average				Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	202.11	99.26	28.44	239.45	115.03	202.27	99.52	28.53	239.69	115.34	202.19	99.39	28.49	239.57	115.19	204.3	103.42	32.22	242.48	119.73	-2.110	-4.030	-3.735	-2.910	-4.545	7.99
3.1	200.96	92.26	21.94	236.31	108.80	201.74	95.22	24.75	237.91	111.65	201.35	93.74	23.35	237.11	110.23	201.97	94.51	20.69	238.28	110.95	-0.620	-0.770	2.655	-1.170	-0.725	3.15
5.1	201.54	88.90	19.54	236.51	106.86	201.52	88.73	19.37	236.43	106.71	201.53	88.82	19.46	236.47	106.79	200.83	87.16	17.93	235.56	105.03	0.700	1.655	1.525	0.910	1.755	3.08
7.1	200.83	91.72	19.90	236.19	108.16	201.01	91.43	19.63	236.33	108.09	200.92	91.58	19.77	236.26	108.13	201.36	88.57	17.21	236.28	106.26	-0.440	3.005	2.555	-0.020	1.865	4.39
9.1	200.78	94.71	26.27	236.91	110.84	200.36	92.55	24.08	235.82	108.83	200.57	93.63	25.18	236.37	109.84	199.76	91.25	23.71	235.26	107.5	0.810	2.380	1.465	1.105	2.335	3.89
11.1	203.29	89.11	19.73	238.18	108.25	203.32	89.40	20.10	238.28	108.50	203.31	89.26	19.92	238.23	108.38	203.07	87.68	17.02	237.82	106.91	0.235	1.575	2.895	0.410	1.465	3.64

Subject 39 Left

	Lacey				JOE				Average				Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	205.02	102.49	36.01	241.98	119.83	204.74	100.25	34.04	241.29	117.89	204.88	101.37	35.03	241.64	118.86	204.97	102.02	35.24	242.89	119.63	-0.090	-0.650	-0.215	-1.255	-0.770	1.63
3.2	204.64	84.99	16.56	238.93	106.32	204.72	85.07	16.81	239.04	106.46	204.68	85.03	16.69	238.99	106.39	206.08	90.72	22.33	241.4	111.57	-1.400	-5.690	-5.645	-2.415	-5.180	9.94
5.2	202.96	84.19	22.75	237.15	105.33	203.00	84.05	22.57	237.16	105.26	202.98	84.12	22.66	237.16	105.30	206.32	87.99	29.01	241.34	110.83	-3.340	-3.870	-6.350	-4.185	-5.535	10.71
7.2	200.54	86.75	20.12	234.61	104.76	200.61	86.64	20.21	234.68	104.75	200.58	86.70	20.17	234.65	104.76	203.17	92.44	26.37	238.74	111.09	-2.595	-5.745	-6.205	-4.095	-6.335	11.63
9.2	199.93	86.27	19.86	234.07	104.00	199.98	86.06	19.68	234.08	103.89	199.96	86.17	19.77	234.08	103.95	202.32	89.57	24.24	237.6	108.47	-2.365	-3.405	-4.470	-3.525	-4.525	8.37
11.2	202.70	84.75	29.18	236.99	106.17	202.72	84.81	29.23	237.02	106.23	202.71	84.78	29.21	237.01	106.20	205.21	86.7	31.91	240.07	109.51	-2.500	-1.920	-2.705	-3.065	-3.310	6.13

Subject 40 Right

	Lacey				JOE				Average				Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	196.35	90.88	15.24	230.96	103.66	196.37	90.46	14.77	230.84	103.35	196.36	90.67	15.01	230.90	103.51	198.09	89.8	14.87	233.13	104.35	-1.730	0.870	0.135	-2.230	-0.845	3.07
3.1	196.21	88.34	10.40	229.73	101.29	196.20	88.34	10.40	229.71	101.28	196.21	88.34	10.40	229.72	101.29	198.42	86.91	9.31	232.5	102.11	-2.215	1.430	1.090	-2.780	-0.825	4.07
5.1	205.04	109.95	28.98	242.94	123.86	204.98	109.95	29.09	242.85	123.83	205.01	109.95	29.04	242.90	123.85	210.11	115.94	38.25	248.39	132.2	-5.100	-5.990	-9.215	-5.495	-8.355	15.71
7.1	201.58	104.06	20.03	239.01	116.65	201.59	105.08	20.98	239.34	117.45	201.59	104.57	20.51	239.18	117.05	205.07	105.3	22.7	242.97	120.27	-3.485	-0.730	-2.195	-3.795	-3.220	6.50
9.1	199.73	97.27	16.52	236.11	110.57	199.69	97.21	16.62	236.02	110.50	199.71	97.24	16.57	236.07	110.54	202.11	93.58	12.11	238	109.47	-2.400	3.660	4.460	-1.935	1.065	6.63
11.1	200.75	103.35	17.26	237.81	115.19	200.62	103.37	17.44	237.64	115.12	200.69	103.36	17.35	237.73	115.16	204.17	104.74	20.24	242.08	119.05	-3.485	-1.380	-2.890	-4.355	-3.895	7.52

Subject 40 Left

	Lacey				JOE				Average				Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	197.50	91.55	18.32	232.28	105.30	197.07	89.75	17.20	231.03	103.62	197.29	90.65	17.76	231.66	104.46	200.84	90.84	19.33	236.29	107.58	-3.555	-0.190	-1.570	-4.635	-3.120	6.81
3.2	206.04	91.83	15.69	240.89	111.43	206.25	92.55	16.41	241.25	112.12	206.15	92.19	16.05	241.07	111.78	211.58	97.19	26.27	246.23	119.58	-5.435	-5.000	-10.220	-5.160	-7.805	15.70
5.2	201.53	94.91	18.14	237.40	110.56	201.66	95.32	18.50	237.61	110.96	201.60	95.12	18.32	237.51	110.76	205.94	95.64	24.28	241.71	114.77	-4.345	-0.525	-5.960	-4.205	-4.010	9.40
7.2	205.64	107.03	24.43	241.87	121.52	205.35	106.60	24.22	241.53	121.02	205.50	106.82	24.33	241.70	121.27	207.97	101.43	25.62	244.53	120.02	-2.475	5.385	-1.295	-2.830	1.250	6.81
9.2	204.17	109.88	24.88	241.27	122.46	203.62	108.24	23.77	240.22	120.84	203.90	109.06	24.33	240.75	121.65	204.51	102.7	24.23	241.72	118.38	-0.615	6.360	0.095	-0.975	3.270	7.24
11.2	201.17	100.73	18.65	237.34	113.90	201.63	102.39	20.00	238.36	115.52	201.40	101.56	19.33	237.85	114.71	204.11	97.06	19.86	240.15	113.95	-2.710	4.500	-0.535	-2.300	0.760	5.81

Table C 3. Continued

Subject 41 Right

	Lacey				JOE					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	202.12	81.38	25.18	235.08	102.99	202.25	81.50	25.40	235.28	103.19	202.19	81.44	25.29	235.18	103.09	204.52	85.88	29.36	239.09	108.14	-2.34	-4.44	-4.07	-3.91	-5.05	9.08
3.1	202.31	99.75	36.11	239.04	116.15	202.41	99.24	35.65	238.90	115.83	202.36	99.50	35.88	238.97	115.99	209.89	116.87	55.43	248.8	134.73	-7.53	-17.38	-19.55	-9.83	-18.74	34.48
5.1	196.71	91.44	22.00	230.83	105.06	196.66	91.17	21.80	230.63	104.64	196.69	91.31	21.90	230.73	104.85	203.89	99.45	38.92	241.71	117.66	-7.20	-8.15	-17.02	-10.98	-12.81	26.32
7.1	198.60	98.06	25.56	235.43	111.25	198.89	98.11	25.55	235.79	111.51	198.75	98.09	25.56	235.61	111.38	205.17	104.23	38.7	243.65	121.66	-6.42	-6.15	-13.15	-8.04	-10.28	20.55
9.1	198.68	99.56	31.43	235.93	113.00	198.86	99.26	31.41	236.03	112.94	198.77	99.41	31.42	235.98	112.97	205.15	113.55	47.11	245.61	128.82	-6.38	-14.14	-15.69	-9.63	-15.85	28.82
11.1	198.86	100.66	29.48	236.43	113.62	198.74	100.65	29.52	236.29	113.52	198.80	100.66	29.50	236.36	113.57	203.69	111.24	41.98	243.76	125.69	-4.89	-10.59	-12.48	-7.40	-12.12	22.21

Subject 41 Left

	Lacey				JOE					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	199.29	86.00	38.52	233.74	105.39	199.29	85.96	38.57	233.73	105.36	199.29	85.98	38.55	233.74	105.38	203.17	92.22	44.41	239.84	113.14	-3.88	-6.24	-5.86	-6.10	-7.77	13.64
3.2	196.29	91.36	23.12	230.12	104.63	197.20	92.95	24.76	232.34	106.67	196.75	92.16	23.94	231.23	105.65	203.02	102.86	38.55	241.71	119.3	-6.28	-10.71	-14.61	-10.48	-13.65	25.76
5.2	198.53	97.35	25.12	235.06	110.71	198.76	97.61	25.59	235.43	111.12	198.65	97.48	25.36	235.25	110.92	203.66	104.26	40.01	242.38	120.84	-5.02	-6.78	-14.66	-7.13	-9.93	20.86
7.2	199.89	97.42	23.08	236.58	111.52	199.85	97.86	23.90	236.72	111.87	199.87	97.64	23.49	236.65	111.70	206.52	106.94	41.76	245.13	124.63	-6.65	-9.30	-18.27	-8.48	-12.94	26.53
9.2	198.79	102.02	29.07	236.51	114.44	198.85	102.08	29.07	236.61	114.53	198.82	102.05	29.07	236.56	114.49	204.66	114.27	47.86	245.34	129.06	-5.84	-12.22	-18.79	-8.78	-14.58	28.74
11.2	198.60	98.80	26.71	234.81	111.74	198.38	98.49	26.59	234.33	111.33	198.49	98.65	26.65	234.57	111.54	205.96	114.99	45.53	245.82	129.96	-7.47	-16.35	-18.88	-11.25	-18.43	33.84

Subject 42 Right

	Lacey				JOE					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	209.53	90.66	12.69	240.16	111.76	210.42	92.76	13.75	241.55	113.83	209.98	91.71	13.22	240.86	112.80	211.1	84.43	3.62	243.9	108.62	-1.13	7.28	9.60	-3.04	4.18	13.16
3.1	208.33	82.08	7.87	238.87	105.30	210.29	87.79	10.60	241.68	110.62	209.31	84.94	9.24	240.28	107.96	214.56	92.31	8.69	247.37	116.23	-5.25	-7.38	0.55	-7.10	-8.27	14.18
5.1	210.28	94.55	15.19	241.81	115.16	209.29	92.07	14.00	240.28	112.75	209.79	93.31	14.60	241.05	113.96	210.65	84.05	3.38	243.52	108.1	-0.87	9.26	11.22	-2.47	5.86	15.90
7.1	206.55	92.06	9.24	238.40	110.57	206.06	90.68	8.80	237.40	109.25	206.31	91.37	9.02	237.90	109.91	208.07	89.86	2.44	242.1	109.92	-1.76	1.51	6.58	-4.20	-0.01	8.14
9.1	210.14	94.75	14.31	242.80	115.25	210.43	96.04	15.23	243.26	116.36	210.29	95.40	14.77	243.03	115.81	211.25	90.31	9	244.89	113.03	-0.97	5.09	5.77	-1.86	2.78	8.44
11.1	209.80	90.45	10.58	241.98	111.99	210.73	93.70	12.36	243.41	114.87	210.27	92.08	11.47	242.70	113.43	212.92	87.22	4.65	245.32	111.52	-2.66	4.86	6.82	-2.63	1.91	9.36

