12-1-2013

Sex Determination Using Discriminant Function Analysis in Hispanic Children and Adolescents: A Lateral Cephalometric Study

Alyssa E. Sprowl
University of Nevada, Las Vegas

SEX DETERMINATION USING DISCRIMINANT FUNCTION ANALYSIS IN HISPANIC CHILDREN AND ADOLESCENTS:A LATERAL CEPHALOMETRIC STUDY

By

Alyssa Elainia Sprowl

Bachelor of Science in Biology
Hampton University
2005

Doctor of Dental Surgery
Meharry Medical College
2009

A thesis submitted in partial fulfillment
of the requirements for the

Master of Science - Oral Biology

School of Dental Medicine
Division of Health Sciences
The Graduate College

University of Nevada, Las Vegas
December 2013

UNLV
UNIVERSITY OF NEVADA LAS VEGAS

THE GRADUATE COLLEGE

We recommend the thesis prepared under our supervision by

Alyssa Elainia Sprowl

entitled

Sex Determination Using Discriminant Function Analysis in Hispanic Children and Adolescents: A Lateral Cephalometric Study

is approved in partial fulfillment of the requirements for the degree of

Master of Science - Oral Biology

School of Dental Medicine

James Mah, D.D.S., Committee Chair

Edward Herschaft, M.A., Committee Member

Clifford Seran, D. M.D., Committee Member

Debra Martin, Ph.D., Graduate College Representative

Kathryn Hausbeck Korgan, Ph.D., Interim Dean of the Graduate College

December 2013

ABSTRACT

Sex Determination Study Using Discriminant Function Analysis in Hispanic Children and Adolescents: A Lateral Cephalometric Study

by

Alyssa Elainia Sprowl

Dr. James Mah, Examination Committee Chair

Director of Orthodontics and Dentofacial Orthopedics

Graduate Coordinator

University of Nevada, Las Vegas
School of Dental Medicine

Lateral cephalometric radiographs have been used for years to help diagnose skeletal and dental patterns in Orthodontics. Within the last decade, these radiographs have caught the interest of the department of Anthropology for the identification of gender within the adult and adolescent population. Numerous publications have been made but failed to identify sexual dimorphism in the pre-adolescent population. 303 lateral cephalograms of pre and post Latino adolescence age ranging from 6.5 to 17.9 years old were obtained from University of Nevada, Las Vegas (UNLV) digital database. 25 variables were identified and plotted with all linear and angular measurements transferred into Statistical Package for the Social Sciences (SPSS) version 17.0. A discriminant analysis with linear discriminant function, forward stepwise discriminant function and canonical correlation analyses were fabricated, compared and analyzed for the entire sample and for each individual age group. The discriminant function analysis yielded 74.6% accuracy with 89% female and 51.7% males accurately identified. The variables contributing the most ($p<.05$) to gender for the overall sample were GSgN,

MaSN, GPI and ULTc. The discriminant function analysis resulted in 100% for 6.5-8.5 age groups; 83.3% for 8.6-10.5 age groups; 71.7% for 10.6-12.5 age groups; 78.3% for 12.6-14.5 age groups; 94.7% for 14.6-17.9 age groups. The landmarks contributing the most ($p<.05$) to sexual dimorphism were GMFH, IOpFH, ULTc, GPI, GSgN, FSHt and Tc. The results of this study confirm sexual dimorphism does exist in the skeleton as early as 6 years old. Further research is needed to determine other landmarks that can aid in sexual identification and norms for Hispanic as well as other races.

ACKOWLEDGEMENTS

I would like to thank Dr. James Mah, my committee chair, for introducing me to this topic. Thank you for your time, patience and optimism. I would also like to thank my committee members, Dr. Edward Herschaft, Dr. Clifford Seran and Dr. Debra Martin for your support. I would also like to thank Ms. Margeaux Randolph for your endless efforts in analyzing the statistical data. Thank you for your interest and dedication to this project. To the Orthodontic Class of 2013, thank you for the laughter and always being a listening ear during times of frustration.

DEDICATION

To my family and friends,

Thank you for always believing in me.

Your support was invaluable and I will always love you for that.

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CHAPTER 1
INTRODUCTION
Background and Significance

The identification of unknown persons is important in forensic and scientific investigations. Over the last 20 years numerous methods have been introduced to improve the accuracy of identifying an unidentified body. Current methods include fingerprinting, hair samples, DNA, visual recognition, subjective classification and dental records. In the latter, existing dental records, which include panoramic and periapical radiographs are compared to the dental restorations, dental anomalies, missing or impacted teeth, and periodontal pathology of the unidentified body. Other dental radiographs such as lateral cephalograms are used to predict gender. This type of radiograph reveals many characteristics that can be used to make the distinction. (Biggerstaff, 1977)

In general, the first step towards identification is determining the sex of the deceased. Forensic science relies heavily on the pelvis and skull as major contributors to identifying skeletal remains. The female pelvis is used as a major identifier because of the wider, smoother and overall smaller presentation. However, the pelvis is normally found in poor condition as a result of its shape and fragility, while the skull, on the other hand, usually presents in a better condition that allows it to be usable (Veyre-Goulet, Mercier, Robin, Gurin, 2008). The prominent supraorbital ridges, mastoid processes and pogonions of males are key identifiers on the skull.

More methodical approaches have been the topic of interest in recent years. Methods such as measuring the mastoid process, size and shape of the nose and mandible, and lateral cephalometric skeletal tracings have been studied to determine gender. The majority of these methods were studied on adult skulls and radiographs with accuracies of 80-100%. However, very few have focused on the pre-adolescent. This may have been due primarily to the belief that the skeleton presented almost identical for males and

females and secondary sexual characteristics were needed to determine gender by skeletal means,

However, sexual dimorphism can be seen in children as early as birth. Children's skulls attain the shapes they will have in adulthood much earlier than was previously thought (Loth & Henneberg, 2001). Lately, research has focused on gender identification with the use of lateral cephalograms in a younger population of 5-17 years of age (Hsiao et al., 2009; Gonzalez, 2010). These studies reported accuracies of 75-95%. The average age in these studies was after peak pubertal growth. There was an inadequate subject count in the pre-pubertal age group to be statistically significant. At present, there remains a paucity of knowledge regarding gender identification using information from the skull in younger age groups. Therefore, the purpose of this study was to determine if lateral cephalometric radiographs of children aged 6.5 to 18 years of age can be used to determine their gender.

Research Question and Hypotheses

1. Can lateral cephalometric analysis accurately identify the gender of children age 6.5-17.9 using the discriminant function analysis?

   Hypothesis: Yes, The discriminant function analysis of lateral cephalometric data can be used to identify gender of children age 6.5-17.9.

   Null Hypothesis: No, The discriminant function analysis of lateral cephalometric data cannot be used to identify gender of children age 6.5-17.9.

2. How reliable is the use of lateral cephalometric analysis to identify children age 6.5-17.9?

   Hypothesis: The discriminant function analysis of lateral cephalometric data will result in accuracy equal to or higher than 75%.

   Null Hypothesis: The discriminant function of lateral cephalometric data will result in an accuracy of less than 75%.

3. How will children age 6.5-10.5 affect the overall accuracy of discriminant function analysis?

   Hypothesis: The discriminant function analysis will result in an accuracy of higher than 75%.

   Null Hypothesis: The discriminant function will result in accuracy of less than 75%.

4. Which lateral cephalometric variables will contribute the most ($p<.05$) to identifying gender of children who have not entered the age of puberty?

   Hypothesis: There are lateral cephalometric variables that will contribute ($p<.05$) to gender identification of children age 6.5-17.9.

   Null Hypothesis: There are no lateral cephalometric variables that will contribute ($p<.05$) to gender identification of children age 6.5-17.9.

CHAPTER 2
LITERATURE REVIEW
Sexual Dimorphism in the Adult

The first step in identification of the deceased is determining gender. The pelvis and skull are two of the most easily sexed parts of the skeletal system, with phenotypic differences between the males and females being evident. Since the pelvis is more fragile and usually found in poor conditions, the skull is used more often. In general, males have a more prominent mastoid process, pogonion and supraorbital ridges. Usually large and strong skulls tend to belong to males, while female skulls are small and smooth in nature. Using these subjective features, a large female skull can be misidentified as male, prolonging forensic and police investigations as a result of misclassification of sex.

Within the last twenty years, new methodical approaches in gender identification using radiographs of skulls have been reported. In 1996, a group in Taiwan used one hundred adult lateral cephalograms of men and women (Hsiao, Chang, Liu, 1996). Eighteen cephalometric variables were analyzed using both a linear and stepwise discriminant function analysis. A discriminant function analysis is an equation used in statistics to show which variables allow for the best discrimination between the two groups. In a stepwise discriminant function analysis, all variables are reviewed and evaluated at each step to determine which one will contribute the most to the discrimination between groups (StatSoft, 2007). This study resulted in a 94% accuracy of sex determination. These researchers also found male values for angular measurements were smaller than female values, but mean male values for all linear measurements and proportional measurements were larger than female values.

A group in central India evaluated sex and stature using adult lateral cephalograms in 2004. One hundred and fifty lateral cephalograms of adults age 25-54 were analyzed using ten cephalometric variables (Patil & Mody, 2004). The Fisher's linear discriminant

analysis was used resulting in 99% accuracy for sex determination. This study found the major variables in determination of sex were basion to nasion, mastoid height and width, Basion to Anterior Nasal Spine, Mastoid to Frankfort horizontal and Gonion to Opisthocranion.

In 2008, a European group also used lateral cephalograms produced from dry skulls to determine gender of the deceased aged 20-55 (Veyre-Goulet et al., 2008). The radiographs of 114 skulls were analyzed using the same eighteen cephalometric variables from the Hsiao 1996 study, resulting in a 95.6% accuracy of sex determination. This study also found the frontal region appeared to be the most significant in identifying sex with 6 major variables in this region. It was noted that these variables differ between ethnic groups.

Metric analysis of key skeletal landmarks to evaluate sexual dimorphism has also been reported (Saini et al., 2010). The mastoid process of 138 adult skulls age 25-65 was measured using a sliding caliper from the upper zygomatic arch to the mastoid tip. Stepwise and direct discriminant function analyses were used to evaluate the computed measurements. This study reported 87% sex accuracy. Researchers also found the most effective measurement was asterion to mastoidale with 75.4% accuracy.

Puberty and the Secondary Sex Characteristics

Previous studies have proven sex identification can be performed with high accuracy using the adult skull, but few studies have examined sex determination using skulls of children (Hsiao et al., 2010). This may have likely been due to many scholars believing secondary sex characteristics are needed to determine gender (Biggerstaff, 1977). At birth, males tend to be 1% longer than females, but by childhood, sexual differences remain insignificant until the onset of puberty (Wells, 2007).

Puberty is a change in the entire body as a result of morphologic and physiologic changes that occur during adolescence. The main indicators of puberty are skeletal growth spurt, development of gonads, secondary sex characteristics and changes in body composition such as muscle mass and distribution of subcutaneous fat as a result of an increase in steroids, insulin like growth factor and leptin (Garnett et al., 2004). These changes can vary in age and duration with girls usually beginning the onset of puberty at an average age of 10, which is 2 years before boys.

During puberty, females will have an increase in adipose tissue deposit and a decrease in bone turnover, hence less growth in stature. In girls, menarche starts almost immediately after the peak growth spurt with an average age of 12 years old for Americans. With this close association between skeletal and sexual maturity, a girl's end of peak growth can be highly predicted. Puberty in boys begins later and extends over a longer period – about 5 years compared to 3 ½ years for girls (Falkner & Tanner, 1986). Since boys are in adolescence longer than girls, their growth is slow but steady until the onset of puberty, at which point growth becomes rapid. Increased levels of testosterone inhibit bone resorption but increase bone apposition and lean mass deposits. Males as result of increase in stature and muscular attachments will tend to have more pronounced supraorbital ridges, glabella, frontal sinus, and mastoid processes.

Sexual Dimorphism in Pre-adolescents

After puberty, males generally have a larger skull and more pronounced skeletal regions and muscular markings than females. However, the major hormonal influences triggered to initiate sexual maturation at puberty also target receptors in the mandible (Loth & Henneberg, 2001). In 1996, a group evaluated mandibular morphology of Black and Caucasian South Africans (Loth, 1996). The sexual characteristics of 609 mandibles age 6months to 90 years old were evaluated. This study found traditional adult chin shapes were recognizable in juveniles from about age 6 years and were identical to adults in both size and form by age 13.

This same group in 2001 conducted another study assessing mandibular morphology (Loth & Henneberg, 2001). The mandibles of 62 Black and Caucasian South Africans, aged from birth to 19 years old, were evaluated at the anterior region, inferior border, and base. Observations of the anterior region revealed at around seven months of age or after eruption of the central incisors, sex differences can be detected in the shape of the inferior symphyseal border. Female mandibles tended to exhibit a gradual curve or rounded corpus shape and symphyseal base with a gradual transition from the symphyseal region to the lateral portions of the corpus. A male mandible had a more pointed or square shape with an angled transition to the lateral body, even when the male symphyseal base was more rounded. A blind test was completed by 3 examiners using the author's standards. All mandibles were reviewed, yielding an accuracy of 81% with the male mandible being the most consistently diagnosed.

In 2011, a group evaluated sexual dimorphism of the mandible in response to dental development (Coquerelle et al., 2011). Using 159 CT scans of mandibles of residents from France ranging from birth to adulthood, each surface of the mandible was plotted and analyzed for mineralization, shape and size using the principal component

analysis. The degree of mineralization of each tooth was assessed by the use of a radiographic rating system for permanent and deciduous teeth. Researchers found shape dimorphism already existed by birth, concentrated at the ramus and the mental region.

Lateral Cephalometric Use in Identifying Gender of Children and Adolescents

The same group, who performed the 1996 (Hsiao et al., 1996) lateral cephalometric study on adults, applied the same methods to 100 Taiwanese children and adolescents in 2010 (Hsiao et al., 2010). Lateral cephalograms (n=100, 50 male and 50 female) were obtained from the files of the Orthodontic Department, Kaoshsiung Medical University, from January 2005 to June 2009. The age range of children and adolescents were from 12 years 2 months to 17 years 11 months with the mean age of 15.52+/- 1.38 and 15.67+/-1.54 years. The 22 cephalometric measurements and a cervical vertebral maturation (CVM) stage were developed throughout the radiographs. The best 7 out of 9 variables were used in a stepwise discriminant function that resulted in 92-95% accuracy when four to seven variables were used.

This study also observed no improvement in sex determination when two or three variables were compared but did find that glabella-metopion to basion-nasion alone classified 73% of sexes correctly. Cross validation also resulted in almost the same sex determination rates with a reduction in accuracy from 1-4%. This study selected four cephalometric measurements as the minimum numbers of traits require obtaining and maintaining the same accuracy rate of 91% with the least possible risk factors. The mean differences for all measurements were statistically significant ($p<.05$), indicating the presence of sexual dimorphism in the skull. Male values for all linear measurements were larger than females, but female angular measurements were larger than the males. Results in linear and angular measurements noted females tended to have steeper forehead ascension, less developed glabella and supraorbital ridges compared to the males. This study was very successful in identifying sexual dimorphism but with the average age being after the onset of puberty, does not represent the pre-pubertal age group.

Another lateral cephalometric study was performed on preadolescents in 2010 (Gonzalez, 2010). This study evaluated sexual dimorphism in 83 hand traced lateral cephalograms of Europeans aged 5-16. Lateral cephalograms of 47 males and 36 females were collected from the Department of Orthodontics, University of Michigan-School of Dentistry. The original 83 samples were converted into a cross sectional sample of 598 individuals by using 25 female and 25 male cephalograms in each age group. Twenty measurements which were concentrated on specific points related to the cranium without any adjacent structures were used in a backward stepwise and canonical discriminant function to result in an accuracy of 87.3%. In a backward step wise discriminant function, the variable that contributes the least to the group is eliminated. In a canonical analysis, optimal combinations of variables are determined first, second and so forth (StatSoft, 2007). The most significant variables were basion-bregma, nasion-bregma, sella-glabella, bregma-opisthocranion and glabella-opisthocranion. This study suggested that while craniofacial growth neared completion around age 6, male and female sexual dimorphism already existed. Further development of these characteristics is the result of craniofacial features that are unique to each sex. This study although successful with 87.3% accuracy, was unsuccessful at isolating the pre-pubertal from post-pubertal age groups. It appears that accuracy is enhanced by post-pubertal sexual dimorphism.

CHAPTER 3
METHODOLOGY
Sampling Procedure

The patient database of the Department of Orthodontics and Dentofacial Orthopedics, University of Nevada, Las Vegas (UNLV) School of Dental Medicine from July 2005 to January 2012 was used to comprise a sample of 303 digital pre-treatment lateral cephalometric radiographs of pre and post Latino adolescence with ages ranging from 6 years 4 months to 17 years 9 months. All lateral cephalograms were taken in natural head position with Frankfort horizontal parallel to the floor using the Planmeca ProMax S3 panoramic and lateral cephalometric x-ray unit 60 inches from focal to midsaggital plane with dosage range of 5-14 Ma and 62-70 kvp.

The sample included 185 females and 118 males divided into age groups with increments of 2.5 years as shown in Table 3.1. Exclusion criteria included previous medical history with any developmental syndrome or disorder which could affect the development of the cranium, maxilla or mandible, a previous dental history with signs or symptoms of temporomandibular joint dysfunction, fractures to nose, orbit, maxilla and or mandible. Any radiograph with artifacts preventing adequate landmark identification, poor resolution, and inadequate articulation of teeth were also excluded.