Subject 42 Left

	Lacey				JOE					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	205.03	84.58	6.18	238.14	104.95	205.65	84.97	6.37	239.01	105.71	205.34	84.78	6.28	238.58	105.33	208.11	88.64	6.2	242.22	109.7	-2.77	-3.86	0.08	-3.65	-4.37	7.42
3.2	209.32	85.81	7.95	242.27	108.80	209.26	86.40	8.36	242.30	109.17	209.29	86.11	8.16	242.29	108.99	213.71	95.61	14.33	246.5	118.21	-4.42	-9.51	-6.18	-4.21	-9.22	15.84
5.2	204.83	81.52	5.80	237.49	102.89	204.55	80.15	5.38	236.81	101.76	204.69	80.84	5.59	237.15	102.33	208.97	90.35	10.11	243.22	111.8	-4.28	-9.51	-4.52	-6.07	-9.47	16.00
7.2	205.55	83.74	5.19	238.22	104.63	205.61	83.99	5.21	238.38	104.85	205.58	83.87	5.20	238.30	104.74	210.17	96.59	11.35	245.02	116.63	-4.59	-12.73	-6.15	-6.72	-11.89	20.18
9.2	205.01	80.52	5.60	237.59	102.36	205.00	80.93	5.77	237.64	102.62	205.01	80.73	5.69	237.62	102.49	207.54	82.1	7.21	240.21	105.2	-2.54	-1.38	-1.53	-2.60	-2.71	4.97
11.2	205.68	88.85	6.98	239.56	108.17	205.70	88.83	6.95	239.57	108.17	205.69	88.84	6.97	239.57	108.17	208.84	93.29	10.11	242.85	113.38	-3.15	-4.45	-3.15	-3.29	-5.21	8.81

Table C 3. Continued

Subject 43 Right

	Lacey				JOE					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	196.17	96.13	28.26	231.77	108.38	196.67	97.04	28.88	232.63	109.46	196.42	96.59	28.57	232.20	108.92	200.55	103.56	36.23	239.52	117.78	-4.13	-6.97	-7.66	-7.32	-8.86	16.01
3.1	198.17	98.03	30.94	234.97	111.54	198.68	99.06	32.08	235.89	112.75	198.43	98.55	31.51	235.43	112.15	203.91	101.24	36.59	241.73	118.59	-5.48	-2.69	-5.08	-6.30	-6.44	12.02
5.1	198.68	111.90	32.36	238.83	121.39	198.12	109.43	29.63	237.19	118.92	198.40	110.67	31.00	238.01	120.16	201.83	116.19	37.65	243.49	127.27	-3.43	-5.52	-6.66	-5.48	-7.11	12.93
7.1	201.84	104.09	31.23	238.69	118.06	210.52	103.15	30.34	237.96	117.07	206.18	103.62	30.79	238.33	117.57	204.66	103.69	35.13	242.57	120.49	1.52	-0.07	-4.35	-4.25	-2.93	6.91
9.1	196.58	107.00	27.72	235.06	115.97	195.92	104.66	25.49	233.37	113.59	196.25	105.83	26.61	234.22	114.78	199.38	110.78	31.77	239.94	121.19	-3.13	-4.95	-5.17	-5.72	-6.41	11.61
11.1	201.94	100.43	28.57	237.25	115.30	201.99	100.18	28.36	237.23	115.14	201.97	100.31	28.47	237.24	115.22	205.03	102.14	32.66	242.53	119.39	-3.07	-1.83	-4.20	-5.29	-4.17	8.70

Subject 43 Left

	Lacey				JOE					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	194.64	94.77	23.21	229.61	105.65	196.03	97.34	25.90	232.62	108.87	195.34	96.06	24.56	231.12	107.26	198.5	100.01	27.25	236.36	112.7	-3.17	-3.96	-2.70	-5.25	-5.44	9.49
3.2	198.47	94.16	27.66	234.43	108.85	198.45	94.61	28.24	234.61	109.22	198.46	94.39	27.95	234.52	109.04	201.46	90.87	26.15	237.11	108.88	-3.00	3.51	1.80	-2.59	0.16	5.60
5.2	197.78	90.64	20.67	232.50	105.22	197.76	90.60	20.65	232.47	105.18	197.77	90.62	20.66	232.49	105.20	199.36	86.29	18.59	233.68	103.37	-1.59	4.33	2.07	-1.19	1.83	5.51
7.2	199.89	99.28	27.59	236.68	113.25	199.65	98.80	27.11	236.21	112.69	199.77	99.04	27.35	236.45	112.97	201.68	97.94	29.34	238.73	113.95	-1.91	1.10	-1.99	-2.29	-0.98	3.87
9.2	195.43	97.14	23.15	231.86	108.01	195.22	97.14	23.25	231.66	107.86	195.33	97.14	23.20	231.76	107.94	197.53	102.02	27.41	235.75	113.41	-2.21	-4.88	-4.21	-3.99	-5.47	9.61
11.2	201.38	96.16	26.68	237.40	112.17	201.37	96.76	27.24	237.59	112.36	201.38	96.46	26.96	237.50	112.27	205.24	99.57	32.13	242.32	117.83	-3.87	-3.11	-5.17	-4.82	-5.57	10.28

Subject 44 Right

	Lacey				JOE					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	196.58	107.00	27.72	235.06	115.97	196.71	98.21	25.61	233.06	109.93	196.65	102.61	26.67	234.06	112.95	199.85	93.3	24.29	236.03	108.99	-3.20	9.30	2.38	-1.97	3.96	11.05
3.1	196.36	93.97	21.72	231.10	106.31	196.48	94.49	22.35	231.59	106.84	196.42	94.23	22.04	231.35	106.58	201.85	92.34	24.73	237.92	109.9	-5.43	1.89	-2.70	-6.57	-3.33	9.73
5.1	202.44	103.49	31.93	239.76	118.23	202.56	103.93	32.37	240.02	118.67	202.50	103.71	32.15	239.89	118.45	208.27	108.47	42.1	246.22	126.68	-5.77	-4.76	-9.95	-6.33	-8.23	16.21
7.1	201.65	94.71	26.64	236.91	111.31	202.10	96.21	28.33	238.11	112.88	201.88	95.46	27.49	237.51	112.10	207.52	98.33	35.24	244.14	118.86	-5.65	-2.87	-7.76	-6.63	-6.77	13.78
9.1	198.31	102.32	30.59	234.94	114.24	199.42	106.48	34.84	237.44	118.39	198.87	104.40	32.72	236.19	116.32	202.89	103.42	36.74	241.5	119.35	-4.02	0.98	-4.03	-5.31	-3.04	8.41
11.1	197.56	96.32	27.83	233.29	109.51	198.17	98.15	29.91	234.75	111.48	197.87	97.24	28.87	234.02	110.50	202.56	96.65	31.97	239.72	114.13	-4.69	0.58	-3.10	-5.70	-3.63	8.81

Subject 44 Left

	Lacey				JOE					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	196.27	96.28	23.64	232.72	108.12	196.65	97.00	24.47	233.41	109.01	196.46	96.64	24.06	233.07	108.57	198.2	92.4	20.78	233.94	106.73	-1.74	4.24	3.28	-0.88	1.83	5.99
3.2	200.67	104.47	29.87	239.45	117.66	200.88	105.21	30.71	239.82	118.40	200.78	104.84	30.29	239.64	118.03	204.5	97.71	32.09	241.6	116.13	-3.73	7.13	-1.80	-1.97	1.90	8.68
5.2	196.73	99.42	22.79	234.05	110.54	196.63	99.06	22.49	233.81	110.18	196.68	99.24	22.64	233.93	110.36	201.39	98.8	30.02	239.08	114.47	-4.71	0.44	-7.38	-5.15	-4.11	10.97
7.2	200.77	99.11	25.69	237.83	113.61	200.63	99.04	25.28	237.71	113.43	200.70	99.08	25.49	237.77	113.52	204.85	101.22	35.01	242.69	119.05	-4.15	-2.15	-9.53	-4.92	-5.53	12.94
9.2	200.05	106.11	32.25	239.01	118.53	200.36	107.07	32.95	239.52	119.48	200.21	106.59	32.60	239.27	119.01	205.62	111.16	45.24	245.34	127.31	-5.41	-4.57	-12.64	-6.08	-8.31	17.77
11.2	198.55	99.15	29.14	235.95	112.44	198.66	99.16	29.79	236.11	112.60	198.61	99.16	29.47	236.03	112.52	201.13	99.78	34.67	239.19	115.47	-2.52	-0.63	-5.21	-3.16	-2.95	7.25

Table C 3. Continued

Subject 45 Right

	Lacey				JOE						Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	196.38	94.36	23.74	231.83	106.83	196.71	93.78	22.75	231.95	106.61	196.55	94.07	23.25	231.89	106.72	196.63	91.11	19.6	231.77	104.51	-0.08	2.96	3.65	0.12	2.21	5.19
3.1	203.63	95.22	28.83	239.80	113.43	203.56	95.03	28.79	239.68	113.25	203.60	95.13	28.81	239.74	113.34	208.05	97.39	38.36	244.52	118.98	-4.46	-2.27	-9.55	-4.78	-5.64	13.07
5.1	196.76	102.58	24.49	234.98	112.83	196.28	102.14	24.02	234.31	112.12	196.52	102.36	24.26	234.65	112.48	199.86	102.96	34.87	238.68	116.58	-3.34	-0.60	-10.62	-4.04	-4.11	12.54
7.1	198.84	98.36	25.94	235.67	111.71	199.35	99.68	27.34	236.56	113.14	199.10	99.02	26.64	236.12	112.43	202.59	99.87	37.37	240.61	116.88	-3.50	-0.85	-10.73	-4.50	-4.46	12.97
9.1	199.38	100.84	26.08	236.27	113.65	200.77	105.10	30.13	238.77	117.99	200.08	102.97	28.11	237.52	115.82	203.36	101.85	37.56	241.59	118.75	-3.29	1.12	-9.46	-4.07	-2.93	11.25
11.1	198.12	94.46	21.65	233.58	108.02	198.85	96.90	23.85	235.17	110.48	198.49	95.68	22.75	234.38	109.25	202.07	94.37	29.36	238.54	111.94	-3.58	1.31	-6.61	-4.16	-2.69	9.10

Subject 45 Left

	Lacey				JOE						Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	194.48	91.91	18.83	229.24	103.19	195.42	93.48	20.33	230.94	105.17	194.95	92.70	19.58	230.09	104.18	195.9	94.46	20.55	232.22	106.34	-0.95	-1.77	-0.97	-2.13	-2.16	3.76
3.2	201.18	101.11	29.73	238.34	115.56	201.07	100.76	29.45	238.15	115.21	201.13	100.94	29.59	238.25	115.39	203.13	106	38.11	242.32	121.4	-2.01	-5.07	-8.52	-4.07	-6.02	12.45
5.2	199.96	104.08	28.59	238.31	116.65	199.75	103.77	28.11	238.03	116.23	199.86	103.93	28.35	238.17	116.44	201.23	110.28	37.57	241.68	122.88	-1.37	-6.36	-9.22	-3.51	-6.44	13.46
7.2	197.60	89.47	19.51	231.95	104.10	198.26	90.77	21.19	233.17	105.69	197.93	90.12	20.35	232.56	104.90	199.88	95.04	30.37	236.69	110.83	-1.95	-4.92	-10.02	-4.13	-5.94	13.44
9.2	200.19	99.95	28.09	237.79	114.03	200.12	98.89	27.26	237.46	113.18	200.16	99.42	27.68	237.63	113.61	201	104.26	33.87	240.01	118.22	-0.84	-4.84	-6.20	-2.38	-4.61	9.46
11.2	199.16	89.13	19.50	234.04	105.15	199.46	89.56	20.10	234.52	105.74	199.31	89.35	19.80	234.28	105.45	201.19	89.98	23.55	236.8	107.79	-1.88	-0.64	-3.75	-2.52	-2.35	5.46

Subject 46 Right

	Lacey				JOE						Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	207.81	105.28	36.85	244.25	123.48	207.60	103.28	35.07	243.64	121.83	207.71	104.28	35.96	243.95	122.66	213.25	119.23	48.64	250.39	137.23	-5.55	-14.95	-12.68	-6.44	-14.58	25.87
3.1	209.60	108.54	36.68	246.19	126.72	209.15	106.19	34.13	245.08	124.55	209.38	107.37	35.41	245.64	125.64	215.16	114.33	46.59	250.4	134.74	-5.79	-6.96	-11.19	-4.77	-9.11	17.68
5.1	203.28	106.70	28.76	241.37	120.65	203.08	104.64	27.13	240.57	118.94	203.18	105.67	27.95	240.97	119.80	209.25	113.03	42.63	247.6	130.36	-6.07	-7.36	-14.69	-6.63	-10.57	21.50
7.1	202.80	113.37	27.30	242.30	124.52	202.75	112.66	26.52	242.04	123.91	202.78	113.02	26.91	242.17	124.22	207.78	120.76	40.51	247.93	134.27	-5.01	-7.75	-13.60	-5.76	-10.06	20.11
9.1	202.97	112.51	28.57	242.11	124.21	202.91	112.35	28.48	241.99	124.05	202.94	112.43	28.53	242.05	124.13	206.57	121.52	39.71	247.36	133.95	-3.63	-9.09	-11.19	-5.31	-9.82	18.59
11.1	207.51	118.63	37.35	246.50	132.12	207.62	119.02	37.68	246.69	132.49	207.57	118.83	37.52	246.60	132.31	212.39	127.14	49.01	250.9	141.84	-4.82	-8.32	-11.50	-4.31	-9.54	18.28

Subject 46 Left

	Lacey				JOE						Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	206.86	104.76	32.83	243.04	121.99	206.76	103.65	31.94	242.65	121.09	206.81	104.21	32.39	242.85	121.54	213.68	112.26	41.64	249.6	132.13	-6.87	-8.05	-9.26	-6.76	-10.59	18.86
3.2	206.52	104.60	30.64	243.02	121.48	206.86	104.51	30.64	243.52	121.69	206.69	104.56	30.64	243.27	121.59	212.33	112.09	39.77	249	131.14	-5.64	-7.54	-9.13	-5.73	-9.55	17.21
5.2	203.16	107.96	26.62	241.51	121.13	203.14	107.11	25.83	241.28	120.45	203.15	107.54	26.23	241.40	120.79	208.54	114.1	36.71	247.25	129.92	-5.39	-6.57	-10.49	-5.86	-9.13	17.31
7.2	202.63	118.76	26.59	243.68	128.02	202.79	119.45	27.20	244.08	128.67	202.71	119.11	26.90	243.88	128.35	206.9	126.01	34.61	248.19	136.46	-4.19	-6.91	-7.72	-4.31	-8.12	14.46
9.2	199.54	105.56	21.40	238.38	116.52	199.61	105.28	20.93	238.37	116.33	199.58	105.42	21.17	238.38	116.43	203.79	107.33	25.82	242.61	121.2	-4.22	-1.91	-4.66	-4.24	-4.78	9.16
11.2	198.93	106.47	24.19	238.07	117.01	198.89	106.09	23.85	237.87	116.67	198.91	106.28	24.02	237.97	116.84	202.72	109.91	29.09	242.39	122.58	-3.81	-3.63	-5.07	-4.42	-5.74	10.29

Table C 3. Continued

Subject 47 Right

	Lacey				JOE				Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	200.48	98.15	27.82	237.10	112.95	200.56	96.95	26.81	236.83	112.09	200.52	97.55	27.32	236.97	112.52	198.53	95.71	21.89	235.24	109.27	1.99	1.84	5.43	1.72	3.25	7.09
3.1	205.08	88.89	24.08	240.08	109.93	205.54	89.73	25.03	240.70	110.92	205.31	89.31	24.56	240.39	110.43	208.04	96.13	34.2	244.2	117.64	-2.73	-6.82	-9.65	-3.81	-7.21	14.61
5.1	202.60	89.90	18.27	237.86	108.15	203.01	89.28	20.23	238.17	108.27	202.81	89.59	19.25	238.02	108.21	206.56	82.27	23.12	240.29	106.61	-3.76	7.32	-3.87	-2.28	1.60	9.51
7.1	211.39	113.71	32.66	248.23	130.73	210.58	111.40	29.56	247.39	128.40	210.99	112.56	31.11	247.81	129.57	214.27	108.92	39.48	249.39	130.06	-3.29	3.64	-8.37	-1.58	-0.50	9.84
9.1	214.84	129.95	50.90	251.26	144.75	212.72	122.79	41.28	249.25	137.93	213.78	126.37	46.09	250.26	141.34	216.1	124.6	53.51	251.74	142.46	-2.32	1.77	-7.42	-1.49	-1.12	8.19
11.1	214.19	121.46	44.19	250.19	138.28	213.89	121.27	43.73	250.07	137.96	214.04	121.37	43.96	250.13	138.12	219.46	129.16	55.95	252.94	147.03	-5.42	-7.80	-11.99	-2.81	-8.91	17.92

Subject 47 Left

	Lacey				JOE				Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	203.93	95.24	30.08	240.07	113.93	204.24	95.58	30.40	240.45	114.42	204.09	95.41	30.24	240.26	114.18	205.06	86.32	24.47	239.78	108.35	-0.97	9.09	5.77	0.48	5.83	12.29
3.2	199.77	84.78	12.80	233.07	102.09	200.73	87.78	14.44	235.08	105.02	200.25	86.28	13.62	234.08	103.56	204.31	91.98	28.1	240.22	111.85	-4.06	-5.70	-14.48	-6.15	-8.29	19.11
5.2	199.25	88.36	10.30	233.59	103.77	199.01	86.44	9.85	232.72	102.25	199.13	87.40	10.08	233.16	103.01	204.21	88.99	24.63	239.51	109.47	-5.08	-1.59	-14.56	-6.35	-6.46	17.95
7.2	217.66	130.26	45.18	251.99	145.55	216.85	125.74	41.14	251.38	141.90	217.26	128.00	43.16	251.69	143.73	220.65	131.48	62.6	253.37	149.68	-3.40	-3.48	-19.44	-1.69	-5.95	20.97
9.2	212.83	127.10	39.76	250.12	140.72	213.06	127.79	40.19	250.29	141.32	212.95	127.45	39.98	250.21	141.02	214.35	124.9	50.26	251.28	141.51	-1.41	2.54	-10.29	-1.08	-0.49	10.75
11.2	213.80	128.91	44.05	250.80	142.85	213.28	123.36	40.58	250.02	138.68	213.54	126.14	42.32	250.41	140.77	217.16	130.15	52.79	252.17	146.23	-3.62	-4.02	-10.48	-1.76	-5.47	13.11

Subject 48 Right

	Lacey				JOE				Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	195.65	99.62	16.00	231.76	108.86	195.62	100.05	16.55	231.87	109.19	195.64	99.84	16.28	231.82	109.03	199.98	114.72	30.81	241.52	124.21	-4.35	-14.89	-14.54	-9.71	-15.19	27.87
3.1	199.53	103.45	21.25	237.71	115.02	199.97	104.10	21.37	238.33	115.83	199.75	103.78	21.31	238.02	115.43	203.82	113.12	29.51	243.73	125.41	-4.07	-9.35	-8.20	-5.71	-9.99	17.42
5.1	197.31	98.09	13.57	233.69	108.90	197.58	98.47	13.75	234.09	109.37	197.45	98.28	13.66	233.89	109.14	201.28	107.96	24.69	240.6	119.76	-3.84	-9.68	-11.03	-6.71	-10.63	19.70
7.1	194.56	85.56	8.80	226.29	97.83	194.74	86.04	9.22	226.70	98.35	194.65	85.80	9.01	226.50	98.09	195.98	92.32	12.64	231.34	104.11	-1.33	-6.52	-3.63	-4.85	-6.02	10.82
9.1	197.48	88.51	18.53	229.13	102.87	197.14	87.72	17.82	228.48	102.00	197.31	88.12	18.18	228.81	102.44	199.03	89.32	17.42	233.77	104.64	-1.72	-1.20	0.75	-4.97	-2.21	5.87
11.1	197.58	98.50	17.32	234.22	109.86	197.14	96.70	15.71	233.17	108.12	197.36	97.60	16.52	233.70	108.99	200.29	103.61	21.41	238.72	115.79	-2.93	-6.01	-4.90	-5.03	-6.80	11.84

Subject 48 Left

	Lacey				JOE				Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	198.89	96.84	20.09	234.54	109.93	197.17	92.87	16.76	231.00	105.50	198.03	94.86	18.43	232.77	107.72	200.51	97.01	20.96	237.34	111.53	-2.48	-2.16	-2.54	-4.57	-3.82	7.26
3.2	204.09	96.13	22.31	239.40	113.42	205.30	99.45	24.59	241.32	116.71	204.70	97.79	23.45	240.36	115.07	208.61	108	33.17	246.29	125.59	-3.92	-10.21	-9.72	-5.93	-10.53	18.97
5.2	198.46	100.11	18.89	235.91	111.79	198.42	99.96	18.83	235.82	111.66	198.44	100.04	18.86	235.87	111.73	200.69	105.56	24.99	239.72	117.81	-2.25	-5.53	-6.13	-3.85	-6.09	11.18
7.2	198.89	95.02	18.30	234.48	108.60	198.94	95.12	18.38	234.57	108.72	198.92	95.07	18.34	234.53	108.66	202.28	102.62	26.37	240.37	117.13	-3.37	-7.55	-8.03	-5.85	-8.47	15.45
9.2	199.82	92.60	21.57	235.48	108.17	199.34	91.77	20.43	234.59	107.10	199.58	92.19	21.00	235.04	107.64	202.23	98.65	28.1	239.69	114.72	-2.65	-6.47	-7.10	-4.66	-7.09	13.08
11.2	197.30	98.66	16.83	234.28	109.73	196.96	97.63	16.49	233.60	108.74	197.13	98.15	16.66	233.94	109.24	198.44	98.29	17.08	235.52	110.39	-1.31	-0.15	-0.42	-1.58	-1.16	2.40

Table C 3. Continued

Subject 49 Right

	Lacey				JOE				Average							Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	194.90	105.62	19.52	233.51	112.93	195.74	107.36	20.77	235.00	114.92	195.32	106.49	20.15	234.26	113.93	197.91	113.4	27.67	239.46	121.52	-2.59	-6.91	-7.53	-5.21	-7.59	13.99
3.1	194.52	110.24	20.10	234.87	116.03	195.37	113.64	22.89	236.84	119.36	194.95	111.94	21.50	235.86	117.70	198.26	125.26	30.87	242.7	130.31	-3.32	-13.32	-9.38	-6.84	-12.62	21.96
5.1	190.32	110.46	12.30	231.08	112.26	190.46	110.99	12.70	231.50	112.80	190.39	110.73	12.50	231.29	112.53	193.02	119.95	22.11	237.37	122.2	-2.63	-9.23	-9.61	-6.08	-9.67	17.74
7.1	202.63	132.19	33.72	246.34	137.84	202.12	129.74	31.64	245.37	135.58	202.38	130.97	32.68	245.86	136.71	205.66	141.81	42.97	249.97	147.81	-3.29	-10.85	-10.29	-4.11	-11.10	19.35
9.1	206.30	136.23	35.30	248.12	142.54	207.20	138.69	37.02	249.10	144.90	206.75	137.46	36.16	248.61	143.72	209.8	150.94	50.23	252.19	155.88	-3.05	-13.48	-14.07	-3.58	-12.16	23.44
11.1	201.85	123.07	28.25	243.56	130.49	203.10	127.80	32.34	245.67	135.00	202.48	125.44	30.30	244.62	132.75	204.79	129.16	32.61	247.34	137.05	-2.32	-3.72	-2.32	-2.72	-4.31	7.11

Subject 49 Left

	Lacey				JOE				Average							Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	194.49	104.07	19.22	233.25	111.59	194.67	104.14	19.05	233.43	111.74	194.58	104.11	19.14	233.34	111.67	196.37	105.36	20.83	235.49	113.94	-1.79	-1.26	-1.70	-2.15	-2.28	4.18
3.2	193.13	106.13	20.91	232.76	112.30	193.28	106.44	21.56	233.04	112.71	193.21	106.29	21.24	232.90	112.51	195.38	107.38	21.89	235.14	114.77	-2.18	-1.10	-0.66	-2.24	-2.27	4.06
5.2	194.40	101.41	16.12	232.36	109.37	194.43	100.97	16.20	232.22	109.09	194.42	101.19	16.16	232.29	109.23	197.31	106.81	23.94	236.77	115.95	-2.89	-5.62	-7.78	-4.48	-6.72	12.87
7.2	202.08	120.51	34.26	244.11	129.82	201.99	120.61	34.32	244.07	129.84	202.04	120.56	34.29	244.09	129.83	204.10	122.78	39.68	246.00	133.28	-2.06	-2.22	-5.39	-1.91	-3.45	7.33
9.2	206.17	128.34	35.97	247.65	137.61	206.20	128.16	35.36	247.58	137.45	206.19	128.25	35.67	247.62	137.53	205.66	123.48	35.75	247.06	134.21	0.53	4.77	-0.09	0.56	3.32	5.86
11.2	202.51	117.56	32.11	243.60	127.81	202.70	117.93	32.81	243.88	128.28	202.61	117.75	32.46	243.74	128.05	203.47	122.4	36.74	245.59	132.27	-0.87	-4.66	-4.28	-1.85	-4.22	7.87