Table 3.1

Sample Distribution of Each Age Group According to Gender and Chronological Age

Gender	Age	Mean Age with St. Deviation	Sample Number	Total Sample
Female	6.5-8.5	7.65 +/-0.6669	13	20
Male		7.85 +/-0.5045	7	
Female	8.6-10.5	9.80+/-0.5438	36	61
Male		9.56+/-0.4641	25	
Female	10.6-12.5	11.62+/-.0567	59	105
Male		11.49+/-0.5432	46	
Female	12.6-14.5	13.48+/-0.5667	36	60
Male		13.30+/-0.5194	24	
Female	14.6-17.9	15.94+/-0.8284	41	57
Male		16.28+/-1.108	16	

Skeletal Landmarks and Digitization

Each lateral cephalometric radiograph (n=303) was calibrated to a ruler of 45mm to ensure accuracy of linear measurements. The 19 skeletal landmarks used in the 2010 Taiwanese study were used with 10 additional landmarks totaling 29 skeletal landmarks (Figure 3.1). These landmarks were identified and plotted on each radiograph and digitized by one observer using a customized analysis created in Dolphin Imaging 11.5 Software (Dolphin Imaging and Management Solutions a Patterson Technology, Chatsworth, Ca) as shown in Figure 3.1 and Appendix A. Sella to Nasion line and Porion to Orbitale line (Frankfort Horizontal) were chosen as the reference lines or planes. To validate consistency of observer, a technical error of measurement (TEM) test was conducted by digitizing 20 randomized lateral cephalograms. One week later the same 20 lateral cephalograms were traced for a second time. The data from tracing 1 and 2 for all lateral cephalograms were entered into the Dahlberg's technical error of measurement equation, which gives the root for the mean squared for each variable with zero denoting no technical inconsistencies exist (Harris and Smith, 2008). The results of each variable ($p </= .58$) are listed in Appendix C.

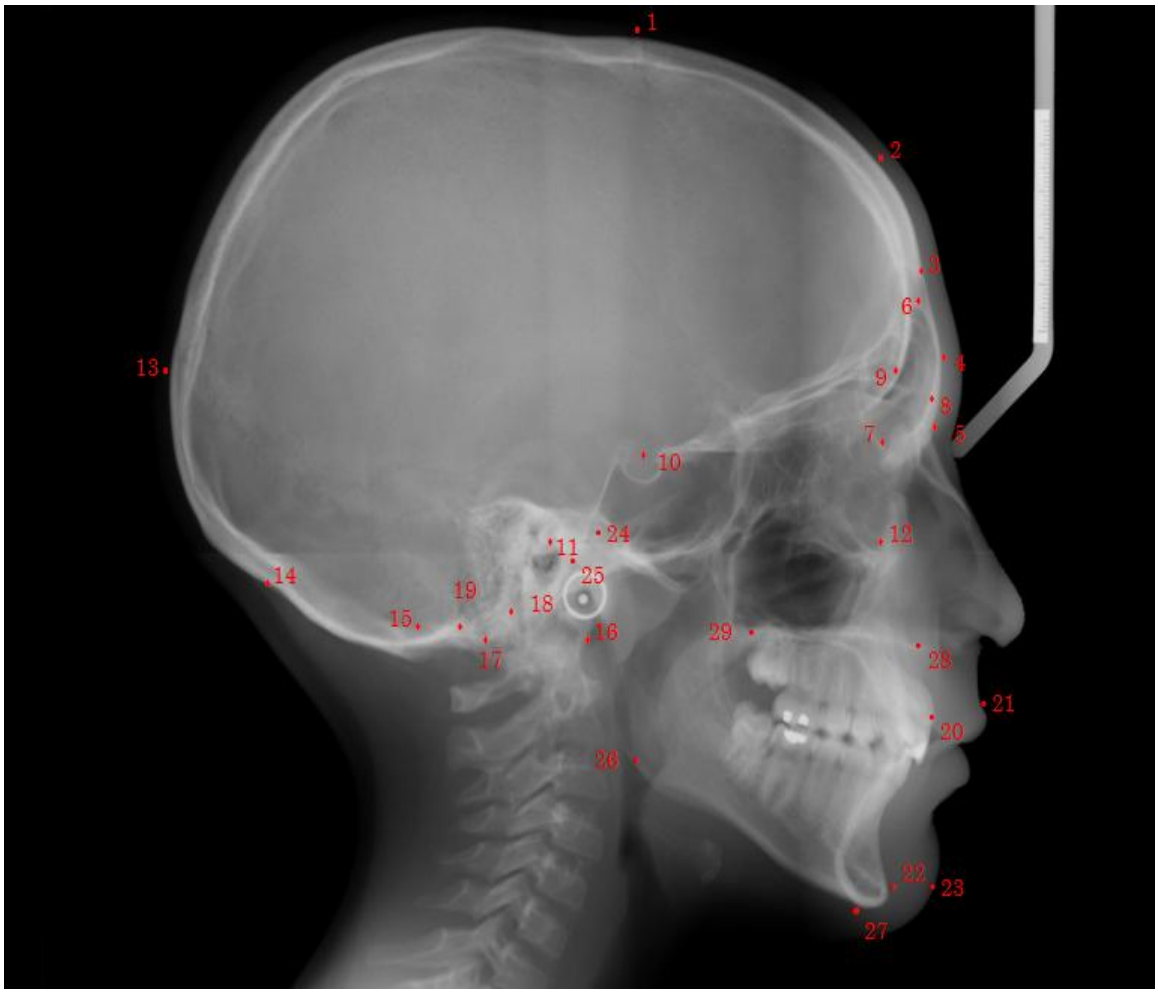

Figure 3.1. Cephalometric landmarks: 1.Bregma (B) 2.Metopion (M) 3. Supraglabellare (Sg) 4. Glabella (G) 5. Nasion (N) 6.V1 7.V2 8.H1 9.H2 10.Sella (S) 11.Orbitale (Or) 12.Porion (Po) 13.Opisthocranion (Op) 14.Inion (I) 15.Opisthion (O) 16.Basion (Ba) 17.Mastoidale (Ma) 18.B1 19.B2 20.Upper Incisor Facial (UIF) 21.Upper lip (UL) 22.Pogonion (Pog) 23. Pogonion Soft Tissue (PogSt) 24. Condylion (Co) 25. Articulare (Ar) 26. Gonion (Go) 27. Menton (Me) 28. Anterior Nasal Spine (ANS) 29. Posterior Nasal Spine (PNS)

Statistical Analysis

All linear and angular variables measurements(n=25) as shown in Appendix B from Dolphin Imaging 11 Software were transferred and organized according to age and gender with females being represented by the binary variables 1 and 0. (1 = Females, 0 = males). Statistical analysis was conducted using the Statistical Package for the Social Sciences (SPSS) version 17.0.

For the entire sample and each individual group, a Fischer's linear discriminant function analysis was used to discriminate and display which variables allow for the best classification between the groups. Wilks' Lambda analysis was used to identify the contribution of each variable and its significance in discriminating each group and the overall sample size. A canonical correlation analysis was then completed to determine the relationship among the variables and the discriminant function analysis. A test for normality was also conducted to determine which variables were normally distributed throughout the groups. The variables listed in Appendix B were then entered into a forward stepwise discriminant function analysis where at each step all variables contributing the most ($p<.05$) to discrimination are included in the model which yields the highest accuracy. A T-test was conducted to compare variables within the two genders groups. Analysis of variance (ANOVA) was also completed for each age group (Group 1: 6.4-8.5; Group 2: 8.6-10.5; Group 3: 10.6-12.5; Group 4: 12.6-14.5; Group 5: 14.6-17.9) to compare differences in variables across the age groups.

CHAPTER 4
RESULTS
Entire Sample

Each variable listed in Appendix B was tested for normality of data. All variables were within normal ($p>.05$) limits except GSgM, OIOp, MaFH, MaWd, UL and AfhPfh (Appendix D). All variables resulted in a 95% confidence interval with mean values falling between the upper and lower bounds (Appendix D). A T-test was completed evaluating differences in male and female with GSgN, FsWd, MaSN, UL, and GPI and ULTc variables significantly different across gender groups (Appendix D). The mean values for all linear measurements and GSgM were larger than female values, but mean female values for all angular measurements were smaller than female values (Appendix).

All variables listed in Appendix B were evaluated for tolerance, with IOpBaN failing the tolerance criteria and was excluded from the group function coefficient. All remaining variables (Table 4.1) were then computed using Fischer's discriminant function for a result of 74.6% of original group cases classified correctly with 89% females and 51.7% males correctly identified. The function coefficients of each variable (Appendix) were then used to create a discriminant function equation with males identified with a result (+/-) .687 and (+/-) -.438 for females (Table 4.2).

Wilks' Lambda analysis yielded a .768 with a significance of .000. The Wilks' Lambda displays each variables contribution based on a .000 to 1.000 scale, with 1.000 the least and .000 representing a highly influential variable contributing to discrimination. The significance of Lambda is also based on a scale from .000 to 1.000 with .000 demonstrating the highest significance of data. Therefore, the overall groups Wilks' Lambda (WL1) resulted in a low contribution but was statistically significant in discrimination of gender (Appendix D). A canonical correlation discriminant function (CAN1)displays the strength of correlation between the discriminant score and the set of

independent variables with minimum acceptable level of.05. Therefore the canonical correlation of the entire sample resulted in a .482 demonstrating a high correlation between the discriminant function and independent variables (Appendix D).

Table 4.1

Classification of Function Coefficients Separated by Gender for Fischer's Linear Discriminant Function Separated by Gender for the Entire Sample

(V)	(0)	(1)
GMSN	-.413	-.402
GMFH	3.927	3.716
GMBaN	1.893	2.086
GSgM	90.765	90.503
IOpSN	10.219	10.183
IOpFH	-11.977	-11.934
OIOp	2.752	2.779
SgGM	379.733	378.496
GSgN	-247.463	-246.102
FSHt	.163	.147
FsWd	-8.593	-8.620
IOpO	10.340	10.356
MaSN	-12.169	-12.250
MaFH	8.965	9.138
MaHt	-.429	-.530
MaWd	-1.841	-1.749
UL	-18.894	-18.646
Tc	14.500	14.162
Pfh	149.125	148.951
LAFH	-114.878	-114.764
GPI	61.712	61.138
ULTc	1.861	1.810
AfhPfh	53.310	53.260

Note. Variable (V), Male (0), Female (1)

Table 4.2

Discriminant Function Equation for Entire Sample

-.166*GMSN +2.481* GMFH + -1.814 *GMBaN +1.416 *GSgM +.490*IOpSN+ -.604*IOpFH + -.427*OIOp + 1.602*SgGM + -1.216 *GSgN + .099*FSHt +.053 *FSWd + -.078 *IOpO + .293 *MaSN + -.404 *MaFH +172 *MaHt + -.226 *MaWd + -.469 *UL + .820 *Tc + .716 *PFH + -.545 *LAFH + 1.353*GPI + 1.281 *ULTc + .565 *AfhPfh

*Male value resulted in .697 Female value will resulted in -.438

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A Stepwise discriminant function was performed to determine the most significant variables contributing to discrimination of gender. This test for equality (Table 4.3) resulted in Tc, GPI and ULTc being the most significant ($p<.05$). A Wilks Lambda (WL2) resulted in .855 with a significance of .000 (Appendix D), showing a low but statistically significant contribution to determination of gender. A canonical discriminant function (CAN2) resulted in .381, demonstrating a high correlation between the discriminant function and these variables (Appendix D). The Stepwise discriminant function analysis (Table 4.4) resulted in a 68% of original group cases classified correctly with 87% female and 38% male identified correctly (Appendix D).

Table 4.3

Test for Equality of Entire Group Means

(V)	(WL1)	(S)
GMSN	.998	.437
GMFH	1.000	.889
GMBaN	1.000	.793
GSgM	.991	.091
IOpSN	.996	.270
IOpFH	.995	.222
OIOp	.993	.141
IOpBaN	.992	.126
SgGM	.999	.539
GSgN	.966	.001
FSHt	.989	.067
FsWd	.986	.040
IOpO	.997	.352
MaSN	.979	.012
MaFH	1.000	.860
MaHt	.998	.488
MaWd	.997	.383
UL	.951	.000
Tc	.993	.157
Pfh	.993	.150
LAFH	.992	.112
GPI	.944	.000
ULTc	.913	.000
AfhPfh	1.000	.878

Note. Variable (V) Wilks' Lambda(WL1), Significance(S)

**p<.05.*

Table 4.4

Classification of Function Coefficients Separated by Gender for Stepwise Discriminant Function for Entire Sample

(V)	(0)	(1)
Tc	4.993	4.829
GPI	.439	.283
ULTc	.485	.452

Note. Variable (V) Male (0) Female (1)

**p<.05.*

Age 6.5-8.5

All variables listed in Appendix B were analyzed for tolerance with IOpFH, IOpBaN, Tc, GPI, and ULTc failed the tolerance criteria and was excluded from the group function coefficient (Appendix E). All remaining variables were computed to an overall Wilks' Lambda (WL1) of .068 with significance of .148, contributing to a high discrimination of gender with statistical significance (Appendix E). A canonical discriminant function (CAN1) resulted in .965 demonstrating a high correlation between the discriminant function and independent variables (Appendix E). Function coefficients for each variable (Table 4.5) were then computed using Fischer's discriminant function for a result of 100% of original group cases classified correctly (Appendix E).

Table 4.5

Classification of Function Coefficients for Fischer's Linear Discriminant Function Separated by Gender for Age 6.5-8.5

(V)	(0)	(1)
GMSN	310.367	295.199
GMFH	-1394.443	-1372.502
GMBaN	2260.996	2240.515
GSgM	979.535	971.004
IOpSN	-18.507	-17.318
OIOp	1194.046	1180.391
SgGM	4364.703	4314.029
GSgN	-6643.820	-6570.485
FSHt	-267.131	-265.313
FsWd	-888.375	-872.497
IOpO	2524.334	2495.662
MaSN	-158.908	-151.732
MaFH	-452.589	-453.674
MaHt	-.3158.822	-.3122.257
MaWd	-462.308	-457.545
UL	-829.870	-819.310
Pfh	110.813	109.289
LAFH	288.180	283.560

Note. Variable (V) Male (0) Female (1)

A Stepwise discriminant function was performed to determine the most significant variables contributing to the discrimination of gender. This test for equality (Table 4.6) resulted in GMFH and IOpFH being the most significant variables ($p<.05$). A Wilks' Lambda (WL2) analysis resulted in .434 with a significance of .001(Appendix E), demonstrating an average statistically significant contribution to discrimination of gender. A canonical discriminant function (CAN2) resulted in .752, demonstrating a high correlation between the discriminant function and independent variables (Appendix E). The Stepwise discriminant function analysis (Table 4.7) resulted in a 90% of original group cases classified correctly (Appendix E).

Table 4.6

Test for Equality of Group Means for Age 6.5-8.5

(V)	(WL1)	(S)
GMSN	.714	.015
GMFH	.569	.002
GMBaN	.723	.017
GSgM	.947	.328
IOpSN	.953	.359
IOpFH	.911	.202
OIOp	.901	.178
IOpBaN	.960	.401
SgGM	.845	.086
GSgN	.752	.025
FSHt	.969	.457
FsWd	1.000	.988
IOpO	.954	.366
MaSN	.998	.849
MaFH	.997	.823
MaHt	.873	.124
MaWd	.966	.436
UL	.949	.339
Tc	.992	.705
Pfh	.889	.152
LAFH	.988	.643
GPI	.745	.023
ULTc	.876	.128
AfhPfh	.900	.175

Note. Variable(V) Wilks' Lambda (WL1) Significance (S)
**p(<.05)*

Table 4.7

Classification of Function Coefficients for Stepwise Discriminant Function Separated by Gender for Age 6.5-8.5

(V)	(0)	(1)
GMFH	11.378	10.712
IOpFH	2.761	2.604

Note. Variable (V) Male (0) Female (1)

Age 8.6-10.5

All variables listed in Appendix B were analyzed for tolerance with IOpBaN, MaFH, Pfh, ULTc, LAFH and AfhPfh failing the tolerance test and was excluded from the group coefficient (Appendix F). All remaining variables were computed to an overall Wilks' Lambda (WL1) of .540 with a significance of .035, an average statistically significant contribution to the discrimination of gender (Appendix F). A canonical discriminant function (CAN1) resulted in .678, a high correlation of discriminant function and independent variables (Appendix F). Function coefficients for each variable (Table 4.8) were computed using Fischer's discriminant function for a result of 83.3% of original group cases classified correctly (Appendix F).

Table 4.8

Classification of Function Coefficients for Fischer's Linear Discriminant Function Separated by Gender for Age 8.6-10.5

(V)	(0)	(1)
GMSN	.082	.103
GMFH	-16.806	-17.810
GMBaN	15.468	16.206
GSgM	89.039	88.864
IOpSN	-31.934	-32.849
IOpFH	31.808	32.801
OIOp	7.016	7.245
SgGM	384.360	382.903
GSgN	-234.908	-231.953
FSHt	8.916	8.966
FsWd	-29.457	-28.801
IOpO	11.646	11.754
MaSN	11.707	12.182
MaHt	-4.632	-5.346
MaWd	.137	.278
UL	-3.201	-3.709
Tc	-9.689	-9.652
GPI	57.736	56.895

Note. Variable (V) Male (0) Female (1)

A Stepwise discriminant function was performed to determine the most significant variables contributing to the discrimination of gender. This test for equality (Table 4.9) resulted in ULTc being the most significant variable ($p<.05$). A Wilks' Lambda (WL2) resulted in .911 with a significance of .020, demonstrating a low but statistically significant contribution to the discrimination of gender (Appendix F). ULTc variable was used in a Canonical discriminant function (CAN2) resulting in .299, displaying a high correlation between discriminant function and the independent variable (Appendix F). The Stepwise discriminant function analysis (Table 4.10) resulted in a 66.7% of original group cases classified correctly (Appendix F).

Table 4.9

Test for Equality of Group Means for Age 8.6-10.5

(V)	(WL1)	(S)
GMSN	.964	.147
GMFH	.988	.406
GMBaN	.986	.376
GSgM	.992	.493
IOpSN	.958	.118
IOpFH	.960	.127
IOpBaN	.948	.080
OIOp	.960	.123
GMSN	.964	.358
GMFH	.988	.935
SgGM	.985	.544
GSgN	1.000	.510
FSHt	.994	.210
FSWd	.992	.863
IOpO	.973	.536
MaSN	.999	.626
MaFH	.993	.174
MaHt	.996	.057
MaWd	.968	.695
Upperlipthickness	.939	.164
ChinThickness	.997	.113
PosteriorFacialHeight	.967	.484
LAFH	.957	.020

Notes. Variable(V) Wilks' Lambda (WL1) Significance (S)

**p(<.05)*

Table 4.10

Classification of Function Coefficients for Stepwise Discriminant Function Separated by Gender for Age 8.6-10.5

(V)	(0)	(1)
ULTc	.147	.125

Notes. Variable (V) Male (0) Female (1)

Age 10.6-12.5

IOpBaN and IOpFH failed the tolerance test and therefore were excluded from the group function coefficients (Appendix G). All remaining variables listed in Appendix B were computed to an overall Wilks' Lambda (WL1) of .747 with a significance of .205, a low but statistically significant contribution to the discrimination of gender (Appendix G). A canonical discriminant function (CAN1) resulted in .503, displaying a high correlation between discriminant function and independent variables (Appendix G). Function coefficients for each variable (Table 4.11) were then computed using Fischer's discriminant function for a result of 71.7% of original group cases classified correctly (Appendix G).

Table 4.11

Classification of Function Coefficients for Fischer's Linear Discriminant Function Separated by Gender for Age 10.6-12.5

(V)	(0)	(1)
GMSN	55.193	55.163
GMFH	-28.628	-28.478
GMBaN	-12.829	-12.930
GSgM	109.984	109.629
IOpSN	-3.233	-3.212
OIOp	16.203	16.294
SgGM	438.168	436.807
GSgN	-267.043	-266.311
FSHt	-7.202	-7.185
FsWd	-3.086	-3.224
IOpO	28.156	28.274
MaSN	-38.347	-38.434
MaFH	33.637	33.666
MaHt	10.576	10.439
MaWd	-19.314	-19.044
UL	-62.115	-61.631
Tc	54.339	53.763
Pfh	285.066	284.740
LAFH	-198.743	-198.560
GPI	50.684	50.515
ULTc	5.955	5.879
AfhPfh	94.079	93.967

Notes. Variable (V) Male (0) Female (1)

A Stepwise discriminant function was performed to determine the most significant variables contributing to the discrimination of gender. This test for equality (Table 4.12) resulted in ULTc being the most significant variable ($p>.05$). A Wilks' Lambda (WL2) resulted in .947 with a significance of .018, demonstrating a low but statistically significant contribution to the discrimination of gender (Appendix G). ULTc variable was used in a Canonical discriminant function (CAN2) resulting in .229, displaying a strong correlation between discriminant function and the independent variable (Appendix G). The Stepwise discriminant function analysis (Table 4.13) resulted in a 58.5% of original group cases classified correctly (Appendix G).

Table 4.12

Test for Equality of Group Means for Age 10.6-12.5

(V)	(WL1)	(S)
GMSN	1.000	.962
GMFH	.997	.592
GMBaN	.998	.658
GSgM	.987	.244
IOpSN	.983	.178
IOpFH	.975	.104
IOpBaN	.977	.121
OIOp	.980	.146
SgGM	.990	.316
GSgN	1.000	.944
FSHt	.991	.328
FsWd	.985	.206
IOpO	.981	.158
MaSN	.973	.090
MaFH	1.000	.839
MaHt	.984	.199
MaWd	.960	.041
UL	.986	.224
Tc	.993	.382
Pfh	.980	.144
LAFH	.999	.808
GPI	.996	.508
ULTc	.947	.018
AfhPfh	.978	.127

Notes. Variable (V) Wilks' Lambda 1(WL1) Significance(S)

**p<,05*

Table 4.13

Classification of Function Coefficients for Stepwise Discriminant Function Separated by Gender for Age 10.6-12.5

(V)	(0)	(1)
ULTc	.149	.133

Notes. Variable (V) Male (0) Female (1)

Age 12.6-14.5

IOpBaN and IOpFH failed the tolerance test and therefore were excluded from the group function coefficient (Appendix H). All remaining variables listed in Appendix B were computed to an overall Wilks' Lambda (WL1) of .568 with a significance of .228, an average statistically significant contribution to the discrimination of gender (Appendix H). A canonical discriminant function (CAN1) resulted in .657, displaying a high correlation between the discriminant function and independent variables (Appendix H). Function coefficients for each variable (Table 4.14) were then computed using Fischer's discriminant function for a result of 78.3% of original group cases classified correctly (Appendix H).

Table 4.14

Classification of Function Coefficients for Fischer's Linear Discriminant Function Separated by Gender for Age 12.6-14.5

(V)	(0)	(1)
GMSN	16.096	16.390
GMFH	-5.172	-5.281
GMBaN	2.963	2.827
GSgM	137.189	136.729
IOpSN	2.144	2.163
OIOp	43.161	43.087
SgGM	641.369	637.977
GSgN	-643.697	-639.448
FSHt	10.950	10.917
FsWd	1.094	1.175
IOpO	88.185	88.072
MaSN	-16.296	-16.520
MaFH	11.591	11.804
MaHt	25.272	25.367
MaWd	-3.310	-3.147
UL	-30.991	-29.933
Tc	67.387	65.910
Pfh	201.236	202.087
LAFH	-162.883	-163.665
GPI	156.923	155.073
ULTc	6.746	6.576
AfhPfh	70.069	70.424

Notes. Variable (V) Male (0) Female (1)

A Stepwise discriminant function was performed to determine the most significant variables contributing to the discrimination of gender. This test for equality (Table 4.15) resulted in GPI being the most significant variable ($p<.05$). A Wilks' Lambda (WL2) resulted in .896 with a significance of .005, demonstrating a low but statistically significant contribution to the discrimination of gender (Appendix). GPI variable was used in a Canonical discriminant function (CAN2) with a correlation of .362, displaying a high correlation between discriminate function and the independent variable (Appendix H). The Stepwise discriminant function analysis (Table 4.16) resulted in a 65.0% of original group cases classified correctly (Appendix H).

Table 4.15

Test for Equality of Group Means for Age 12.6-14.5

(V)	(WL)	(S)
GMSN	.975	.226
GMFH	.957	.114
GMBaN	.981	.296
GSgM	.994	.550
IOpSN	.999	.826
IOpFH	1.000	.906
IOpBaN	.998	.716
OIOp	.999	.793
SgGM	.999	.806
GSgN	.899	.013
FSHt	.992	.500
FsWd	.996	.648
IOpO	1.000	.930
MaSN	.985	.347
MaFH	.998	.740
MaHt	.999	.774
MaWd	.996	.637
UL	.936	.050
Tc	.995	. 598
Pfh	.959	.121
LAFH	.975	.223
GPI	.869	.005
ULTc	.929	.040
AfhPfh	.996	.647

Notes. Variable (V) Wilks' Lambda 1(WL1) Significance(S)

**p<.05*

Table 4.16

Classification of Function Coefficients for Stepwise Discriminant Function Separated by Gender for Age 12.6-14.5

(V)	(0)	(1)
GPI	1.231	.937

Notes. Variable (V) Male (0) Female (1)

Age 14.6-17.9

IOpBaN and IOpFH failed the tolerance test and therefore were excluded from the group function coefficient (Appendix I). All remaining variables were listed in Appendix B were computed to an overall Wilks' Lambda (WL1) of .278 with a significance of .000, demonstrating above average statistically significant contribution to the discrimination of gender (Appendix I). A canonical discriminant function resulted (CAN1) in .849, displaying a high correlation between the discriminate function and independent variables (Appendix I). Function coefficients for each variable (Table 4.18) were computed using Fischer's discriminant function for a result of 94.7% of original group cases classified correctly (Appendix I).

Table 4.17

Classification of Function Coefficients for Fischer's Linear Discriminant Function Separated by Gender for Age 14.6-17.9

(V)	(0)	(1)
GMSN	277.284	278.835
GMFH	-86.384	-87.612
GMBaN	-126.421	-126.601
GSgM	238.950	238.186
IOpSN	-6.055	-6.380
OIOp	50.035	50.540
SgGM	965.618	962.426
GSgN	-507.961	-510.666
FSHt	-5.319	-5.594
FsWd	-88.134	-88.368
IOpO	102.784	103.175
MaSN	-149.761	-150.653
MaFH	68.011	68.486
MaHt	110.729	111.143
MaWd	-28.270	-28.035
UL	-151.350	-150.516
Tc	109.995	109.843
Pfh	173.341	170.979
LAFH	-132.674	-130.713
GPI	161.027	160.665
ULTc	12.162	12.077
AfhPfh	67.497	66.721

Notes. Variable (V) Male (0) Female (1)

A Stepwise discriminant function was performed to determine the most significant variables contributing to the discrimination of gender. This test for equality (Table 4.19) resulted in GSgN, ULTc, and FSHt being the most significant variables ($p>.05$). A Wilks' Lambda (WL2) resulted in .458 with a significance of .000, demonstrating an average statistically significant contribution to the discrimination of gender discrimination of gender (Appendix I). This variable was used in a Canonical discriminant function (CAN2) with a correlation of .736, displaying a high correlation between discriminate function and the independent variable (Appendix I). The Stepwise discriminant function analysis (Table 4.20) resulted in 86.0% of original group cases classified correctly (Appendix I).

Table 4.18

Test for Equality of Group Means for Age 14.6-17.9

(V)	(WL1)	(S)
GMSN	.871	.006
GMFH	.901	.017
GMBaN	.944	.076
GSgM	.813	.001
IOpSN	.940	.065
IOpFH	.950	.093
IOpBaN	.963	.153
OIOp	1.000	.874
SgGM	.907	.021
GSgN	.693	.000
FSHt	.941	.069
FsWd	.830	.001
IOpO	.997	.685
MaSN	.885	.010
MaFH	.931	.049
MaHt	.973	.222
MaWd	.858	.004
UL	.919	.032
Tc	.987	.407
Pfh	.822	.001
LAFH	.972	.212
GPI	.702	.000
ULTc	.861	.004
AfhPfh	.968	.180

Notes. Variable (V) Wilks' Lambda 1(WL1) Significance (S)

Table 4.19

Classification of Function Coefficients for Stepwise Discriminant Function Separated by Gender for Age 14.6-17.9

(V)	(0)	(1)
GSgN	5.182	3.384
FSHt	.938	.756
ULTc	.261	.211

Notes. Variable (V), Male (0), Female (1)

CHAPTER 5
DISCUSSION
Entire Sample

Determination of gender is the first step in identification of unknown skeleton remains. Numerous studies have been conducted to determine gender using adult skeletal remains, but few studies have examined children. Previous researchers believed sexual dimorphism does not exist in the skeleton until secondary sexual characteristics develop during puberty. The size and shape of the mandible, pogonion, glabella and supraorbital region made identifying male and female skeletal remains easier. Within recent years, researchers have found sexual dimorphism does exist in the shape of the craniofacial complex in the preadolescent. The results of this study support previous theories of sexual dimorphism of the human craniofacial skeleton in preadolescence. The discriminant function analysis resulted in a 74.6% discrimination of gender with 89% females and 51.7% males correctly identified. The overall accuracy of 74.6% is relatively lower than previous lateral cephalometric studies, most likely due to our preadolescent sample. Although, sexually dimorphic characteristics are not as apparent in the skeleton until after the onset of puberty, this study demonstrates that sexual dimorphism can be identified with statistical significance in the preadolescent.

In this study, the females were identified at a higher percentage (89%) than the males (51.7%). Males were identified at a lower percentage due to the lack of identifiable sexual characteristics in the craniofacial skeleton of a preadolescent male. The sample size of males (n=118) was also smaller than the females (n=185), with the age groups having the most variation in sample size among females who have completed puberty. A female craniofacial skeleton after puberty can be identified easier due to the development of secondary sexual characteristics such as smaller skeletons and less pronounced glabella, pogonion, mastoid process and supraorbital ridges. Therefore a larger sample

size with an increase in identifiable sexual characteristics will yield a larger percentage of sexual dimorphism.

The variables contributing the most ($p<.05$) to the discriminant function result of 74.6% were GSgN, FSWd, MaSN, UL, GPI and ULTc. The variables contributing the most ($p<.05$) to the stepwise discriminant function analysis for the overall sample size was Tc, GPI and ULTc (Table 5.1). GPI was found in a previous study to classify sexes accurately at a range of 92-95% (Hsiao et.al, 2010). The additional variables TC and ULTc in this study demonstrated a statistically significance ($p<.05$) and thus could be used to identify gender. The variables contributing the least ($p<.50$) to the discrimination of gender were GMFH, GMBaN, SgGM, MaFH and AfhPfh. In this study, GMBaN ($p=.793$) was found to contribute the least to gender of the overall sample size which contradicted the results found in a previous study where GMBaN alone classified 73% of sexes correctly (Hsiao et.al, 2010). This finding could be due to preadolescent sample lack of development of the secondary sexual skeletal characteristics such as prominent glabella, nasion and basion that is found in a post-adolescent.

Males vs. Females

A t-test was completed for the 25 variables (Appendix B) comparing the averages and standard deviations for male and females (Appendix D). The variables GSgN, FsWd, MaSN, UL, GPI and ULTc were significantly different across gender groups ($p<.05$) (Appendix D). An oneway Analysis of Variance (ANOVA) was completed comparing the 25 variables (Appendix B) within each age group. The oneway ANOVA resulted in GMSN, GMBaN, GSgM, SgGM, GSgN, FSHt, FSWd, MaFH, MaHt, MaWd, UL, Tc, and GPI variables demonstrating statistical differences across all age groups($p<.05$) (Appendix D). The results of t-test and one way ANOVA in this study support previous research suggestions of glabella, frontal sinus, mastoid process and pogonion can be used to identify gender.

The additional variables (Appendix B) used in the study were found to be statistically significant in identifying gender especially in the 8.6-10.5 and 10.6-12.5 age groups. A difference in male and female AfhPfh variable was observed, but was not as significant ($p>.05$) in determining gender in the individual age groups. AfhPfh has many contributing factors to its overall measurement. The direction of growth can affect these measurements. The direction of growth in an anterior-posterior direction will more than likely have a more uniform anterior and posterior facial height. A growth pattern in a vertical direction will rotate the mandible in a downward and backward position, creating a longer anterior face height while decreasing the posterior face height.

The mean values (Appendix D) for all linear measurements and GSgM were larger than female values, but mean male values for all angular measurements were smaller than female values which was also found in the 2010 Lateral Cephalometric study (Hsiao et.al, 2010). Our findings also generally show that males tend to have a larger glabella, frontal sinus, posterior cranium, mastoid length and height, longer

posterior and anterior facial heights. Upper lip thickness was also greater in males than females, which supports the theory of greater increases proportionally and absolutely from age 8 to 16 (Mamandras, 1988). Females displayed larger pogonion to soft tissue pogonion measurements (Tc). This may be due to females tending to express 75% of their total chin projection by age 7, while males tend to express 50 % of their total chin projection by age 7 (Subtelny, 1959).

Age 6.5-8.5

The discriminant function analysis conducted within the 6.5-8.5 age groups yielded a 100% discrimination of gender (Table 5.1), thus further supporting previous theories of sexual dimorphism of the human craniofacial skeleton in preadolescence does exist. As craniofacial growth nears completion around age 6, male and female sexual dimorphism already exists at that early age (Gonzalez, 2010). Craniofacial growth before the age of 6 is a reflection of growth within the brain, with the craniofacial complex being displaced downward and forward as the brain is growing in length and width reaching 95% of its adult length by age 6 (Enlow, 1990).

The variables contributing the most ($p<.05$) to the discriminant function result of 100% were GMSN, GMFH, GMBaN, GSgN and GPI(Appendix E). The variables contributing the most ($p>.05$) to the stepwise discriminant function analysis in the 6.5-8.5 age group (Table 5.2) was the GMFH and IOpFH. The aforementioned variables demonstrate glabella and inion could be used as key landmark in identification of gender due to its prominence as a results of displacement in this age group. Glabella is the most anterior point on the frontal bone and inion is the most prominent point on the occipital bone tends be more pronounced in males. The stepwise discriminant function analysis yielded at 90% accuracy demonstrating sexual dimorphic differences are present in the neurocranium and may be used to identify gender (Gonzalez 2010).