Subject 50 Right

	Lacey				JOE				Average							Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	202.02	90.52	20.35	237.26	108.34	202.05	89.66	19.10	237.10	107.67	202.04	90.09	19.73	237.18	108.01	205.8	91.78	25.77	241.35	112.43	-3.76	-1.69	-6.05	-4.17	-4.43	9.52
3.1	200.68	85.61	13.87	234.63	103.46	200.89	85.65	13.68	234.88	103.62	200.79	85.63	13.78	234.76	103.54	205.63	88.75	22.03	240.6	109.97	-4.85	-3.12	-8.26	-5.85	-6.43	13.30
5.1	199.85	96.28	10.24	235.52	109.18	200.72	98.49	12.10	236.86	111.49	200.29	97.39	11.17	236.19	110.34	204.74	99.76	27.55	241.95	117.07	-4.46	-2.38	-16.38	-5.76	-6.73	19.30
7.1	199.64	97.15	12.21	235.57	109.84	199.50	96.57	11.62	235.27	109.28	199.57	96.86	11.92	235.42	109.56	203.87	98.86	26.36	241.05	115.75	-4.30	-2.00	-14.45	-5.63	-6.19	17.35
9.1	199.56	108.04	14.56	237.98	117.26	199.70	108.51	15.00	238.23	117.72	199.63	108.28	14.78	238.11	117.49	204.24	113.65	34.2	244.47	126.69	-4.61	-5.38	-19.42	-6.37	-9.20	23.50
11.1	203.58	109.72	21.35	241.54	121.84	203.34	109.00	20.68	241.15	121.12	203.46	109.36	21.02	241.35	121.48	205.62	109.99	33.98	244.84	125.17	-2.16	-0.63	-12.97	-3.50	-3.69	14.11

Subject 50 Left

	Lacey				JOE				Average							Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	204.05	95.71	28.66	240.11	114.03	203.63	93.91	27.03	239.27	112.35	203.84	94.81	27.85	239.69	113.19	205.48	95.14	30.49	241.74	114.92	-1.64	-0.33	-2.65	-2.05	-1.73	4.12
3.2	208.18	111.92	34.51	244.16	127.22	206.65	108.53	31.53	242.81	123.85	207.42	110.23	33.02	243.49	125.54	208.77	112.96	40.34	247.36	129.79	-1.35	-2.74	-7.32	-3.88	-4.26	9.80
5.2	198.73	96.61	15.04	235.17	109.22	198.54	96.82	15.46	235.06	109.27	198.64	96.72	15.25	235.12	109.25	201.76	104.11	33.74	240.67	118.64	-3.13	-7.40	-18.49	-5.55	-9.40	22.92
7.2	198.74	92.13	11.56	233.90	105.89	198.53	91.69	11.09	233.56	105.39	198.64	91.91	11.33	233.73	105.64	202.5	101.04	31.48	240.38	116.83	-3.87	-9.13	-20.16	-6.65	-11.19	25.96
9.2	198.36	99.44	13.00	235.50	110.60	198.12	99.12	12.67	235.19	110.18	198.24	99.28	12.84	235.35	110.39	201.61	105.76	32.76	240.9	119.51	-3.37	-6.48	-19.93	-5.56	-9.12	23.76
11.2	199.69	94.26	14.20	235.61	108.33	199.78	94.34	14.44	235.76	108.49	199.74	94.30	14.32	235.69	108.41	202.34	102.44	31.39	240.55	117.63	-2.60	-8.14	-17.07	-4.87	-9.22	21.75

Table C 3. Continued

Subject 51 Right

	Lacey				JOE					Average					Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	200.64	97.73	22.40	237.14	112.21	200.76	96.37	20.58	236.88	111.20	200.70	97.05	21.49	237.01	111.71	204.11	100.67	25.84	241.42	117.05	-3.41	-3.62	-4.35	-4.41	-5.35	9.57
3.1	197.66	113.31	23.71	238.48	120.72	196.97	110.87	21.57	236.96	118.27	197.32	112.09	22.64	237.72	119.50	200.43	111.41	27.21	241	121.83	-3.12	0.68	-4.57	-3.28	-2.33	6.87
5.1	197.59	108.82	21.26	237.29	117.32	198.01	109.84	22.20	238.08	118.42	197.80	109.33	21.73	237.69	117.87	202.36	112.39	28.99	242.64	123.98	-4.56	-3.06	-7.26	-4.95	-6.11	12.03
7.1	205.94	114.74	27.73	245.00	127.55	206.17	116.31	29.48	245.63	128.96	206.06	115.53	28.61	245.32	128.26	209.76	128.57	43.14	249.99	140.71	-3.70	-13.05	-14.54	-4.68	-12.46	23.92
9.1	212.54	138.91	47.11	249.90	148.31	212.88	140.66	48.87	250.31	149.82	212.71	139.79	47.99	250.11	149.07	222.72	170.29	77.95	254.78	175.74	-10.01	-30.51	-29.96	-4.67	-26.68	51.59
11.1	211.82	134.35	42.66	249.92	144.88	211.69	135.10	43.62	250.03	145.42	211.76	134.73	43.14	249.98	145.15	217.19	155.9	66.29	253.83	163.78	-5.44	-21.18	-23.15	-3.86	-18.63	37.09

Subject 51 Left

	Lacey				JOE					Average					Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	197.18	95.69	19.90	233.61	108.03	197.31	95.55	19.69	233.71	108.01	197.25	95.62	19.80	233.66	108.02	199.02	101.96	26.3	237.25	114.22	-1.78	-6.34	-6.51	-3.59	-6.20	11.70
3.2	198.90	99.59	23.77	236.38	112.38	199.54	100.93	25.46	237.40	113.95	199.22	100.26	24.62	236.89	113.17	203.3	105.36	32.79	242.14	120.39	-4.08	-5.10	-8.18	-5.25	-7.23	13.76
5.2	194.69	99.09	18.76	231.88	108.31	194.76	98.99	18.62	231.92	108.28	194.73	99.04	18.69	231.90	108.30	196.78	97.38	19.56	233.77	108.85	-2.06	1.66	-0.87	-1.87	-0.55	3.40
7.2	207.36	131.64	40.86	248.99	141.08	207.33	132.09	41.51	249.06	141.44	207.35	131.87	41.19	249.03	141.26	211.71	148.7	57.84	252.82	156.27	-4.36	-16.84	-16.66	-3.79	-15.01	28.63
9.2	208.53	130.51	39.99	249.35	140.85	209.10	132.28	42.07	249.80	142.52	208.82	131.40	41.03	249.58	141.69	211.18	134.75	46.58	251.35	145.86	-2.37	-3.36	-5.55	-1.78	-4.18	8.26
11.2	204.38	111.69	26.32	243.42	124.41	204.37	111.69	26.31	243.42	124.40	204.38	111.69	26.32	243.42	124.41	208.35	123.62	36.36	248.4	135.88	-3.97	-11.93	-10.05	-4.98	-11.48	20.38

Subject 52 Right

	Lacey				JOE					Average					Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	202.70	95.80	17.95	238.68	111.93	202.90	95.84	17.64	238.89	112.07	202.80	95.82	17.80	238.79	112.00	205.69	103.43	21.63	243	119.35	-2.89	-7.61	-3.84	-4.22	-7.35	12.36
3.1	200.96	94.40	15.86	237.04	109.60	201.06	94.44	15.68	237.16	109.69	201.01	94.42	15.77	237.10	109.65	205.25	95.36	18.83	241.28	113.59	-4.24	-0.94	-3.06	-4.18	-3.95	7.83
5.1	201.20	94.79	13.28	237.02	109.67	200.88	93.68	12.27	236.41	108.59	201.04	94.24	12.78	236.72	109.13	203.34	91.67	14.48	238.72	109.39	-2.30	2.57	-1.71	-2.01	-0.26	4.34
7.1	199.74	90.94	14.69	234.30	106.16	199.28	89.35	13.38	233.33	104.61	199.51	90.15	14.04	233.82	105.39	202.04	88.88	14.33	237.11	106.66	-2.53	1.27	-0.30	-3.30	-1.28	4.54
9.1	202.34	95.38	17.06	238.06	111.24	202.64	97.80	19.21	239.03	113.31	202.49	96.59	18.14	238.55	112.28	204.43	102.2	24.42	242.01	118.08	-1.94	-5.61	-6.29	-3.46	-5.80	10.97
11.1	203.69	85.97	13.50	237.29	105.74	203.67	88.15	15.99	237.74	107.39	203.68	87.06	14.75	237.52	106.57	205.58	85.12	12.81	239.75	106.58	-1.90	1.94	1.94	-2.24	-0.02	4.01

Subject 52 Left

	Lacey				JOE					Average					Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	206.12	103.41	28.46	243.26	120.40	205.28	100.10	25.70	241.86	117.36	205.70	101.76	27.08	242.56	118.88	208.69	101.24	30.02	245.21	120.91	-2.99	0.52	-2.94	-2.65	-2.03	5.38
3.2	202.71	88.33	14.85	237.59	106.83	203.00	88.46	14.92	237.93	107.15	202.86	88.40	14.89	237.76	106.99	203.3	91.17	16.36	238.84	109.29	-0.44	-2.78	-1.48	-1.08	-2.30	4.07
5.2	199.61	91.40	14.67	235.08	106.49	199.60	90.99	14.11	234.92	106.14	199.61	91.20	14.39	235.00	106.32	200.91	91.83	18.72	236.78	108.19	-1.30	-0.64	-4.33	-1.78	-1.88	5.25
7.2	200.09	86.67	15.98	234.36	103.88	200.17	86.99	16.61	234.56	104.22	200.13	86.83	16.30	234.46	104.05	202.23	88.31	18.82	237.21	106.87	-2.10	-1.48	-2.53	-2.75	-2.82	5.34
9.2	200.82	90.79	17.59	236.23	107.32	200.68	90.69	17.42	236.04	107.13	200.75	90.74	17.51	236.14	107.23	202.66	87.91	17.51	237.59	106.81	-1.91	2.83	0.00	-1.46	0.41	3.73
11.2	204.33	86.93	19.32	238.87	107.56	204.20	86.51	18.72	238.62	107.12	204.27	86.72	19.02	238.75	107.34	207.4	79.57	14.69	240.57	104.52	-3.14	7.15	4.33	-1.82	2.82	9.54

Table C 3. Continued

Subject 53 Right

	Lacey				JOE						Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	201.98	97.18	22.33	238.29	112.76	201.97	96.74	21.89	238.16	112.41	201.98	96.96	22.11	238.23	112.59	200.92	94.17	19.27	237.15	109.78	1.06	2.79	2.84	1.07	2.81	5.10
3.1	206.42	86.78	14.08	240.58	108.32	206.25	86.61	13.83	240.39	108.07	206.34	86.70	13.96	240.49	108.20	209.76	96.01	26.23	245.14	117.79	-3.43	-9.32	-12.28	-4.65	-9.60	19.05
5.1	204.31	84.86	15.11	237.94	105.74	203.91	83.87	14.38	237.16	104.71	204.11	84.37	14.75	237.55	105.23	209.75	99.25	31.15	245.66	120.46	-5.64	-14.89	-16.41	-8.11	-15.24	28.64
7.1	200.65	93.29	15.30	236.30	108.59	200.13	91.84	14.57	235.19	107.15	200.39	92.57	14.94	235.75	107.87	203.92	104.27	28.45	241.91	119.58	-3.53	-11.71	-13.52	-6.16	-11.71	22.52
9.1	201.22	98.07	18.37	237.99	112.46	201.57	98.61	19.23	238.53	113.17	201.40	98.34	18.80	238.26	112.82	204.39	108.91	31.09	243.25	123.22	-3.00	-10.57	-12.29	-4.99	-10.41	20.12
11.1	204.20	93.48	18.11	239.67	111.50	204.36	94.02	18.57	240.01	112.03	204.28	93.75	18.34	239.84	111.77	208.65	104.69	30.37	245.76	123.17	-4.37	-10.94	-12.03	-5.92	-11.41	21.18