The variables contributing the least ($p<.50$) to the discrimination of gender were FSWd, MaSN, MaFH and Tc (Appendix E). As previously discussed, This may be due to females tending to express 75% their total chin projection by age 7,while males tend to express 50% their total chin projection by age 7(Subtelny, J. D., 1959) (Appendix). In this study, the mastoid process in the female was slightly larger than males (Appendix E) but

not a significant size difference to distinguish male from females. The mastoid air cell system is most often larger in females until puberty (Cinamon 2009).

Age 8.6-10.5

The discriminant function analysis conducted within the 8.6-10.5 age groups yielded an 83.3% discrimination of gender (Table 5.1). In this age group, the average female is beginning puberty while males are still in preadolescent growth. Increase in physical stature, broadening of hips, and growth within the craniofacial complex such as glabella, inion, mastoid process and frontal sinus is observed. A female entering puberty within the craniofacial complex may resemble a preadolescent male. This was found in this study when comparing variables contributing the most ($p<.05$) to discrimination of gender in the 8.6-10.5 age group. ULTc was the most significant variable in the discriminant function analysis (p=83.3%; Table 5.1) and stepwise discriminant function analysis (p=66.7%; Table 5.2). The most change to upper lip thickness of a female starts at age 10 while males have a steady change (Mamandras ,1988), thus could be used as key identifier to some degree of gender in this age group. The remaining variables were not as significant ($p<.05$) but was still needed to identify gender to a higher accuracy in this age group (Appendix F). The variables contributing the least ($p<.50$) to the discrimination of gender were FSHt, FSWd, MaSN, MaFH, MaHt, Tc and AfhPfh (Appendix F).

Age 10.6-12.5

The discriminant function analysis conducted within the 10.6-12.5 age groups yielded a 71.7% discrimination of gender (Table 5.1). In this age group as was first observed in the 8.6-10.5 age group, most females are developing secondary sexual skeletal characteristics which resembles a preadolescent male. The variables contributing the least ($p<.50$) to the discrimination of gender were GMSN, GMFH, GMBaN, GSgN, MaFH, LAFH, and GPI (Appendix G)which are landmarks known to differentiate between the sexes. Male linear measurements were larger than females in 8.6-10.5 and 10.6-12.5 age groups, but not a substantial difference to differentiate between the sexes in this study (Appendix G). This close proximity in growth is due to preadolescent males' steady and consistent increase as females are growing rapidly in puberty. This finding supports the theory of a small male and a pubertal female has similar sexual characteristics until the onset of puberty for males. The variables contributing the most ($p<.05$) to the discriminant function analysis and stepwise discriminant function analysis ($p=58.5\%$; Table 23) was ULTc (Appendix G). The remaining variables were not as significant ($p<.05$) but was still needed to identify gender to a higher accuracy in this age group (Appendix G).

Age 12.6-14.5

The discriminant function analysis conducted within the 12.6-14.5 age groups yielded a 78.3% discrimination of gender (Table 5.1). At or around the age of 12, most females are ending puberty with the onset of menarche. Skeletal sexual characteristics such as broader hips, less muscular markings with smooth and small skeletons are identified. A male before puberty, can have some of these same characteristics. Males tend to enter puberty 3-5 years after females, therefore in this age group, as previously mentioned, male linear measurements were larger than females, but not a substantial difference to differentiate between the sexes in this study (Appendix H). This study when comparing variables contributing the most ($p<.05$) to discrimination of gender with GPI being the most significant variable in the discriminant function analysis (p=83.3%; Table 5.1) and stepwise discriminant function analysis (p=65%; Table 5.2). GPI alone was not significant enough to differentiate between the sexes in this study, the remaining variables combined was needed to increase the identification of gender. The variables contributing the least ($p<.50$) to the discrimination of gender were IOpSN, IOpFH, IOpBaN, OIOp, SgGM, FSHt, FSWd, IOpO, MaFH, MaHt, MaWd, Tc and AfhPfh (Appendix H).

Age 14.6-17.9

The discriminant function analysis conducted within the 14.6-17.9 age groups yielded a 94.7% discrimination of gender (Table 5.1). Females are expressing all of their secondary sexual characteristics and males are now entering puberty. Increase in height, muscle mass, muscular markings, and prominence of supraorbital ridges, glabella, frontal sinus and mastoid process is observed. These skeletal sexual characteristics make identification of gender easier. The variables contributing the most ($p>.05$) to discrimination of gender were FSHt, GSgN, ULTc (Appendix I). The stepwise discriminant functional yielded an 86% identification of gender (Table 5.2). In this age group, almost all variables were statically significant ($p<.05$) with OIOp contributing the least ($p<.50$) to the discrimination of gender (Appendix I).

Wilks' Lambda, Canonical Correlation and Stepwise Discriminant Function Analyses

A Wilks' Lambda analysis was used to display each variables contribution based on a .000 to 1.000 scale, with 1.000 the least and .000 representing a highly influential variable contributing to discrimination ($p<.05$). The significance of Lambda is also based on a scale from .000 to 1.000 with .000 demonstrating the highest significance of data($p<.05$). A canonical correlation discriminant function analysis was also used to display the strength of correlation between the discriminant score and the set of independent variables with minimum acceptable level of.05($p\geq05$).

In this study, the Wilks' Lambda statistical analysis yielded a .768 with a high significance of .000 for the entire sample size. The Wilks' Lambda analysis was very significant($p=.000$) in the results that were obtained but together was not as influential in discrimination of gender, possibly due to the variation between the 10-14.5 male and female age groups. Usually girls enter puberty around 10 years old, 2 years before males. The secondary characteristics females develop very similarly to males before their onset of puberty, making sexual dimorphism difficult to distinguish in this age group. By age 12.5 females have generally completed puberty. Consequently increases in Wilks' Lambda, Canonical and Discriminant Function analyses are noted (Table 5.1 and 5.2). At around age 14.5 males enter puberty, and the secondary characteristics again make it easier to accurately identify gender.

In Table 5.1 and 5.2, a comparison between all age groups demonstrates how the onset of puberty affects discrimination of gender with increases in Wilks' Lambda, Canonical and Discriminant Function were found (Table 5.1 and 5.2). At or around age 14.5 males enter puberty, and these secondary characteristics again make it easier to

accurately identify gender. In Table 5.1 5.2, a comparison between all age groups demonstrates how the onset of puberty affects discrimination

The forward stepwise discriminant function analysis for the overall sample and individual age groups yielded different variables contributing the most to discrimination ($p<.05$). Table 5.2 demonstrates the variables that represented the most significance ($p<.05$) in discrimination of gender of each age group. These variables were entered into the Stepwise Discriminate Function to yield the accuracies seen in Table 23. These variables were significant to some degree in indentifying gender as represented by Wilks' Lambda (WL2) and Canonical Discriminate Function (CAN2), but the entire variable sample combined was needed to identify gender above 70% except the 6.5-8.5 and 14.6-17.9 age groups. The 14.6-17.9 age groups resulted in 86% accuracy as females are ending peak pubertal growth and males were entering puberty of gender.

Table 5.1

Discriminant Function Comparison of all Groups

AGE	(WL1)	(S)	(CAN1)	(DF1)
6.5-8.5	.068	.148	.965	100%
8.6-10.5	.540	.035	.678	83.3%
10.6-12.5	.747	.205	.503	71.7%
12.6-14.5	.568	.228	.657	78.3%
14.6-17.9	.278	.000	.849	94.7%
Entire Sample	.768	.000	.482	74.6%

Notes. Wilks Lambda 1(WL1), Significance (S), Canonical Correlation 1(CAN1), Discriminant Function1(DF1)

**p<.05*

Table 5.2

Stepwise Discriminant Function Comparison of all Groups

AGE	WL2	V	CAN2	SDF
6.5-8.5	.434	GMFH IOpFH	.752	90%
8.6-10.5	.911	ULTc	.299	66.7%
10.6-12.5	.947	ULTc	.229	58.50%
12.6-14.5	.896	GPI	.362	65%
14.6-17.9	.458	GSgN ULTc FSHt	.736	86%
Entire Sample	.855	Tc GPI ULTc	.381	68%

Notes. Wilks' Lambda 2(WL2), Variables(V) Canonical Correlation 2(CAN2) Stepwise Discriminant Function(SDF)

**p<.05*

Limitations and Future Research

The onset of puberty can vary depending on developmental maturity. On average, a female enters puberty around age 10 but can be as early as 8 years old in some instances. To accurately identify stage of development, a diagnosis of skeletal age was needed. This study evaluated expression of secondary sexual skeletal characteristics based on chronological age without identifying skeletal age as was done in previous studies (Hsiao et.al, 2010). The results of this study can be deficient or enhanced based on development of secondary sexual skeletal characteristics. Further research to correlate chronological age, skeletal age and sexual skeletal characteristics within these age groups can aid in the identification of gender.

Overall sample size (n=303) was large enough to represent an entire population (Table 3.1). The 6.5-8.5 age groups (n=20) had an insufficient sample size compared to the other age groups($n \geq 55$) due to lack of available data. Further studies with a larger sample size will enhance results within this age group. Prior studies sample size (n=100) varied with a wide range of ages from 12-17 years old. This study was able to isolate landmarks that aided in identification of gender. Future studies using the same age groups or with one year duration instead of two and a half years with at least 100 samples could yield more sexual skeletal characteristics that will aid in gender identification.

The characteristics that aid in identifying male and female skeletons such as mastoid process, inion, glabella and frontal sinus may not be visualized accurately using lateral cephalograms. Lateral cephalometric radiographs are two dimensional representations of a structure in three planes of space; sagittal, axial, and vertical. Lateral cephalograms are taken in the natural head position with Frankfort Horizontal (Porion to Orbitale) parallel to the floor. Ear rods and nasal postioners are used to maintain this position, however, if the head is positioned incorrectly within the sagittal, axial, or

vertically, cephalometric linear and angular measurements will vary depending on the central ray's penetration to the head (Malkoc, Sari, Usumex, & Koyuturk, 2005). As with any radiograph, a possibility of distortion due to patient positioning must be taken into account for variability in linear and angular measurements (Appendix D).

Bilateral structures can cause difficulty in landmark identification. Typically, the structures closer to the film will appear smaller. To increase reliability of tracings and accuracy of measurements, the same side (left or right) should be traced on all films. The bilateral structures used in this study were the mastoid process, temporomandibular joint, porion, and frontal sinus. The same magnified side (left) was traced, but distortion was noted with contrast of radiograph being more radiopaque in the area of the TMJ-mastoid area and superimposition of structures creating a difficulty in proper identification of landmarks on some radiographs. Within recent years, Cone Beam Computed Tomography (CBCT) has been introduced to dentistry. This 3-dimensional imaging technology eliminates anatomic superimposition and magnification problems, thus offering an opportunity to evaluate craniofacial structures from an unobstructed view (Papadopoulos et al., 2000). CBCT allows for structures to be analyzed in all three planes of space, decreasing tracing error of bilateral structures and increasing accuracy of measurements. CBCT can increase overall accuracy of hard and soft tissue structures, thus aiding in the development of normal values for each variable.

This study used Latino pre and post adolescence lateral radiographs, as previous studies analyzed lateral cephalograms of populations with Taiwanese and European descent. More research is needed within the Latino population to determine normal values of each variable. The trends noted from this study can be used for comparison in future studies within the Latino and other populations.

Conclusion

In conclusion, the results presented in this study demonstrate sexual dimorphism can be determined in pre and post adolescents using the discriminant function analysis. The accuracy of sexual dimorphism presented in this study coincides with the onset of puberty within each age group; with the trend of accuracy decreasing as females enter puberty and increase once again as males enter puberty. Further research in this area is needed to determine normal values in order to aid forensic investigations in identifying a deceased preadolescent.

APPENDIX A

Skeletal Landmarks with Abbreviations

Name	Abbreviation	Description
Bregma	*(B)*	Point at which sagittal and coronal sutures meet
Metopion	*(M)*	Point where the line that connects the highest points of the frontal eminences crosses the sagittal plane
Glabella	*(G)*	Glabella (G)most anterior point in the midsagittal plane between the superciliary arches
Supraglabellare	*(Sg)*	Most posterior midline point in the supraglabellar fossa, the concavity between glabella and metopion most posterior midline point in the supraglabellar fossa
Nasion	*(N)*	Most anterior point on the frontonasal suture in the midsagittal plane
V1	*V1*	Upper parameter of the frontal sinus cavity
V2	*V2*	Lower parameter of the frontal sinus cavity
H1	*H1*	Anterior parameter of the frontal sinus cavity on bregma to nasion line, the line from the inner location of bregma to nasion
H2	*H2*	Posterior parameter of the frontal sinus cavity on bregma to nasion line
Sella	*(S)*	Midpoint of sella turcica, hypophyseal fossa
Orbitale	*(Or)*	Lowest point on the lower margin of the bony orbit
Porion	*(Po)*	Top of the external auditory meatus
Opisthocranion	*(Op)*	Most prominent point of the occipital bone in the midline
Inion	*(I)*	Most prominent point of the external occipital Protuberance
Opisthion	*(O)*	Midpoint of the posterior border of the foramen magnum
Basion	*(Ba)*	Most inferior posterior point in the sagittal plane on the anterior rim of the foramen magnum
Mastoidale	*(Ma)*	Lowest point of the mastoid process
B1	*B1*	Anterior parameter of the mastoidale width at the level of cranial base
B2	*B2*	Posterior parameter of the mastoidale width at the level of cranial base
Upper lip	*(UL)*	Soft tissue of Upper Lip
Upper Incisor Facial	*(UIF)*	Most facial surface of Upper incisor
Pogonion	*(Pog)*	The most anterior point on the chin.
Pogonion Soft Tissue	*(PgSt)*	The most anterior point on the soft tissue chin.
Menton	*(Me)*	The lowest point on the symphyseal shadow of the mandible seen on a lateral cephalogram.
Gonion	*(Go)*	A point on the curvature of the angle of the mandible located by bisecting the angle formed by lines tangent to the posterior ramus and the inferior border of the mandible

Articulare	*(Ar)*	A point at the junction of the posterior border of the ramus and the inferior border of the posterior cranial base (occipital bone).
Condylion	*(Co)*	A point on the curvature of the angle of the mandible located by bisecting the angle formed by lines tangent to the posterior ramus and the inferior border of the mandible
Anterior Nasal Spine	*(ANS)*	The anterior tip of the sharp bony process of the maxilla at the lower margin of the anterior nasal opening.
Posterior Nasal Spine	*(PNS)*	The posterior spine of the palatine bone constituting the hard palate.

Appendix B

Angular and Linear Variables

Cephalometric Variables:
Angular Variables(º):
GMSN angle between the glabella to metopion line and the sella to nasion line
GMFH angle between the glabella to metopion line and the porion to orbitale line
GMBaN angle between the glabella to metopion line and the basion to nasion line
GSgM angle between the metopion to supraglabellare line and the supraglabellare to glabella line
IOpSN angle between inion to opisthocranion line and the SN line
IOpFH angle between inion to opisthocranion line and the FH line
IOpBaN angle between the inion to opisthocranion line and the BaN line
OIOp angle between the opisthrocranion to inion line and the inion to opisthion line
Linear Variables(mm):
SgGM distance between supraglabellare and the glabella to metopion line
GSgN distance between glabella and the supraglabellare to nasion line
FSHt frontal sinus height, vertical parameters of the frontal sinus cavity
FsWd frontal sinus width on bregma to nasion line
IOpO distance between inion and opisthocranion to opisthion line
MaSN distance between mastoidale and the SN line
MaFH distance between mastoidale and the FH line
MaHt mastoid height from cranial base
MaWd mastoid width at the level of cranial base
Proportional % :
GPI glabella projection index=distance between glabella and the supraglabellare to nasion X 100/distance between supraglabellare and nasion
Additional Cephalometric Variables:
Linear, mm
UL thickness distance between UL to UIF
Pfh distance from ramus height in mm from Ar tangent to ascending ramus to Mandibular plane(Go to Me)
LAFH: distance between ANS to Me line
ULTc ratio of total chin thickness to upper lip thickness
AfhPfh palatal plane(ANS-PNS) to Me in relation to Pfh

APPENDIX C

Dahlberg's Technical Error of Measurement for the 25 Variables

Variable	Sum	Divide	Square Root
GMSN	6.7	.01675	.409268
GMFH	7.52	0.188	.403359
GMBaN	7.32	0.183	.427785
GSgM	9.66	.2415	.491426
IOpSN	8.57	.21425	.462871
IOpFH	7.09	.17725	.421011
IOpBaN	10.88	.272	.521536
OIOp	8.68	.217	.465833
SgGM	5.54	.1385	.372156
GSgN	7.94	.1985	.445533
FSHt	7.74	.1935	.439886
FsWd	7.2	.018	.424264
IOpO	13.49	.33725	.580732
MaSN	5.83	.14575	.381772
MaFH	8.84	.221	.470106
MaHt	5.35	.13375	.365718
MaWd	7.16	.179	.423084
UL	5.5	.1375	.37081
Tc	6.36	.159	.398748
Pfh	7.73	.19325	.439602
LAFH	5.39	.13475	.367083
GPI	6.96	.174	.417133
ULTc	8.17	.20425	.45194
AfhPfh	9.98	.2495	.4995

**p<1, 0-1 scale*

APPENDIX D

Data for the Overall Sample

Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
GMSN	303	100.0%	0	0.0%	303	100.0%
GMFH	303	100.0%	0	0.0%	303	100.0%
GMBaN	303	100.0%	0	0.0%	303	100.0%
GSgM	303	100.0%	0	0.0%	303	100.0%
IOpSN	303	100.0%	0	0.0%	303	100.0%
IOpFH	303	100.0%	0	0.0%	303	100.0%
IOpBaN	303	100.0%	0	0.0%	303	100.0%
OIOp	303	100.0%	0	0.0%	303	100.0%
SgGM	303	100.0%	0	0.0%	303	100.0%
GSgN	303	100.0%	0	0.0%	303	100.0%
FSHt	303	100.0%	0	0.0%	303	100.0%
FSWd	303	100.0%	0	0.0%	303	100.0%
IOpO	303	100.0%	0	0.0%	303	100.0%
MaSN	303	100.0%	0	0.0%	303	100.0%
MaFH	303	100.0%	0	0.0%	303	100.0%
MaHt	303	100.0%	0	0.0%	303	100.0%
MaWd	303	100.0%	0	0.0%	303	100.0%
Upperlipthickness	303	100.0%	0	0.0%	303	100.0%

ChinThickness	303	100.0%	0	0.0%	303	100.0%
PosteriorFacialHeight	303	100.0%	0	0.0%	303	100.0%
LAFH	303	100.0%	0	0.0%	303	100.0%
GPI	303	100.0%	0	0.0%	303	100.0%
ULTc	303	100.0%	0	0.0%	303	100.0%
AfhPfh	303	100.0%	0	0.0%	303	100.0%

Descriptives

			Statistic	Std. Error
GMSN	Mean		95.736	.9577
	95% Confidence Interval for Mean	Lower Bound	93.852	
		Upper Bound	97.621	
	5% Trimmed Mean		97.007	
	Median		96.800	
	Variance		277.882	
	Std. Deviation		16.6698	
	Minimum		-101.7	
	Maximum		110.6	
	Range		212.3	
	Interquartile Range		7.3	
	Skewness		-10.401	.140
	Kurtosis		119.685	.279
GMFH	Mean		104.445	.7588

GMBaN	95% Confidence Interval for Mean	Lower Bound	102.952	
		Upper Bound	105.938	
	5% Trimmed Mean		105.151	
	Median		105.100	
	Variance		174.462	
	Std. Deviation		13.2084	
	Minimum		-107.6	
	Maximum		119.8	
	Range		227.4	
	Interquartile Range		6.3	
	Skewness		-13.773	.140
	Kurtosis		221.389	.279
	Mean		78.283	.6072
	95% Confidence Interval for Mean	Lower Bound	77.088	
		Upper Bound	79.477	
	5% Trimmed Mean		78.801	
	Median		78.800	
	Variance		111.715	
	Std. Deviation		10.5695	
	Minimum		-82.8	
	Maximum		92.7	
	Range		175.5	
	Interquartile Range		6.5	
	Skewness		-11.770	.140

	Kurtosis		179.350	.279
	Mean		162.474	.3510
	95% Confidence Interval for Mean	Lower Bound	161.784	
		Upper Bound	163.165	
	5% Trimmed Mean		162.477	
	Median		162.500	
	Variance		37.323	
GSgM	Std. Deviation		6.1093	
	Minimum		143.3	
	Maximum		177.9	
	Range		34.6	
	Interquartile Range		8.0	
	Skewness		-.017	.140
	Kurtosis		-.100	.279
	Mean		97.515	.8663
	95% Confidence Interval for Mean	Lower Bound	95.810	
		Upper Bound	99.219	
	5% Trimmed Mean		97.858	
	Median		97.200	
IOpSN	Variance		227.396	
	Std. Deviation		15.0797	
	Minimum		-98.4	
	Maximum		129.7	
	Range		228.1	

	Interquartile Range		13.4	
	Skewness		-7.141	.140
	Kurtosis		93.807	.279
	Mean		105.606	.8927
	95% Confidence Interval for Mean	Lower Bound	103.850	
		Upper Bound	107.363	
	5% Trimmed Mean		105.971	
	Median		106.000	
	Variance		241.477	
IOpFH	Std. Deviation		15.5395	
	Minimum		-104.4	
	Maximum		138.4	
	Range		242.8	
	Interquartile Range		12.3	
	Skewness		-8.077	.140
	Kurtosis		110.149	.279
	Mean		79.444	.7758
	95% Confidence Interval for Mean	Lower Bound	77.917	
		Upper Bound	80.971	
	5% Trimmed Mean		79.677	
IOpBaN	Median		79.600	
	Variance		182.359	
	Std. Deviation		13.5040	
	Minimum		-79.5	

		Maximum		112.3	
		Range		191.8	
		Interquartile Range		13.1	
		Skewness		-5.226	.140
		Kurtosis		62.706	.279
		Mean		131.414	1.0285
		95% Confidence Interval for Mean	Lower Bound	129.390	
			Upper Bound	133.438	
		5% Trimmed Mean		132.145	
		Median		132.000	
		Variance		320.540	
OIOp		Std. Deviation		17.9036	
		Minimum		-136.0	
		Maximum		161.8	
		Range		297.8	
		Interquartile Range		12.9	
		Skewness		-11.046	.140
		Kurtosis		165.282	.279
		Mean		3.394	.0836
		95% Confidence Interval for Mean	Lower Bound	3.230	
			Upper Bound	3.558	
SgGM		5% Trimmed Mean		3.350	
		Median		3.400	
		Variance		2.115	

	Std. Deviation		1.4544	
	Minimum		.3	
	Maximum		7.7	
	Range		7.4	
	Interquartile Range		1.8	
	Skewness		.430	.140
	Kurtosis		.147	.279
	Mean		2.177	.0587
	95% Confidence Interval for Mean	Lower Bound	2.061	
		Upper Bound	2.292	
	5% Trimmed Mean		2.143	
	Median		2.100	
	Variance		1.043	
GSgN	Std. Deviation		1.0212	
	Minimum		-2.4	
	Maximum		6.4	
	Range		8.8	
	Interquartile Range		1.1	
	Skewness		.462	.140
	Kurtosis		2.078	.279
	Mean		20.518	.4160
FSHt	95% Confidence Interval for Mean	Lower Bound	19.700	
		Upper Bound	21.337	
	5% Trimmed Mean		20.625	

	Median		21.400	
	Variance		52.428	
	Std. Deviation		7.2407	
	Minimum		1.9	
	Maximum		37.7	
	Range		35.8	
	Interquartile Range		9.7	
	Skewness		-.312	.140
	Kurtosis		-.188	.279
	Mean		7.049	.1287
	95% Confidence Interval for Mean	Lower Bound	6.796	
		Upper Bound	7.302	
	5% Trimmed Mean		6.974	
	Median		6.900	
	Variance		5.019	
FSWd	Std. Deviation		2.2402	
	Minimum		2.4	
	Maximum		15.8	
	Range		13.4	
	Interquartile Range		3.1	
	Skewness		.478	.140
	Kurtosis		.383	.279
	Mean		18.048	.3123
IOpO	95% Confidence Interval for Mean	Lower Bound	17.433	

		Upper Bound	18.662	
	5% Trimmed Mean		17.995	
	Median		18.300	
	Variance		29.560	
	Std. Deviation		5.4369	
	Minimum		4.7	
	Maximum		32.1	
	Range		27.4	
	Interquartile Range		8.0	
	Skewness		.076	.140
	Kurtosis		-.433	.279
	Mean		31.631	.2361
	95% Confidence Interval for Mean	Lower Bound	31.166	
		Upper Bound	32.095	
	5% Trimmed Mean		31.643	
	Median		31.700	
	Variance		16.893	
MaSN	Std. Deviation		4.1101	
	Minimum		14.1	
	Maximum		44.4	
	Range		30.3	
	Interquartile Range		5.1	
	Skewness		-.161	.140
	Kurtosis		1.125	.279

		Mean		21.090	.1500
		95% Confidence Interval for Mean	Lower Bound	20.795	
			Upper Bound	21.386	
		5% Trimmed Mean		21.112	
		Median		20.900	
		Variance		6.813	
MaFH		Std. Deviation		2.6102	
		Minimum		10.8	
		Maximum		28.4	
		Range		17.6	
		Interquartile Range		3.6	
		Skewness		-.157	.140
		Kurtosis		.488	.279
		Mean		5.675	.1103
		95% Confidence Interval for Mean	Lower Bound	5.458	
			Upper Bound	5.892	
		5% Trimmed Mean		5.600	
		Median		5.600	
MaHt		Variance		3.685	
		Std. Deviation		1.9195	
		Minimum		-9.5	
		Maximum		12.2	
		Range		21.7	
		Interquartile Range		1.8	

	Skewness		-.754	.140
	Kurtosis		13.720	.279
	Mean		15.192	.1577
	95% Confidence Interval for Mean	Lower Bound	14.882	
		Upper Bound	15.502	
	5% Trimmed Mean		15.156	
	Median		15.200	
	Variance		7.539	
MaWd	Std. Deviation		2.7457	
	Minimum		8.9	
	Maximum		23.2	
	Range		14.3	
	Interquartile Range		4.1	
	Skewness		.151	.140
	Kurtosis		-.241	.279
	Mean		11.960	.1249
	95% Confidence Interval for Mean	Lower Bound	11.714	
		Upper Bound	12.205	
	5% Trimmed Mean		11.914	
Upperlipthickness	Median		11.900	
	Variance		4.726	
	Std. Deviation		2.1739	
	Minimum		5.5	
	Maximum		19.5	

	Range		14.0	
	Interquartile Range		2.7	
	Skewness		.342	.140
	Kurtosis		.432	.279
	Mean		11.352	.1569
	95% Confidence Interval for Mean	Lower Bound	11.043	
		Upper Bound	11.661	
	5% Trimmed Mean		11.280	
	Median		11.200	
	Variance		7.459	
ChinThickness	Std. Deviation		2.7311	
	Minimum		4.8	
	Maximum		21.7	
	Range		16.9	
	Interquartile Range		3.5	
	Skewness		.430	.140
	Kurtosis		.390	.279
	Mean		46.018	.2655
	95% Confidence Interval for Mean	Lower Bound	45.496	
		Upper Bound	46.541	
PosteriorFacialHeight	5% Trimmed Mean		45.946	
	Median		45.900	
	Variance		21.354	
	Std. Deviation		4.6210	

		Minimum		24.8	
		Maximum		62.0	
		Range		37.2	
		Interquartile Range		6.0	
		Skewness		.075	.140
		Kurtosis		1.497	.279
		Mean		58.829	.3092
		95% Confidence Interval for Mean	Lower Bound	58.221	
			Upper Bound	59.438	
		5% Trimmed Mean		58.822	
		Median		58.800	
		Variance		28.963	
LAFH		Std. Deviation		5.3817	
		Minimum		31.9	
		Maximum		76.3	
		Range		44.4	
		Interquartile Range		7.7	
		Skewness		-.190	.140
		Kurtosis		1.566	.279
		Mean		6.854	.1565
		95% Confidence Interval for Mean	Lower Bound	6.546	
GPI			Upper Bound	7.162	
		5% Trimmed Mean		6.772	
		Median		6.800	

	Variance		7.422	
	Std. Deviation		2.7243	
	Minimum		.6	
	Maximum		16.8	
	Range		16.2	
	Interquartile Range		3.5	
	Skewness		.489	.140
	Kurtosis		.660	.279
	Mean		110.289	1.7021
	95% Confidence Interval for Mean	Lower Bound	106.940	
		Upper Bound	113.639	
	5% Trimmed Mean		108.320	
	Median		104.800	
	Variance		877.880	
ULTc	Std. Deviation		29.6290	
	Minimum		55.5	
	Maximum		254.4	
	Range		198.9	
	Interquartile Range		35.0	
	Skewness		1.239	.140
	Kurtosis		2.812	.279
	Mean		128.576	.7318
AfhPfh	95% Confidence Interval for Mean	Lower Bound	127.136	
		Upper Bound	130.016	

5% Trimmed Mean	128.616	
Median	128.700	
Variance	162.254	
Std. Deviation	12.7379	
Minimum	89.9	
Maximum	173.3	
Range	83.4	
Interquartile Range	16.4	
Skewness	-.027	.140
Kurtosis	.634	.279

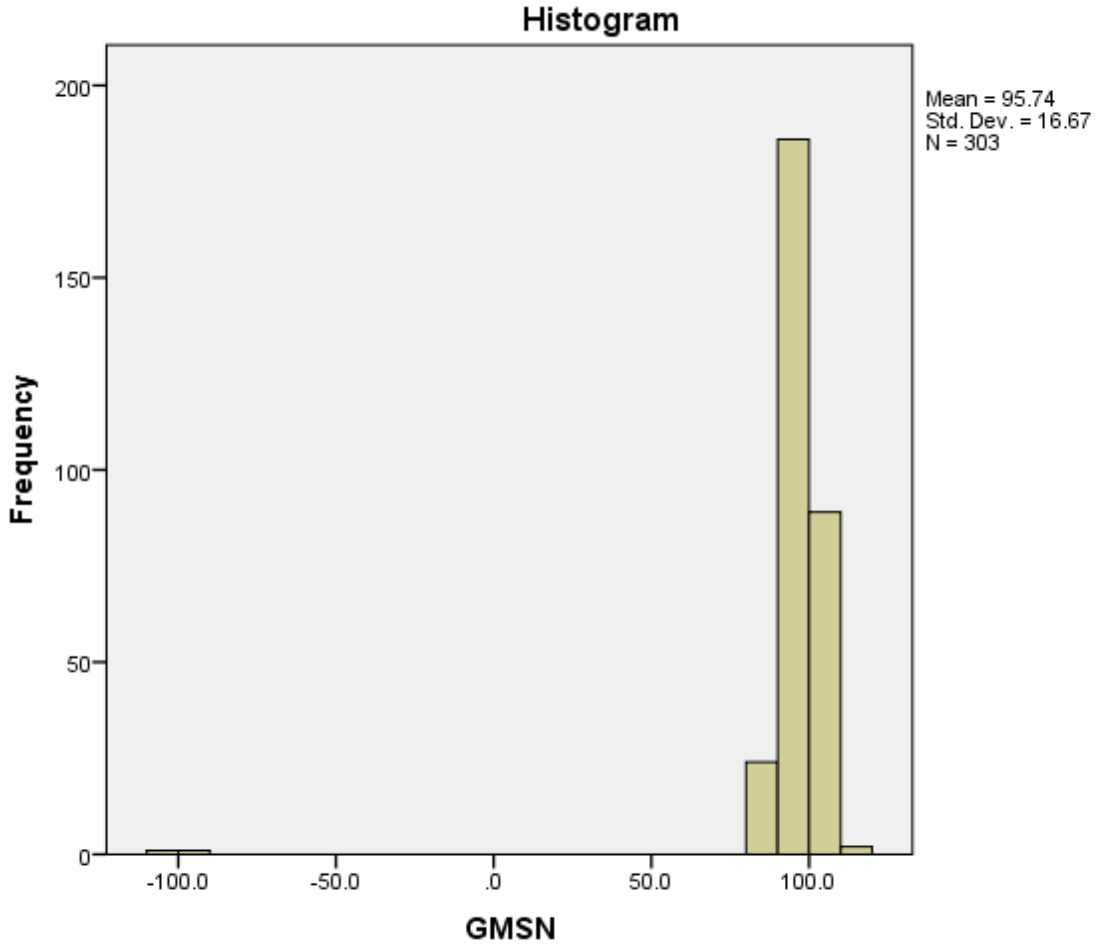
Tests of Normality

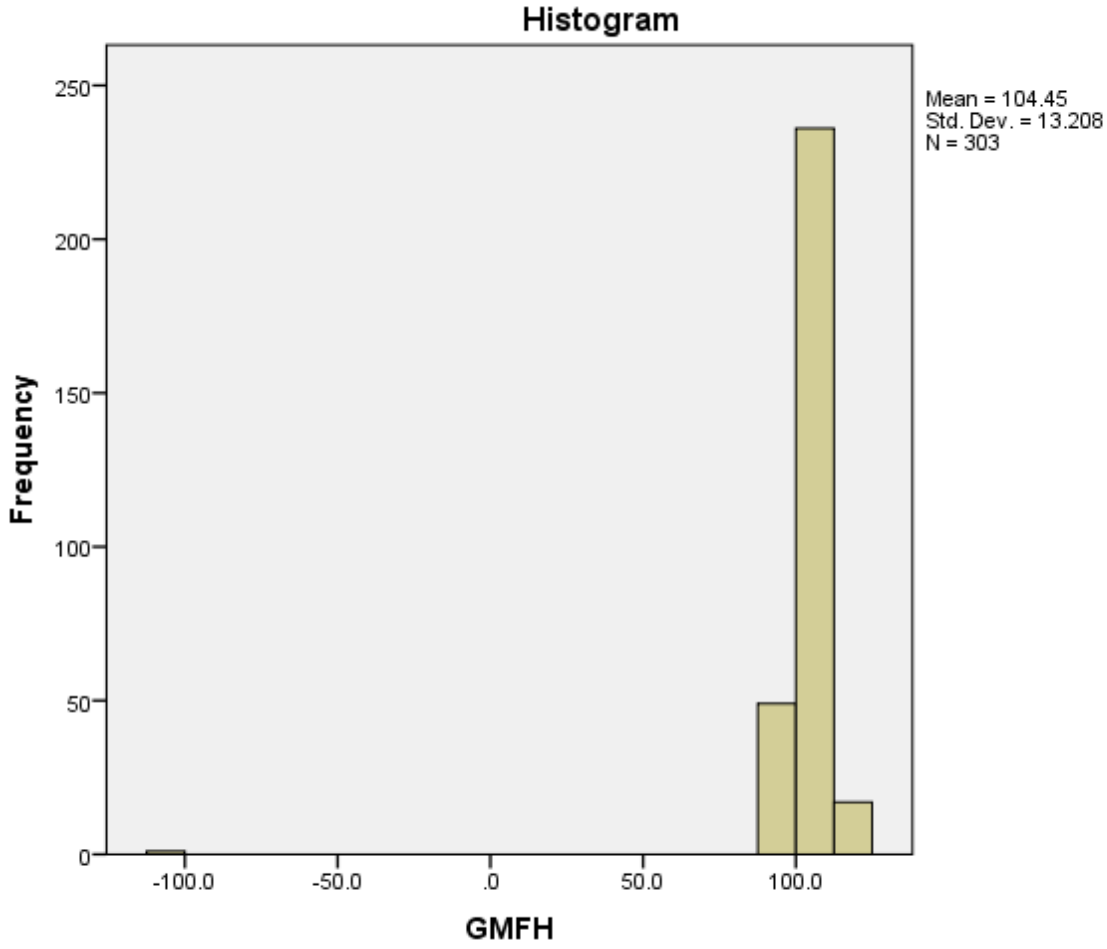
	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
GMSN	.280	303	.000	.281	303	.000
GMFH	.240	303	.000	.289	303	.000
GMBaN	.194	303	.000	.391	303	.000
GSgM	.026	303	.200*	.997	303	.881
IOpSN	.126	303	.000	.613	303	.000
IOpFH	.137	303	.000	.567	303	.000
IOpBaN	.099	303	.000	.707	303	.000
OIOp	.178	303	.000	.427	303	.000