Subject 53 Left

	Lacey				JOE						Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	205.85	105.43	28.79	242.78	121.42	206.35	106.67	29.73	243.54	122.70	206.10	106.05	29.26	243.16	122.06	207.65	104.79	29.3	245	122.43	-1.55	1.26	-0.04	-1.84	-0.37	2.74
3.2	204.05	90.36	20.01	239.35	109.65	203.83	89.95	20.01	239.04	109.21	203.94	90.16	20.01	239.20	109.43	206.11	87.19	16.91	240.69	108.75	-2.17	2.97	3.10	-1.50	0.68	5.08
5.2	203.94	88.98	16.71	238.94	108.34	203.85	89.12	17.08	238.90	108.40	203.90	89.05	16.90	238.92	108.37	205.72	89.26	15.39	240.63	109.62	-1.83	-0.21	1.51	-1.71	-1.25	3.18
7.2	201.28	88.28	13.62	235.96	105.60	200.71	87.24	12.53	234.90	104.34	201.00	87.76	13.08	235.43	104.97	205.16	94.74	19.95	241.23	113.31	-4.16	-6.98	-6.88	-5.80	-8.34	14.71
9.2	201.78	90.14	14.72	237.06	107.33	201.79	89.92	14.64	237.01	107.18	201.79	90.03	14.68	237.04	107.26	203.91	92.19	17.27	239.63	110.48	-2.13	-2.16	-2.59	-2.60	-3.23	5.75
11.2	203.35	88.29	15.19	238.18	107.30	203.34	88.38	15.30	238.21	107.37	203.35	88.34	15.25	238.20	107.34	205.68	90.31	18.45	240.91	110.64	-2.34	-1.97	-3.21	-2.72	-3.30	6.16

Subject 54 Right

	Lacey				JOE						Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	201.50	106.67	38.65	239.60	120.48	202.95	112.28	43.68	242.38	125.85	202.23	109.48	41.17	240.99	123.17	203.68	112.65	46.47	244.16	127.16	-1.46	-3.18	-5.31	-3.17	-4.00	8.15
3.1	199.44	99.15	31.10	235.09	113.06	201.12	105.79	37.78	239.22	119.61	200.28	102.47	34.44	237.16	116.34	202.05	103.41	39.07	241.01	119.06	-1.77	-0.94	-4.63	-3.85	-2.72	6.91
5.1	201.20	97.96	31.59	236.38	113.65	200.54	96.56	30.48	235.17	112.08	200.87	97.26	31.04	235.78	112.87	202.01	92.88	30.8	238.25	111.1	-1.14	4.38	0.23	-2.48	1.77	5.46
7.1	199.15	110.88	36.77	238.43	121.50	199.39	111.80	37.55	238.99	122.41	199.27	111.34	37.16	238.71	121.96	200.32	103.2	33.68	239.2	117.04	-1.05	8.14	3.48	-0.49	4.91	10.19
9.1	196.84	97.77	27.62	232.72	109.93	197.67	100.64	30.32	234.60	112.83	197.26	99.21	28.97	233.66	111.38	198.94	88.05	22.67	233.39	104.66	-1.69	11.16	6.30	0.27	6.72	14.57
11.1	197.31	101.12	32.45	234.66	113.19	196.67	99.27	30.80	233.30	111.24	196.99	100.20	31.63	233.98	112.22	199.42	98.49	33.88	237.16	113.18	-2.43	1.71	-2.26	-3.18	-0.97	4.99

Subject 54 Left

	Lacey				JOE						Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	195.65	97.02	30.02	231.86	108.80	196.77	99.30	32.13	234.01	111.48	196.21	98.16	31.08	232.94	110.14	198.43	101.11	34.65	236.76	114.24	-2.22	-2.95	-3.58	-3.82	-4.10	7.61
3.2	203.43	86.53	22.71	237.92	107.05	202.23	85.62	21.75	236.15	105.40	202.83	86.08	22.23	237.04	106.23	206.91	91.24	29.79	242.41	113.3	-4.08	-5.16	-7.56	-5.38	-7.08	13.39
5.2	200.96	91.22	28.67	235.94	108.80	199.28	88.51	25.51	232.82	105.30	200.12	89.87	27.09	234.38	107.05	201.24	89.57	29.1	236.61	108.15	-1.12	0.30	-2.01	-2.23	-1.10	3.40
7.2	198.18	102.53	32.29	236.49	114.77	198.08	102.60	32.44	236.40	114.76	198.13	102.57	32.37	236.45	114.77	199.34	101.53	32.13	237.58	114.93	-1.21	1.04	0.23	-1.14	-0.17	1.98
9.2	197.04	94.14	25.71	232.91	107.52	197.03	94.33	25.73	232.95	107.65	197.04	94.24	25.72	232.93	107.59	197.03	98.11	28.41	234.33	110.47	0.00	-3.88	-2.69	-1.40	-2.88	5.70
11.2	195.16	91.71	26.66	230.00	104.60	194.43	91.40	26.70	229.63	104.11	194.80	91.56	26.68	229.82	104.36	196.13	89.72	25.67	230.7	103.82	-1.33	1.84	1.01	-0.88	0.53	2.69

Table C 3. Continued

Subject 55 Right

	Lacey				JOE						Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	211.05	132.08	51.17	248.64	143.78	212.84	136.41	54.55	250.45	148.01	211.95	134.25	52.86	249.55	145.90	211.43	129.83	49.69	250.78	143.16	0.51	4.41	3.17	-1.24	2.73	6.23
3.1	212.73	130.18	48.88	249.63	143.29	212.95	130.94	49.61	249.82	143.98	212.84	130.56	49.25	249.73	143.64	213.7	120.21	43.5	250.42	137.37	-0.86	10.35	5.75	-0.69	6.26	13.44
5.1	209.86	123.20	38.83	248.45	136.57	209.96	123.56	39.18	248.59	136.91	209.91	123.38	39.01	248.52	136.74	211.74	123.5	43.87	249.96	138.53	-1.83	-0.12	-4.87	-1.44	-1.79	5.68
7.1	209.34	123.67	39.01	247.99	136.53	209.40	123.91	39.27	248.08	136.75	209.37	123.79	39.14	248.04	136.64	211.51	122.36	41.09	249.23	137.23	-2.14	1.43	-1.95	-1.19	-0.59	3.49
9.1	198.81	99.69	23.56	235.78	112.31	198.40	97.92	21.91	234.67	110.60	198.61	98.81	22.74	235.23	111.46	198.96	88.31	13.92	233.3	103.86	-0.35	10.50	8.82	1.92	7.60	15.79
11.1	200.52	105.61	27.36	238.91	117.93	200.58	105.44	27.19	238.91	117.84	200.55	105.53	27.28	238.91	117.89	203.43	110.13	32	243	123.56	-2.88	-4.60	-4.73	-4.09	-5.68	10.04

Subject 55 Left

	Lacey				JOE						Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	204.89	107.61	32.56	242.43	122.73	204.46	106.05	30.87	241.59	121.19	204.68	106.83	31.72	242.01	121.96	207.68	115.13	39.72	245.96	130.25	-3.01	-8.30	-8.01	-3.95	-8.29	15.04
3.2	209.08	109.83	32.35	245.68	126.67	208.89	109.10	31.42	245.35	125.95	208.99	109.47	31.89	245.52	126.31	211.12	112.41	37.18	247.64	130.18	-2.13	-2.94	-5.30	-2.13	-3.87	7.79
5.2	211.31	126.06	42.20	249.19	139.48	211.52	126.29	42.08	249.32	139.72	211.42	126.18	42.14	249.26	139.60	213.58	127.01	47.76	250.97	142.09	-2.16	-0.83	-5.62	-1.72	-2.49	6.79
7.2	211.60	129.59	44.20	250.15	142.22	211.69	129.76	44.28	250.23	142.39	211.65	129.68	44.24	250.19	142.31	214.79	129.19	48.15	251.39	144.01	-3.15	0.49	-3.91	-1.20	-1.70	5.46
9.2	198.45	97.26	23.00	234.82	110.35	198.69	97.40	23.35	235.08	110.67	198.57	97.33	23.18	234.95	110.51	200.14	98.07	24.67	237.34	112.38	-1.57	-0.74	-1.50	-2.39	-1.87	3.80
11.2	198.81	100.30	23.89	235.63	112.68	198.72	100.03	23.40	235.43	112.38	198.77	100.17	23.65	235.53	112.53	199.76	101.19	25.85	237.05	114.24	-1.00	-1.03	-2.21	-1.52	-1.71	3.48

Subject 56 Right

	Lacey				JOE						Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	201.40	89.50	19.59	235.41	106.92	202.38	91.16	21.27	236.96	108.95	201.89	90.33	20.43	236.19	107.94	200.81	90.74	18.82	236.35	107.39	1.08	-0.41	1.61	-0.16	0.55	2.06
3.1	201.20	99.10	21.43	238.40	113.44	201.32	99.38	21.77	238.59	113.75	201.26	99.24	21.60	238.50	113.60	203.11	105.51	28.13	241.81	119.82	-1.85	-6.27	-6.53	-3.32	-6.22	11.62
5.1	202.51	91.61	16.93	236.08	108.65	204.72	99.71	23.83	240.38	116.35	203.62	95.66	20.38	238.23	112.50	203.16	95.55	20.22	239.48	112.42	0.46	0.11	0.16	-1.25	0.08	1.35
7.1	203.17	95.48	20.81	239.22	112.35	204.18	98.78	24.32	240.85	115.63	203.68	97.13	22.57	240.04	113.99	204.21	99.23	25.51	241.4	116.14	-0.53	-2.10	-2.95	-1.37	-2.15	4.46
9.1	202.75	94.53	20.29	238.03	111.27	203.09	95.71	21.45	238.61	112.41	202.92	95.12	20.87	238.32	111.84	203.49	94.88	21.89	239.79	112.38	-0.57	0.24	-1.02	-1.47	-0.54	1.97
11.1	205.12	84.93	18.13	237.64	106.47	204.62	84.34	17.54	237.06	105.53	204.87	84.64	17.84	237.35	106.00	203.63	76.19	7.11	236.03	98.93	1.24	8.45	10.73	1.32	7.07	15.48

Subject 56 Left

	Lacey				JOE						Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	203.82	91.00	22.52	239.05	110.12	204.00	91.06	22.33	239.21	110.26	203.91	91.03	22.43	239.13	110.19	206.03	93.97	28.03	241.87	114.22	-2.12	-2.94	-5.61	-2.74	-4.03	8.26
3.2	203.78	95.63	20.07	239.42	112.73	203.06	94.34	19.07	238.52	111.28	203.42	94.99	19.57	238.97	112.01	205.18	94.79	24.43	241.2	113.77	-1.76	0.19	-4.86	-2.23	-1.77	5.90
5.2	204.04	96.07	20.25	239.96	113.25	204.10	96.05	20.16	240.01	113.28	204.07	96.06	20.21	239.99	113.27	208.16	98.96	30.75	244.29	119.14	-4.09	-2.90	-10.55	-4.30	-5.88	13.76
7.2	200.74	87.93	16.05	235.28	105.22	200.79	88.09	16.43	235.37	105.40	200.77	88.01	16.24	235.33	105.31	202.76	85.33	18.83	237.27	105.44	-2.00	2.68	-2.59	-1.95	-0.13	4.66
9.2	199.33	84.90	10.55	232.93	101.58	199.30	85.23	10.94	232.97	101.81	199.32	85.07	10.75	232.95	101.70	201.31	83.02	11.12	235.14	101.99	-2.00	2.05	-0.37	-2.19	-0.30	3.63
11.2	201.58	86.13	17.90	235.80	104.83	201.75	86.60	18.24	236.13	105.31	201.67	86.37	18.07	235.97	105.07	203.34	86.58	17.04	238.01	106.43	-1.67	-0.22	1.03	-2.04	-1.36	3.15

Table C 3. Continued

Subject 57 Right

	Lacey				JOE						Average						Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	208.75	88.17	34.52	243.00	113.04	208.59	87.08	33.33	242.63	112.10	208.67	87.63	33.93	242.82	112.57	212.88	85.83	34.04	246.11	114.12	-4.21	1.80	-0.12	-3.30	-1.55	5.85
3.1	214.02	84.12	19.60	245.88	112.00	213.91	83.29	18.76	245.69	111.32	213.97	83.71	19.18	245.79	111.66	217.78	87.93	26.61	248.65	117.2	-3.82	-4.22	-7.43	-2.87	-5.54	11.25
5.1	206.32	87.03	27.87	240.60	109.95	206.73	89.71	30.81	241.66	112.30	206.53	88.37	29.34	241.13	111.13	210.24	89.77	35.41	244.72	115.15	-3.72	-1.40	-6.07	-3.59	-4.03	9.04
7.1	209.18	83.18	15.93	242.07	108.04	209.22	83.24	15.98	242.12	108.11	209.20	83.21	15.96	242.10	108.08	212.63	85.35	21.13	245.35	112.16	-3.43	-2.14	-5.18	-3.26	-4.08	8.39
9.1	207.57	84.71	17.52	241.30	108.17	207.45	84.02	16.94	241.00	107.58	207.51	84.37	17.23	241.15	107.88	210.68	85.85	21.93	244.2	111.4	-3.17	-1.49	-4.70	-3.05	-3.53	7.49
11.1	204.11	83.73	29.33	237.44	106.38	205.31	87.60	33.47	239.99	110.28	204.71	85.67	31.40	238.72	108.33	205.01	81.63	29.09	238.89	105.78	-0.30	4.04	2.31	-0.17	2.55	5.31

Subject 57 Left

	Lacey				JOE						Average						Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	207.71	91.32	38.42	242.68	114.78	207.91	91.30	38.04	242.89	114.87	207.81	91.31	38.23	242.79	114.83	211.15	93.24	42.03	246.23	118.81	-3.34	-1.93	-3.80	-3.44	-3.99	7.55
3.2	214.39	86.87	23.13	245.97	114.16	214.61	87.43	23.59	246.23	114.70	214.50	87.15	23.36	246.10	114.43	218.35	88.57	28.96	249.09	118.18	-3.85	-1.42	-5.60	-2.99	-3.75	8.44
5.2	209.09	97.40	39.63	244.71	119.73	208.32	94.30	37.38	243.53	116.96	208.71	95.85	38.51	244.12	118.35	211.66	95.02	42.18	246.54	120.17	-2.96	0.83	-3.68	-2.42	-1.83	5.67
7.2	212.64	111.38	50.69	248.69	131.92	211.79	108.79	49.03	247.85	129.58	212.22	110.09	49.86	248.27	130.75	215.47	112.71	53.12	250.44	134.66	-3.26	-2.62	-3.26	-2.17	-3.91	6.94
9.2	213.65	104.29	34.87	247.80	126.03	212.75	101.29	32.73	246.80	123.36	213.20	102.79	33.80	247.30	124.70	215.11	100.05	34.17	248.78	124.28	-1.91	2.74	-0.37	-1.48	0.41	3.70
11.2	203.51	92.11	38.76	239.66	112.58	203.42	90.93	38.26	239.29	111.67	203.47	91.52	38.51	239.48	112.13	206.04	90.9	39.57	241.78	113.65	-2.58	0.62	-1.06	-2.31	-1.53	3.97

Subject 58 Right

	Lacey				JOE						Average						Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	212.67	147.72	55.00	250.75	154.89	212.16	145.93	53.32	250.39	153.31	212.42	146.83	54.16	250.57	154.10	220.76	171.58	78.27	254.79	175.91	-8.35	-24.76	-24.11	-4.22	-21.81	41.92
3.1	212.22	121.41	36.21	247.98	135.87	215.09	130.03	43.68	250.36	143.73	213.66	125.72	39.95	249.17	139.80	222.65	153.64	72.91	254.2	165	-9.00	-27.92	-32.97	-5.03	-25.20	51.06
5.1	200.08	110.27	23.40	239.33	120.16	200.03	110.10	23.28	239.24	120.00	200.06	110.19	23.34	239.29	120.08	207.41	137.65	51.83	250.47	146.53	-7.35	-27.47	-28.49	-11.19	-26.45	49.45
7.1	199.42	104.81	20.83	237.19	115.71	199.18	104.22	20.31	236.76	115.08	199.30	104.52	20.57	236.98	115.40	206.97	127.41	47.08	248.7	138.99	-7.67	-22.90	-26.51	-11.73	-23.60	44.50
9.1	199.66	105.82	23.52	237.36	116.78	198.93	103.87	21.83	235.92	114.72	199.30	104.85	22.68	236.64	115.75	208.54	132.39	48.16	249.92	143.16	-9.24	-27.55	-25.49	-13.28	-27.41	49.21
11.1	197.14	94.84	16.72	231.33	106.79	199.56	101.40	21.82	236.06	113.63	198.35	98.12	19.27	233.70	110.21	207.22	129.52	48.06	248.86	140.54	-8.87	-31.40	-28.79	-15.17	-30.33	55.17

Subject 58 Left

	Lacey				JOE						Average						Control				Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	212.57	122.43	32.87	247.97	136.33	213.36	124.86	34.58	248.75	138.51	212.97	123.65	33.73	248.36	137.42	223.7	167.35	75.78	254.85	174.09	-10.74	-43.71	-42.06	-6.49	-36.67	71.98
3.2	212.89	106.60	23.40	247.08	125.70	212.25	105.90	23.58	246.48	124.87	212.57	106.25	23.49	246.78	125.29	216.96	144.89	57.75	253.41	156.02	-4.39	-38.64	-34.26	-6.63	-30.74	60.62
5.2	204.77	112.15	25.89	242.63	124.62	205.72	115.73	29.24	244.29	128.03	205.25	113.94	27.57	243.46	126.33	208.72	135.75	48.58	249.96	145.28	-3.47	-21.81	-21.02	-6.50	-18.96	36.48
7.2	204.77	101.61	22.60	240.26	117.36	204.57	101.32	22.46	239.99	117.01	204.67	101.47	22.53	240.13	117.19	208.01	133	49.28	249.66	143.34	-3.34	-31.54	-26.75	-9.54	-26.16	49.96
9.2	201.60	92.00	14.39	236.83	108.29	210.80	92.05	14.12	237.07	108.45	206.20	92.03	14.26	236.95	108.37	199.94	96.85	24	236.88	111.32	6.26	-4.82	-9.75	0.07	-2.95	12.89
11.2	201.78	92.33	13.22	236.97	108.50	200.17	89.06	9.89	233.95	104.66	200.98	90.70	11.56	235.46	106.58	200.99	105.17	27.51	239.68	118.01	-0.02	-14.48	-15.96	-4.22	-11.43	24.75

Table C 3. Continued

Subject 59 Right

Picture	Lacey C	Lacey M	Lacey Y	Lacey K	Lacey L	JOE C	JOE M	JOE Y	JOE K	JOE L	Average C	Average M	Average Y	Average K	Average L	Control C	Control M	Control Y	Control K	Control L	Difference C	Difference M	Difference Y	Difference K	Difference L	CD
1.1	195.33	100.25	24.18	231.35	109.93	195.93	100.64	24.70	232.17	110.72	195.63	100.45	24.44	231.76	110.33	201.83	121.96	45.17	244.71	132.04	-6.20	-21.52	-20.73	-12.95	-21.72	39.63
3.1	199.72	113.37	32.91	239.18	122.98	197.43	104.36	25.69	233.90	114.32	198.58	108.87	29.30	236.54	118.65	206.98	136.32	53.76	250.13	145.66	-8.41	-27.46	-24.46	-13.59	-27.01	48.34
5.1	200.26	115.23	29.72	240.88	124.41	198.95	108.79	24.86	236.92	118.38	199.61	112.01	27.29	238.90	121.40	206.53	132.56	46.99	249.35	142.13	-6.93	-20.55	-19.70	-10.45	-20.74	37.38
7.1	201.97	116.46	30.43	242.04	126.33	201.27	113.65	27.88	240.16	123.55	201.62	115.06	29.16	241.10	124.94	209.75	136.33	51.25	250.91	146.68	-8.13	-21.28	-22.10	-9.81	-21.74	39.70
9.1	198.80	110.11	27.03	238.71	119.71	198.39	106.98	24.23	237.07	116.91	198.60	108.55	25.63	237.89	118.31	202.93	121.07	40.96	244.99	131.56	-4.34	-12.53	-15.33	-7.10	-13.25	25.23
11.1	203.17	106.84	25.67	240.60	120.18	200.90	100.68	20.99	235.88	113.73	202.04	103.76	23.33	238.24	116.96	209.97	125.62	45.34	249.23	139.1	-7.94	-21.86	-22.01	-10.99	-22.15	40.45

Subject 59 Left

Picture	Lacey C	Lacey M	Lacey Y	Lacey K	Lacey L	JOE C	JOE M	JOE Y	JOE K	JOE L	Average C	Average M	Average Y	Average K	Average L	Control C	Control M	Control Y	Control K	Control L	Difference C	Difference M	Difference Y	Difference K	Difference L	CD
1.2	199.08	104.23	25.19	237.01	115.63	199.19	104.52	25.47	237.21	115.94	199.14	104.38	25.33	237.11	115.79	201.64	109.82	30.77	241.56	121.95	-2.51	-5.44	-5.44	-4.45	-6.17	11.11
3.2	196.09	105.30	20.69	234.53	113.68	196.42	106.18	21.54	235.17	114.64	196.26	105.74	21.12	234.85	114.16	198.25	110.78	27.8	239	119.9	-2.00	-5.04	-6.69	-4.15	-5.74	11.15
5.2	198.09	106.69	21.85	237.00	116.26	198.26	106.90	22.18	237.24	116.57	198.18	106.80	22.02	237.12	116.42	201.07	115.22	32.87	242.41	125.48	-2.89	-8.43	-10.86	-5.29	-9.07	17.53
7.2	199.40	102.63	20.83	237.12	114.34	199.67	102.84	21.21	227.46	114.73	199.54	102.74	21.02	232.29	114.54	202.77	109.08	30.83	242.30	122.26	-3.24	-6.35	-9.81	-10.01	-7.73	17.52
9.2	198.57	105.59	24.03	237.43	116.15	197.96	103.13	21.60	235.91	113.72	198.27	104.36	22.82	236.67	114.94	202.54	111.02	33.27	242.51	123.66	-4.28	-6.66	-10.46	-5.84	-8.72	16.80
11.2	198.88	100.12	16.90	235.99	111.86	199.54	102.32	19.04	237.38	114.09	199.21	101.22	17.97	236.69	112.98	202.97	105.18	24.63	241.45	119.09	-3.76	-3.96	-6.66	-4.76	-6.12	11.59

Subject 60 Right

Picture	Lacey C	Lacey M	Lacey Y	Lacey K	Lacey L	JOE C	JOE M	JOE Y	JOE K	JOE L	Average C	Average M	Average Y	Average K	Average L	Control C	Control M	Control Y	Control K	Control L	Difference C	Difference M	Difference Y	Difference K	Difference L	CD
1.1	197.03	105.91	26.17	235.12	115.35	196.92	105.13	25.22	234.80	114.64	196.98	105.52	25.70	234.96	115.00	196.76	101.86	23.14	234.65	112.18	0.22	3.66	2.56	0.31	2.82	5.29
3.1	196.39	105.69	25.06	235.87	114.84	196.20	105.01	24.34	235.44	114.15	196.30	105.35	24.70	235.66	114.50	200.42	106.32	31.83	239.95	118.91	-4.13	-0.97	-7.13	-4.29	-4.41	10.33
5.1	198.10	111.08	27.06	237.90	119.77	198.92	113.76	29.27	239.38	122.44	198.51	112.42	28.17	238.64	121.11	200.83	114.27	34.75	242.09	124.9	-2.32	-1.85	-6.59	-3.45	-3.80	8.86
7.1	197.34	96.90	23.19	233.80	109.30	197.60	98.05	24.41	234.51	110.43	197.47	97.48	23.80	234.16	109.87	200.39	96.14	26.41	237.2	111.49	-2.92	1.33	-2.61	-3.04	-1.62	5.39
9.1	206.18	118.42	37.55	244.98	131.01	206.77	120.50	39.73	245.88	133.02	206.48	119.46	38.64	245.43	132.02	208.07	125.08	44.16	248.54	137.64	-1.59	-5.62	-5.52	-3.11	-5.63	10.29
11.1	208.57	125.86	44.26	248.60	138.31	208.31	125.03	43.36	248.32	137.52	208.44	125.45	43.81	248.46	137.92	211.03	131.99	48.83	250.8	144.22	-2.59	-6.55	-5.02	-2.34	-6.30	10.95