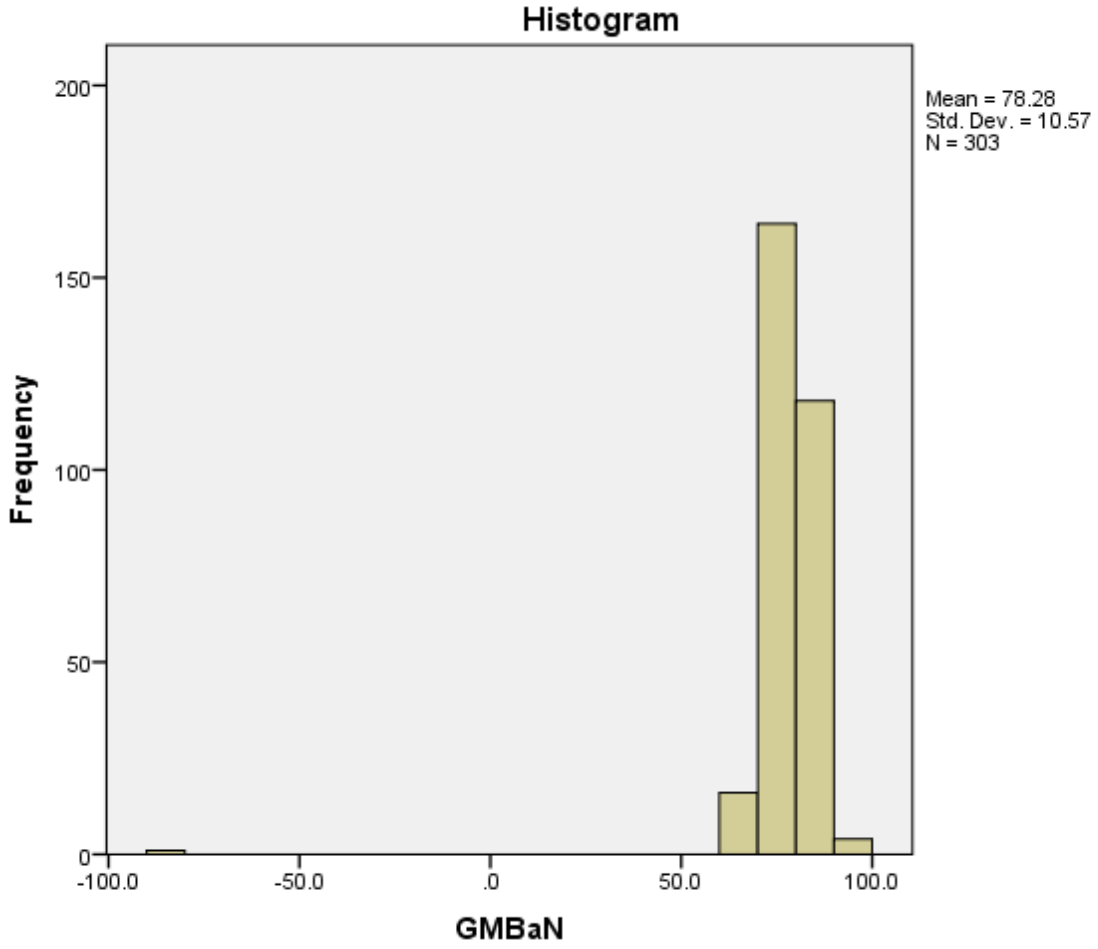
SgGM	.063	303	.005	.981	303	.000
GSgN	.090	303	.000	.964	303	.000
FSHt	.060	303	.010	.986	303	.004
FSWd	.040	303	.200*	.984	303	.002
IOpO	.052	303	.043	.993	303	.138
MaSN	.033	303	.200*	.990	303	.044
MaFH	.043	303	.200*	.994	303	.320
MaHt	.108	303	.000	.859	303	.000
MaWd	.042	303	.200*	.994	303	.258
Upperlipthickness	.060	303	.011	.991	303	.067
ChinThickness	.058	303	.015	.988	303	.015
PosteriorFacialHeight	.033	303	.200*	.983	303	.001
LAFH	.033	303	.200*	.984	303	.002
GPI	.062	303	.007	.984	303	.002
ULTc	.085	303	.000	.931	303	.000
AfhPfh	.047	303	.097	.994	303	.241

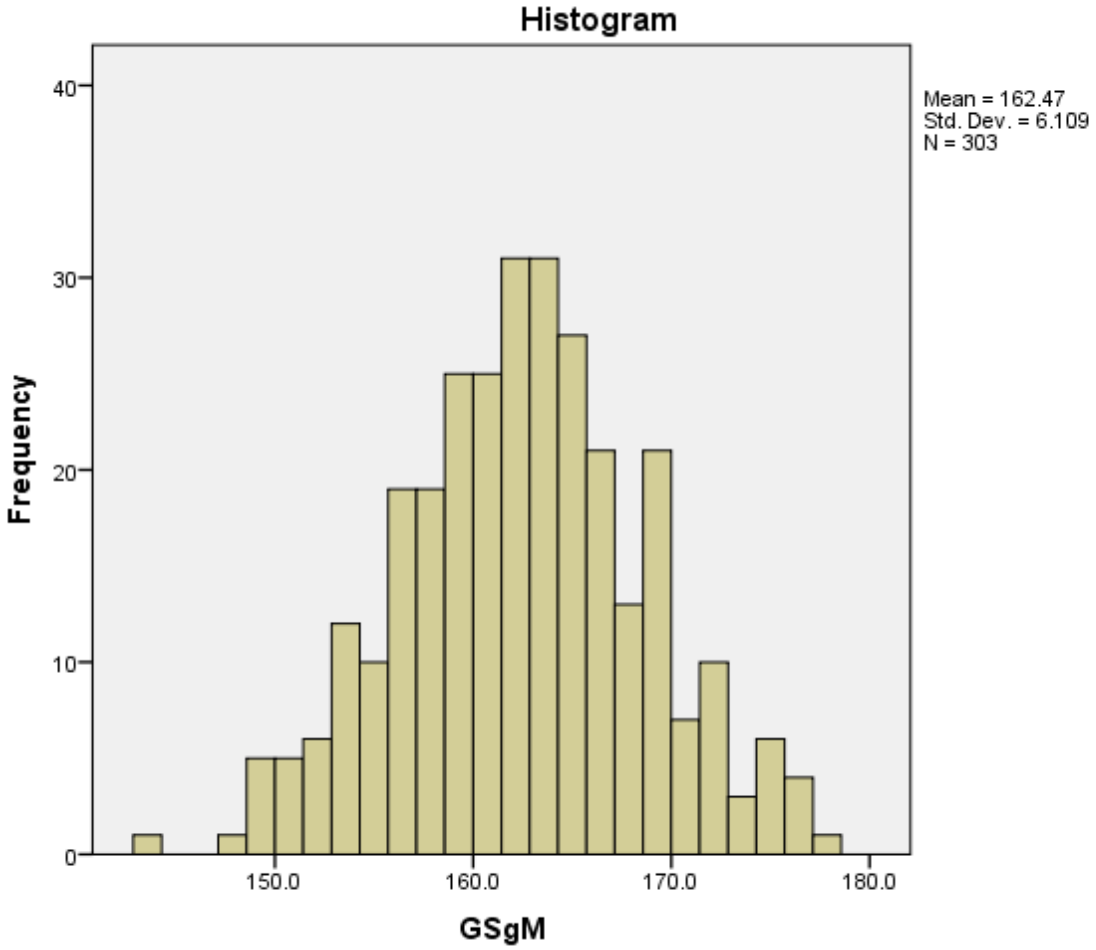
*. This is a lower bound of the true significance.

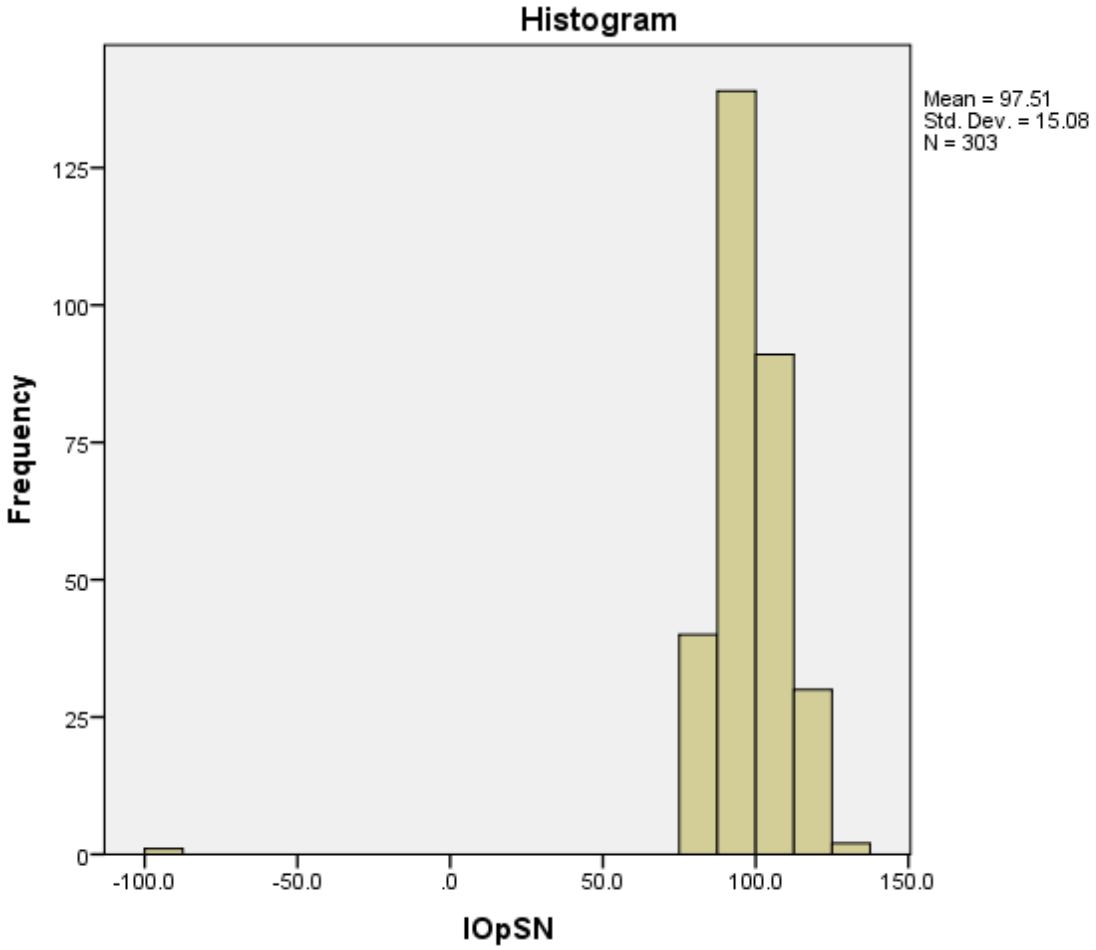
a. Lilliefors Significance Correction

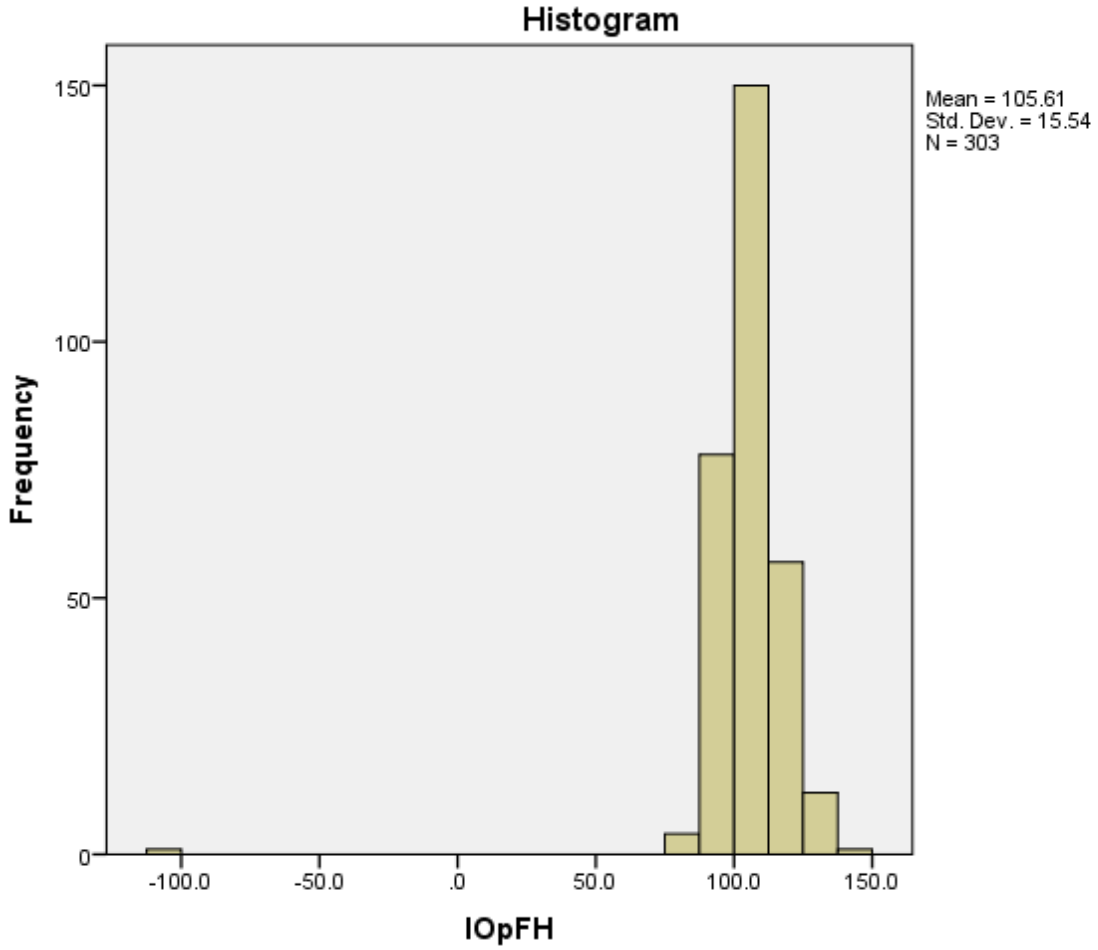


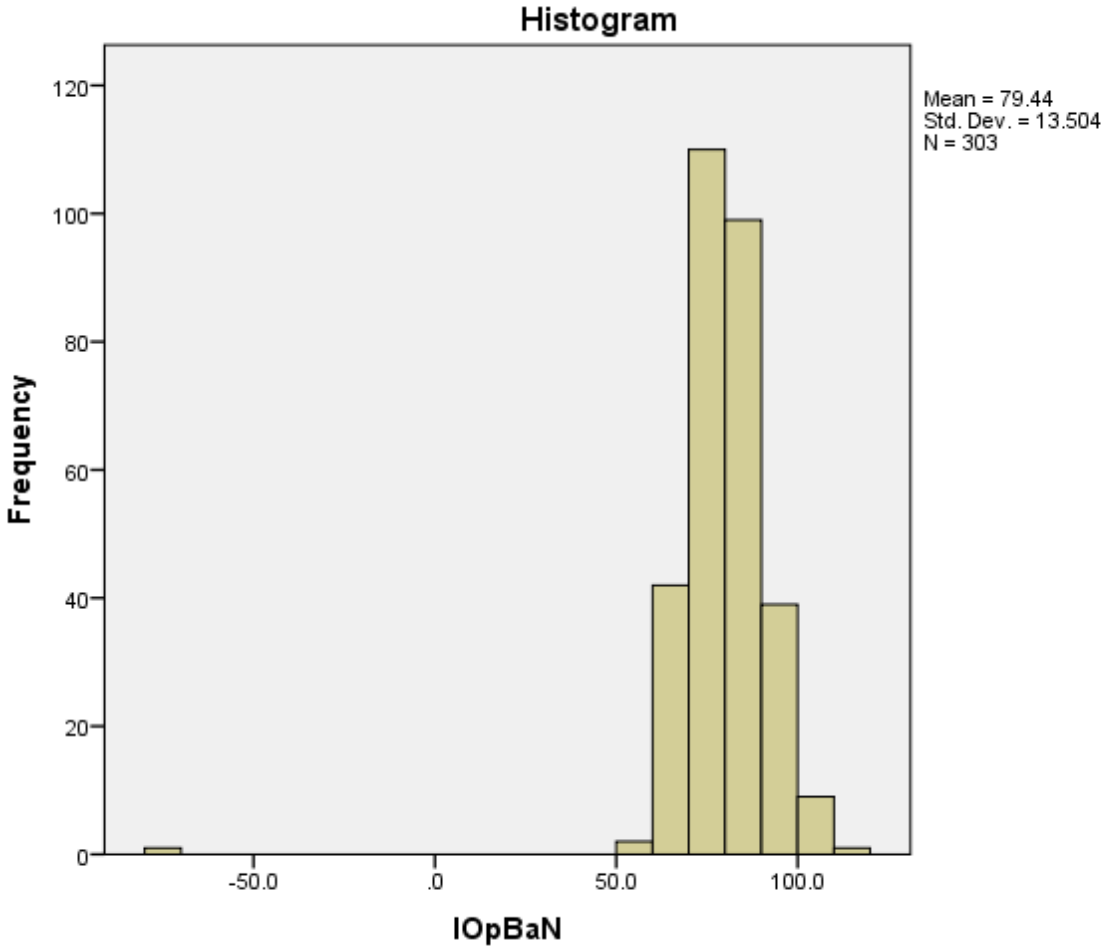


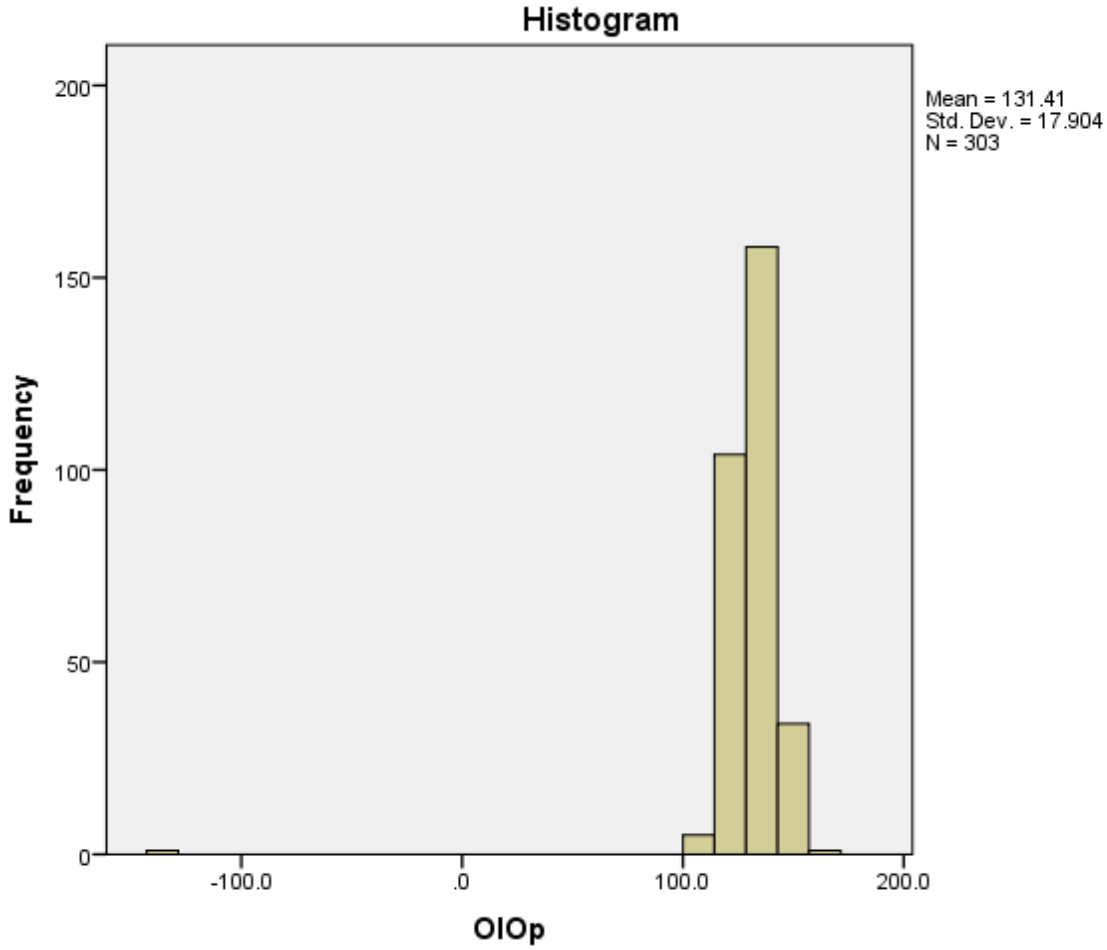


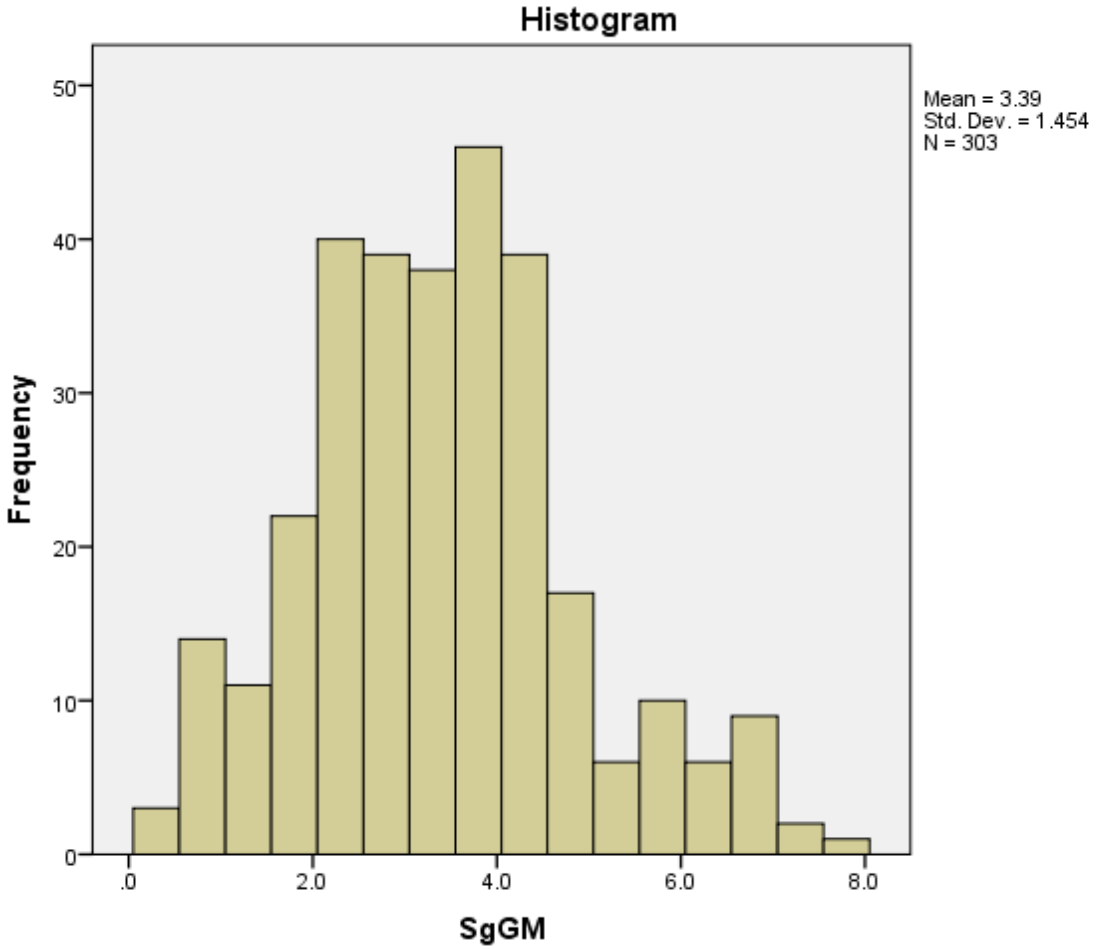


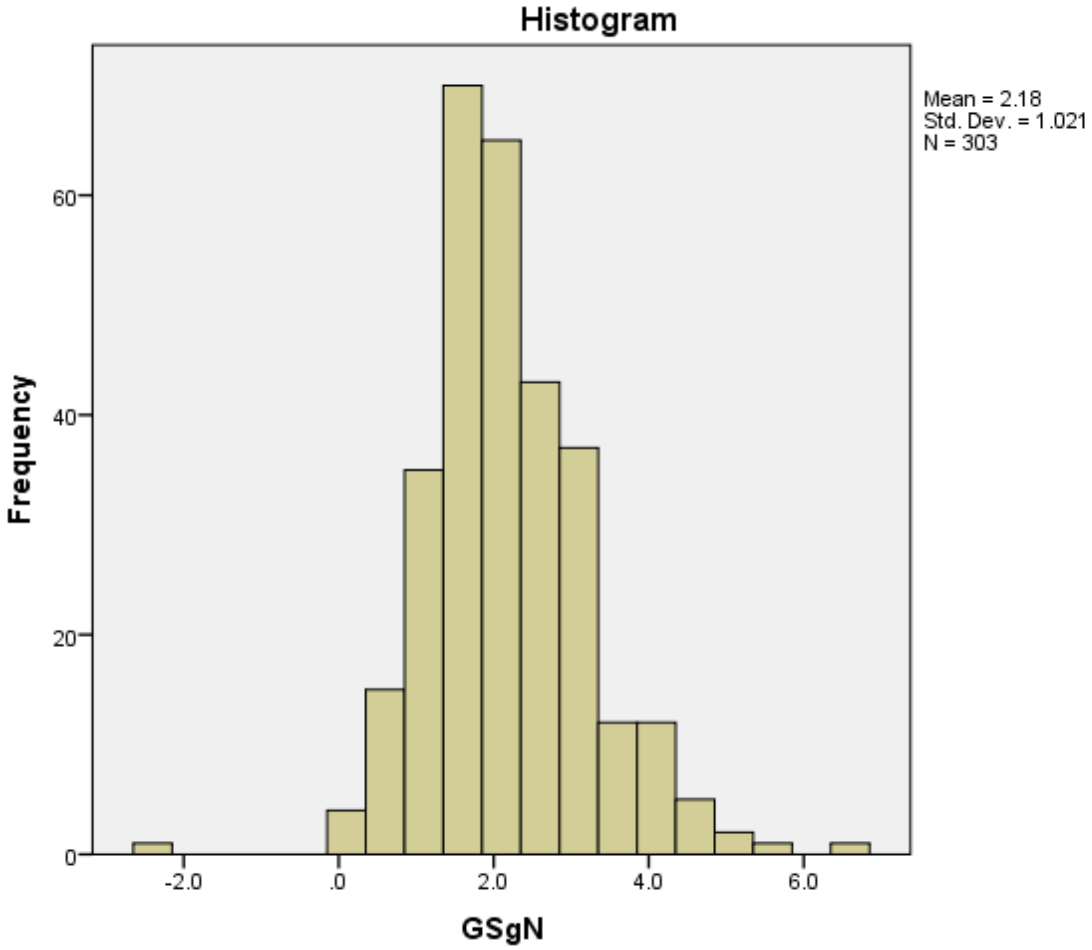