Subject 60 Left

Picture	Lacey C	Lacey M	Lacey Y	Lacey K	Lacey L	JOE C	JOE M	JOE Y	JOE K	JOE L	Average C	Average M	Average Y	Average K	Average L	Control C	Control M	Control Y	Control K	Control L	Difference C	Difference M	Difference Y	Difference K	Difference L	CD
1.2	198.67	102.69	28.33	235.68	114.58	198.87	102.81	28.31	235.95	114.81	198.77	102.75	28.32	235.82	114.70	203.02	107.55	34.21	242	121.82	-4.25	-4.80	-5.89	-6.19	-7.13	12.84
3.2	199.13	106.61	28.20	237.97	117.67	199.40	107.23	28.63	238.42	118.33	199.27	106.92	28.42	238.20	118.00	202.96	122.65	41.69	245.63	132.85	-3.70	-15.73	-13.28	-7.44	-14.85	26.70
5.2	200.43	117.77	32.29	242.06	126.63	199.43	115.26	29.48	240.31	123.85	199.93	116.52	30.89	241.19	125.24	203.32	122.96	40.33	245.81	133.07	-3.39	-6.44	-9.45	-4.63	-7.83	15.00
7.2	200.19	111.84	32.99	240.30	122.49	199.50	110.48	31.41	239.10	120.85	199.85	111.16	32.20	239.70	121.67	204.76	120.37	42.59	246.21	132.51	-4.91	-9.21	-10.39	-6.51	-10.84	19.41
9.2	212.66	140.32	55.50	250.73	150.46	210.79	134.61	49.58	248.84	145.05	211.73	137.47	52.54	249.79	147.76	212.75	141.62	57.49	252.5	152.21	-1.03	-4.16	-4.95	-2.72	-4.46	8.37
11.2	208.39	128.60	46.52	248.80	140.22	208.67	129.26	47.12	249.06	140.88	208.53	128.93	46.82	248.93	140.55	210.62	134.01	52.95	251.17	145.87	-2.09	-5.08	-6.13	-2.24	-5.32	10.05

Table C 3. Continued

Subject 61 Right

	Lacey				JOE					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	195.28	106.59	29.13	233.70	114.88	195.60	105.69	27.93	233.71	114.37	195.44	106.14	28.53	233.71	114.63	199.2	108.37	33.98	239.32	119.59	-3.76	-2.23	-5.45	-5.62	-4.97	10.25
3.1	193.86	93.45	21.22	228.65	104.05	193.58	92.27	20.04	227.73	102.87	193.72	92.86	20.63	228.19	103.46	198.1	93.19	25.88	234.18	107.72	-4.38	-0.33	-5.25	-5.99	-4.26	10.04
5.1	194.97	112.63	28.49	235.86	118.87	195.31	113.66	29.56	236.54	119.96	195.14	113.15	29.03	236.20	119.42	197.67	108.53	33.44	237.99	118.6	-2.53	4.61	-4.42	-1.79	0.81	7.15
7.1	196.75	114.96	32.68	237.82	122.19	197.20	116.17	33.86	238.70	123.51	196.98	115.57	33.27	238.26	122.85	200.13	118.46	42.91	242.8	128.33	-3.16	-2.90	-9.64	-4.54	-5.48	12.72
9.1	191.76	99.80	24.20	228.24	107.08	192.36	101.50	25.74	229.64	108.95	192.06	100.65	24.97	228.94	108.02	191.03	97.53	17.64	227.84	104.42	1.03	3.12	7.33	1.10	3.60	8.87
11.1	199.77	110.00	32.73	237.14	120.50	198.09	105.38	29.41	233.72	115.71	198.93	107.69	31.07	235.43	118.11	195.15	89.14	14.12	229.29	101.42	3.78	18.55	16.95	6.14	16.69	31.01

Subject 61 Left

	Lacey				JOE					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	193.27	97.07	22.61	227.79	105.93	196.34	104.00	28.37	234.46	113.87	194.81	100.54	25.49	231.13	109.90	197.08	96.33	23.45	233.97	108.78	-2.28	4.21	2.04	-2.85	1.12	6.03
3.2	195.26	111.97	35.50	236.35	119.50	194.58	110.58	34.33	235.30	117.90	194.92	111.28	34.92	235.83	118.70	198.77	112.62	40.66	240.41	123.14	-3.85	-1.35	-5.75	-4.59	-4.44	9.51
5.2	194.56	110.26	27.98	235.26	116.97	195.26	111.58	29.35	236.34	118.54	194.91	110.92	28.67	235.80	117.76	197.25	111.64	37.71	238.88	121.04	-2.34	-0.72	-9.05	-3.08	-3.29	10.40
7.2	196.64	112.39	32.93	236.40	120.17	197.56	114.69	35.20	238.35	122.77	197.10	113.54	34.07	237.38	121.47	200.39	120.25	45.3	243.65	130.06	-3.29	-6.71	-11.24	-6.28	-8.59	17.18
9.2	192.74	98.67	24.47	229.53	107.16	193.30	100.07	25.85	230.72	108.73	193.02	99.37	25.16	230.13	107.95	191.32	97.52	23.54	228.03	105.26	1.70	1.85	1.62	2.10	2.68	4.53
11.2	193.56	102.54	27.98	231.67	110.82	194.35	104.48	29.84	233.27	113.02	193.96	103.51	28.91	232.47	111.92	198.36	112.54	40.17	240.16	122.75	-4.41	-9.03	-11.26	-7.69	-10.83	20.10

Subject 62 Right

	Lacey				JOE					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	200.12	114.16	38.35	239.63	124.37	199.37	111.19	35.45	237.66	121.40	199.75	112.68	36.90	238.65	122.89	197.63	104.02	32.59	236.76	115.35	2.12	8.66	4.31	1.88	7.54	12.58
3.1	202.35	100.81	26.85	238.14	115.65	204.71	108.36	22.58	242.62	123.21	203.53	104.59	24.72	240.38	119.43	205.16	94.83	30.12	241.56	114.49	-1.63	9.76	-5.41	-1.18	4.94	12.36
5.1	195.43	108.65	17.96	233.00	114.86	197.41	114.61	22.25	237.36	121.00	196.42	111.63	20.11	235.18	117.93	199.12	118.31	35.01	241.99	126.63	-2.70	-6.68	-14.91	-6.81	-8.70	19.90
7.1	204.69	120.23	31.60	242.35	130.01	205.40	122.81	33.62	243.44	132.38	205.05	121.52	32.61	242.90	131.20	208.83	126.74	46.14	249.41	139.44	-3.79	-5.22	-13.53	-6.52	-8.25	18.30
9.1	201.08	106.91	30.87	237.58	119.00	201.44	107.78	31.28	237.96	119.85	201.26	107.35	31.08	237.77	119.43	203.16	99.16	32.09	240.51	116.14	-1.90	8.19	-1.02	-2.74	3.29	9.48
11.1	198.44	106.45	22.52	235.78	116.15	200.53	113.31	27.90	239.91	122.94	199.49	109.88	25.21	237.85	119.55	202.39	107.04	28.6	241.49	120.38	-2.90	2.84	-3.39	-3.65	-0.83	6.48

Subject 62 Left

	Lacey				JOE					Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	195.83	104.04	33.56	233.94	114.13	197.19	106.74	36.40	236.54	117.39	196.51	105.39	34.98	235.24	115.76	197.81	102.2	35.1	236.6	114.59	-1.30	3.19	-0.12	-1.36	1.17	3.89
3.2	196.90	100.66	23.68	233.57	111.44	197.89	103.63	26.45	235.80	114.56	197.40	102.15	25.07	234.69	113.00	200	108.36	37.69	240.16	120.67	-2.61	-6.22	-12.63	-5.47	-7.67	17.13
5.2	195.15	98.43	15.73	231.16	107.72	196.45	103.58	19.60	234.80	112.76	195.80	101.01	17.67	232.98	110.24	199.14	113.96	37.69	241.03	123.98	-3.34	-12.96	-20.03	-8.05	-13.74	28.87
7.2	197.93	101.77	23.66	235.67	113.08	197.33	100.94	22.34	234.64	111.90	197.63	101.36	23.00	235.16	112.49	199.42	103.33	31.44	238.18	116.08	-1.79	-1.98	-8.44	-3.03	-3.59	10.02
9.2	197.15	91.98	20.98	232.29	105.62	197.44	92.90	22.08	233.00	106.60	197.30	92.44	21.53	232.65	106.11	197.36	87.18	16.65	231.52	102.16	-0.06	5.26	4.88	1.12	3.95	8.27
11.2	195.09	91.34	17.79	229.53	103.23	196.19	93.82	20.38	231.85	106.07	195.64	92.58	19.09	230.69	104.65	195.56	88.79	16.7	229.94	101.82	0.08	3.79	2.39	0.75	2.83	5.35

Table C 3. Continued

Subject 63 Right

	Lacey				JOE						Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	200.54	97.86	34.22	237.38	113.61	200.43	96.90	33.19	236.97	112.78	200.49	97.38	33.71	237.18	113.20	202.06	101.71	39.1	240.18	117.89	-1.57	-4.33	-5.40	-3.01	-4.70	9.02
3.1	196.68	98.91	28.53	233.68	110.78	197.22	100.15	28.52	234.82	112.06	196.95	99.53	28.53	234.25	111.42	201.77	110.41	43.25	242.49	124.1	-4.82	-10.88	-14.73	-8.24	-12.68	24.23
5.1	196.78	105.49	25.45	235.07	114.92	197.13	106.56	27.04	235.86	116.11	196.96	106.03	26.25	235.47	115.52	200.74	113.54	43.63	242.01	125.52	-3.79	-7.52	-17.39	-6.54	-10.01	22.72
7.1	200.23	114.62	31.81	239.98	124.13	200.30	114.50	31.55	240.00	124.08	200.27	114.56	31.68	239.99	124.11	205.44	130.84	55.78	248.23	141.39	-5.18	-16.28	-24.10	-8.24	-17.29	35.20
9.1	200.07	110.71	27.83	239.50	121.01	199.01	107.06	23.90	237.20	117.27	199.54	108.89	25.87	238.35	119.14	205.24	122.12	50.35	246.53	134.85	-5.70	-13.24	-24.49	-8.18	-15.71	33.48
11.1	195.76	100.28	21.79	232.11	110.06	199.46	113.09	33.71	240.14	123.01	197.61	106.69	27.75	236.13	116.54	202.37	116.44	45.45	243.85	128.76	-4.76	-9.76	-17.70	-7.72	-12.23	25.30

Subject 63 Left

	Lacey				JOE						Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	200.60	103.29	39.52	238.95	117.90	200.50	102.51	38.76	238.64	117.20	200.55	102.90	39.14	238.80	117.55	201.24	101.21	40.78	239.1	117.17	-0.69	1.69	-1.64	-0.31	0.38	2.50
3.2	200.64	105.55	33.57	239.24	118.83	201.43	107.09	34.34	240.15	120.37	201.04	106.32	33.96	239.70	119.60	205.85	119.13	52.22	246.96	133.53	-4.82	-12.81	-18.27	-7.27	-13.93	27.71
5.2	195.74	102.63	22.59	234.00	111.97	195.64	102.87	22.36	233.97	112.04	195.69	102.75	22.48	233.99	112.01	199.61	107.27	41.34	239.71	120.22	-3.92	-4.52	-18.87	-5.72	-8.22	22.18
7.2	193.80	107.66	18.20	233.70	113.54	193.91	107.74	18.59	233.87	113.72	193.86	107.70	18.40	233.79	113.63	197.23	112.57	36.5	239.02	121.55	-3.37	-4.87	-18.11	-5.24	-7.92	21.28
9.2	198.94	109.40	22.76	238.46	118.83	199.11	109.82	23.44	238.72	119.32	199.03	109.61	23.10	238.59	119.08	200.4	110.21	39.75	240.92	122.54	-1.38	-0.60	-16.65	-2.33	-3.47	17.23
11.2	198.05	108.31	26.11	237.67	117.88	197.96	107.45	26.24	237.39	117.25	198.01	107.88	26.18	237.53	117.57	201.16	116.82	43.5	243.14	127.98	-3.16	-8.94	-17.33	-5.61	-10.42	23.02

Subject 64 Right

	Lacey				JOE						Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.1	193.76	104.91	29.47	232.49	112.76	193.87	105.14	29.35	232.61	112.98	193.82	105.03	29.41	232.55	112.87	196.04	101.13	28.83	234.32	111.79	-2.22	3.90	0.58	-1.77	1.08	4.98
3.1	196.13	108.44	28.27	235.94	116.80	196.55	110.69	30.00	237.07	118.87	196.34	109.57	29.14	236.51	117.84	199.21	112.49	34.07	240.5	122.49	-2.87	-2.93	-4.94	-4.00	-4.65	8.88
5.1	196.76	119.22	29.45	238.86	124.64	197.10	119.71	29.62	239.24	125.21	196.93	119.47	29.54	239.05	124.93	198.59	118.64	32.61	241.72	126.25	-1.66	0.83	-3.08	-2.67	-1.33	4.67
7.1	196.25	113.72	25.60	236.67	120.03	194.42	106.89	20.83	232.60	113.39	195.34	110.31	23.22	234.64	116.71	197.09	109.67	24.85	237.47	117.91	-1.76	0.64	-1.64	-2.84	-1.20	3.95
9.1	192.56	110.65	27.84	232.90	115.69	192.72	111.32	28.36	233.34	116.36	192.64	110.99	28.10	233.12	116.03	192.89	100.55	20.66	230.78	108.21	-0.25	10.44	7.44	2.34	7.82	15.19
11.1	196.76	119.22	29.45	238.86	124.64	192.25	105.88	24.56	230.30	111.62	194.51	112.55	27.01	234.58	118.13	193.38	101.52	21.62	231.55	109.34	1.13	11.03	5.39	3.03	8.79	15.44

Subject 64 Left

	Lacey				JOE						Average					Control					Difference				
Picture	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	C	M	Y	K	L	CD
1.2	193.34	108.32	30.42	233.63	114.98	194.14	109.52	31.31	234.86	116.52	193.74	108.92	30.87	234.25	115.75	195.66	116.95	35.04	239.21	123.37	-1.92	-8.03	-4.18	-4.97	-7.62	12.97
3.2	194.83	103.45	26.23	233.51	112.22	195.38	104.47	27.42	234.46	113.48	195.11	103.96	26.83	233.99	112.85	198.06	111.8	34.05	239.38	121.23	-2.95	-7.84	-7.22	-5.39	-8.38	14.89
5.2	193.27	110.19	24.56	233.52	115.45	193.38	110.46	24.77	233.77	115.76	193.33	110.33	24.67	233.65	115.61	198.34	123.25	37.29	242.68	129.83	-5.02	-12.93	-12.63	-9.04	-14.23	25.21
7.2	196.49	112.72	27.80	237.70	119.98	196.58	112.81	28.11	237.86	120.15	196.54	112.77	27.96	237.78	120.07	198.49	119.56	32.98	241.91	126.91	-1.95	-6.80	-5.03	-4.13	-6.85	11.80
9.2	191.24	101.97	22.19	228.89	107.97	191.03	101.61	22.20	228.53	107.54	191.14	101.79	22.20	228.71	107.76	194.14	109.53	29.24	234.94	116.32	-3.01	-7.74	-7.05	-6.23	-8.57	15.19
11.2	190.99	102.33	24.40	228.08	108.15	191.09	102.45	24.46	228.24	108.32	191.04	102.39	24.43	228.16	108.24	195.8	117.03	38.03	239.28	123.91	-4.76	-14.64	-13.60	-11.12	-15.68	28.13

Figure C 1. Cryotherapy and compression color difference value means

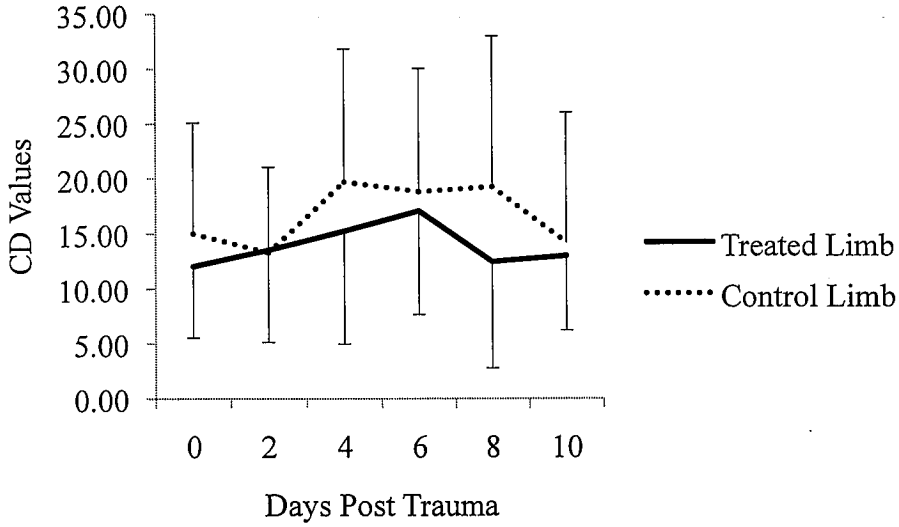


Figure C 2. Cryotherapy alone color difference value means

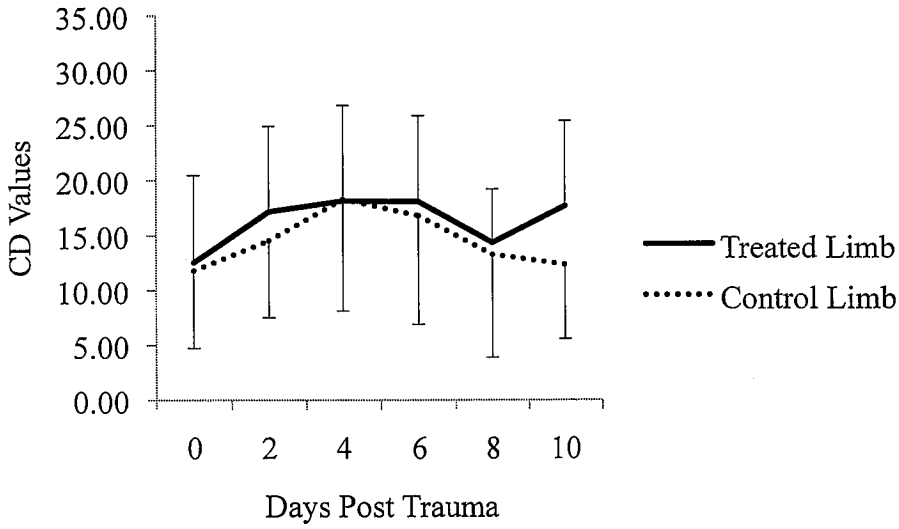


Figure C 3. Tobacco poultice color difference value means

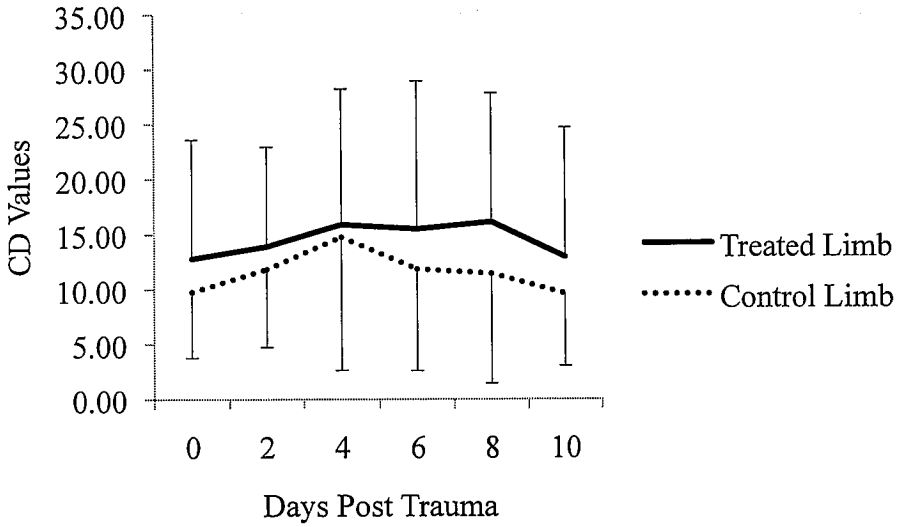


Figure C 4. SportsWrap color difference value means

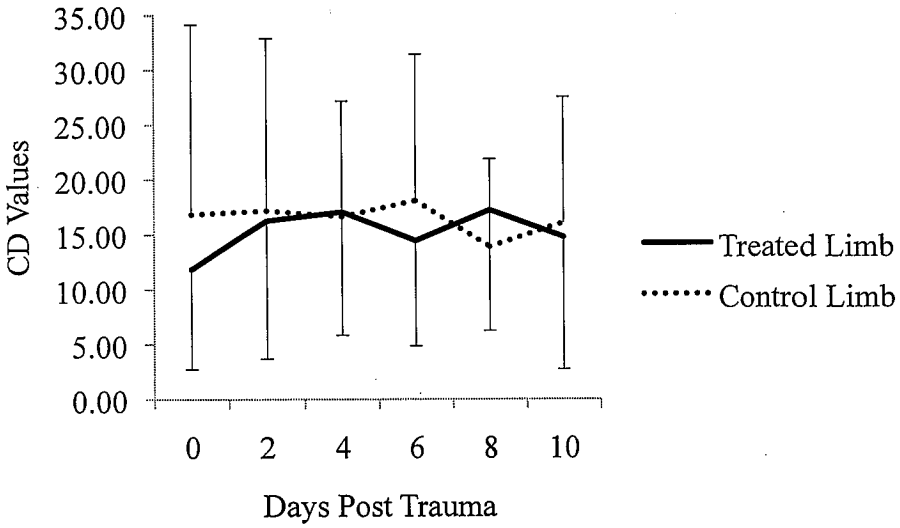
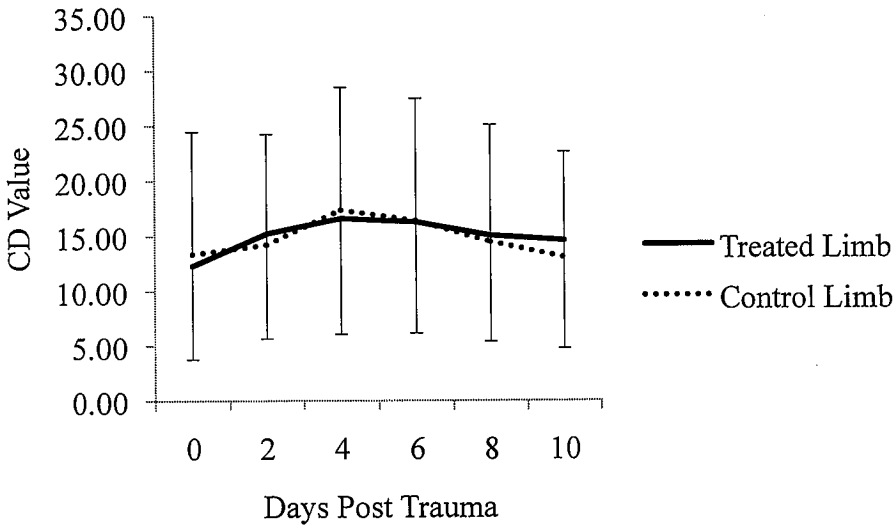


Figure C 5. Combined color difference value means for all treatments



Appendix D

Ideas for Future Research

Table D 1. Ideas for future research

- Determine if pixel analysis is an effective dependent variable. One method would be to analyze the time course of resolution of bruises in actual patients.
- Determine if greater bruising results in a treatment effect.
- Evaluate the benefits of real-time diagnostic ultrasound as an additional dependent variable.
- Evaluate the role the higher quality, softer lighting would have on potential washout of color.
- Determine whether greater velocity or a different ball would provide greater bruising or functional changes (decrease range of motion, limp, etc.).
- Evaluate the effectiveness of other modalities.