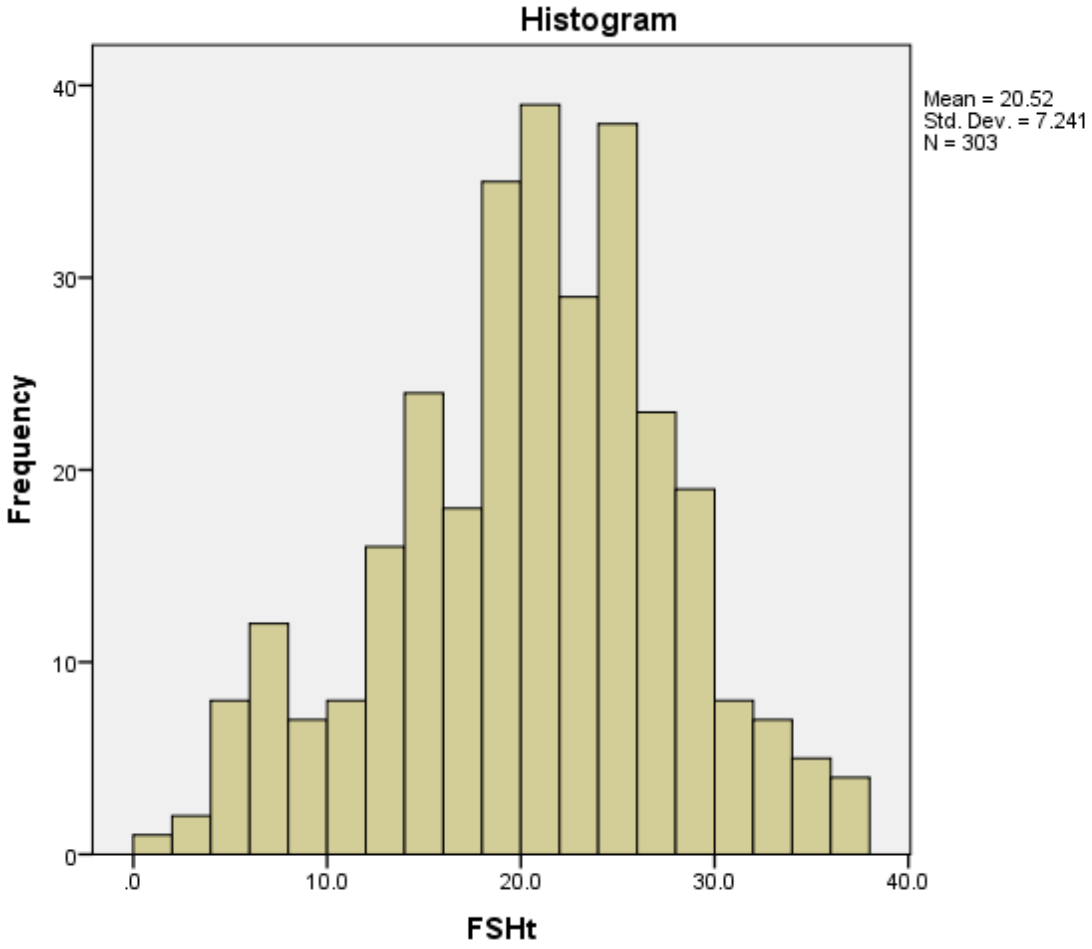


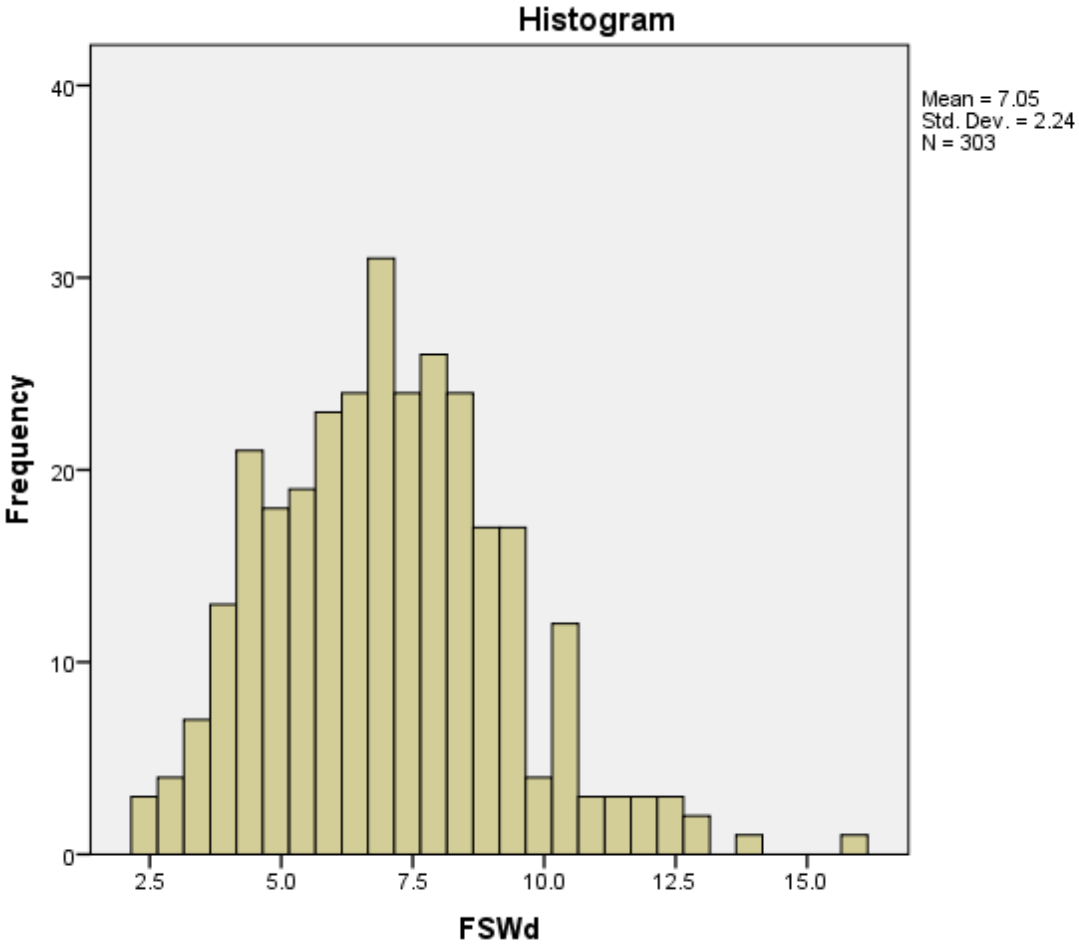


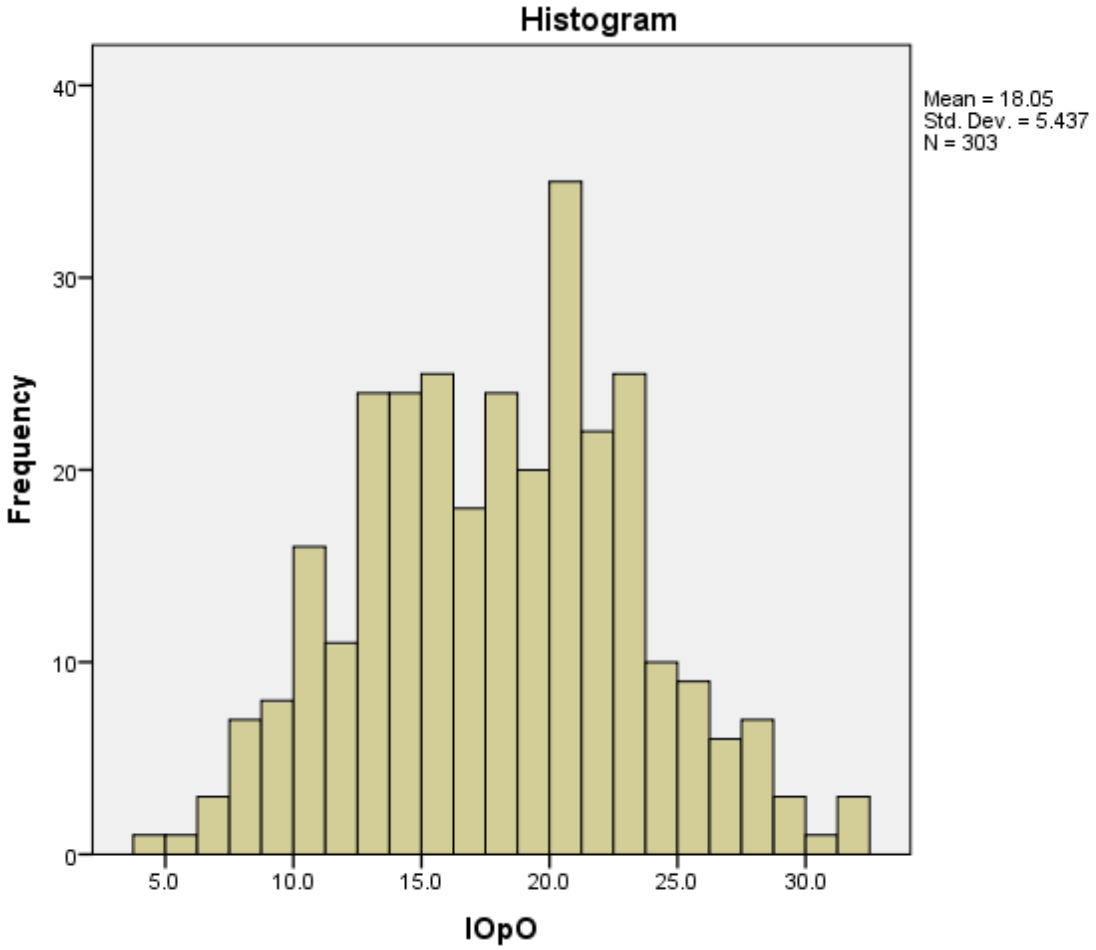


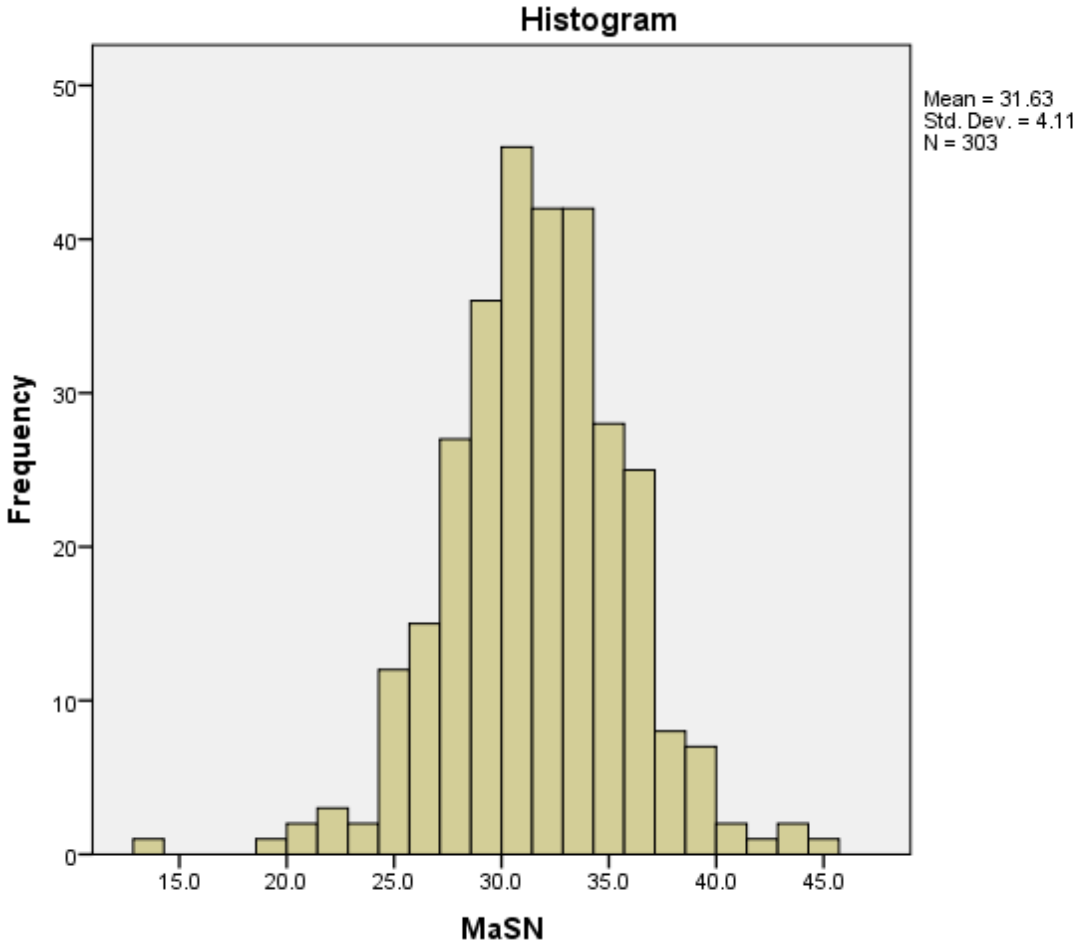


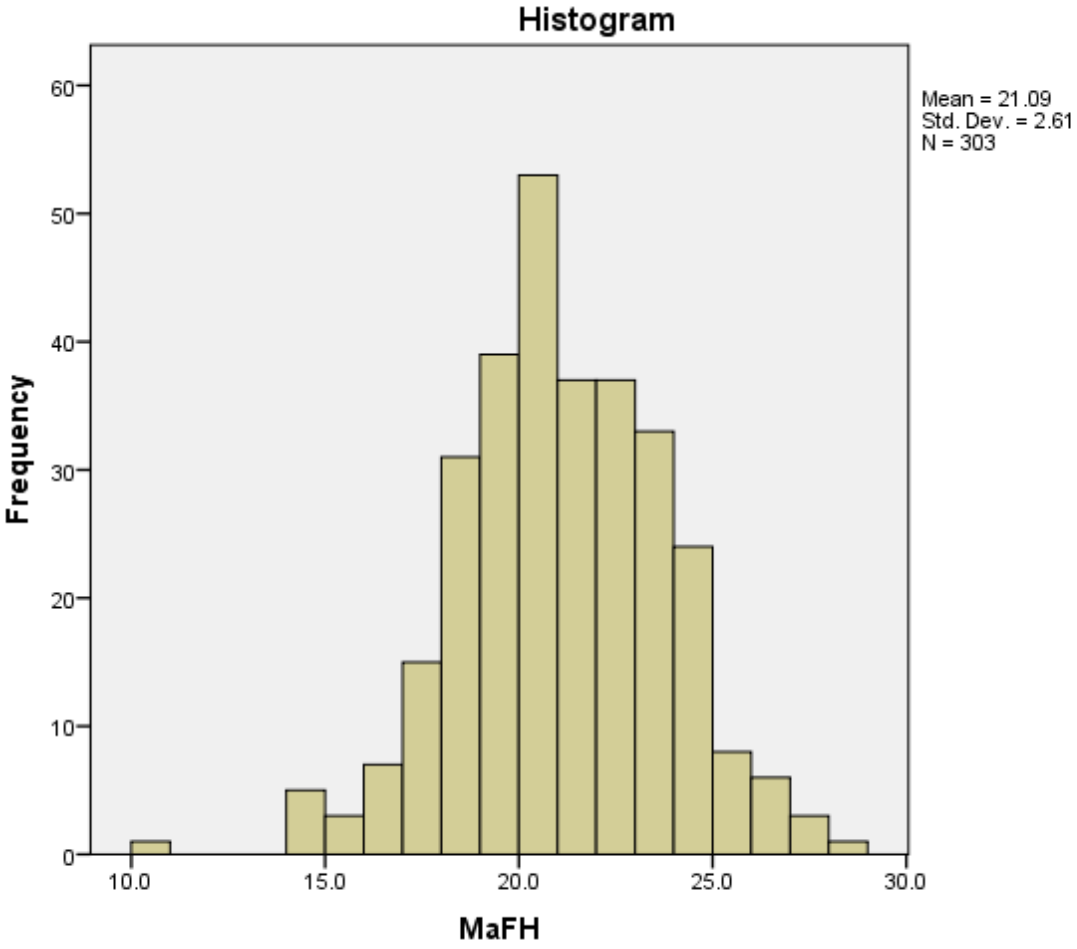


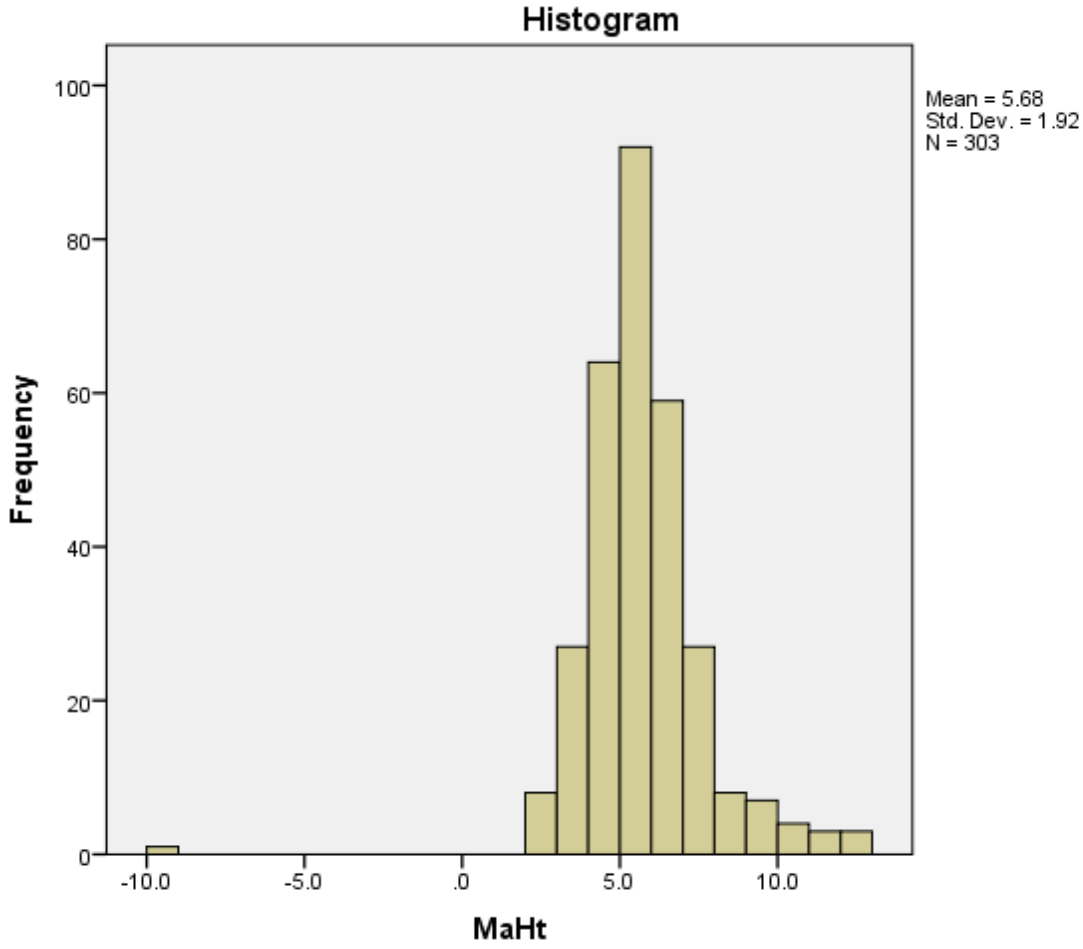


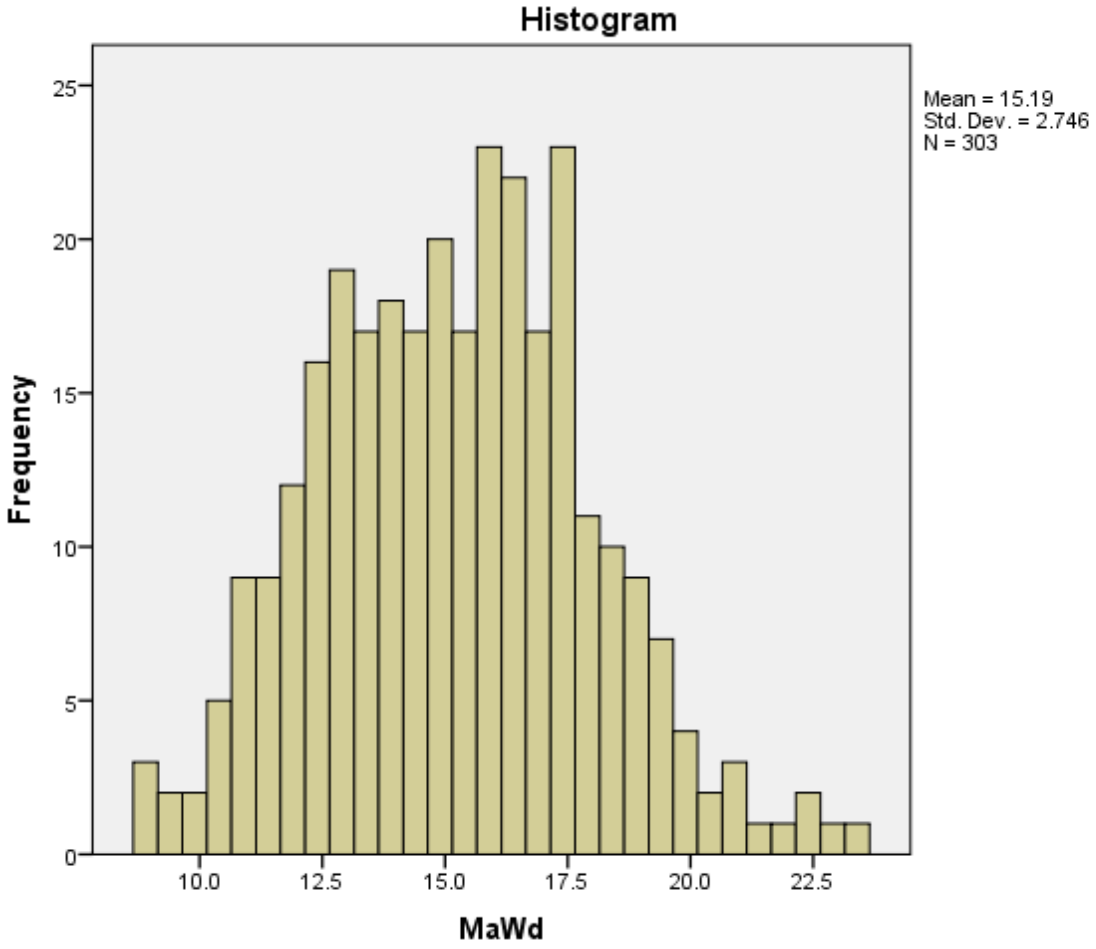


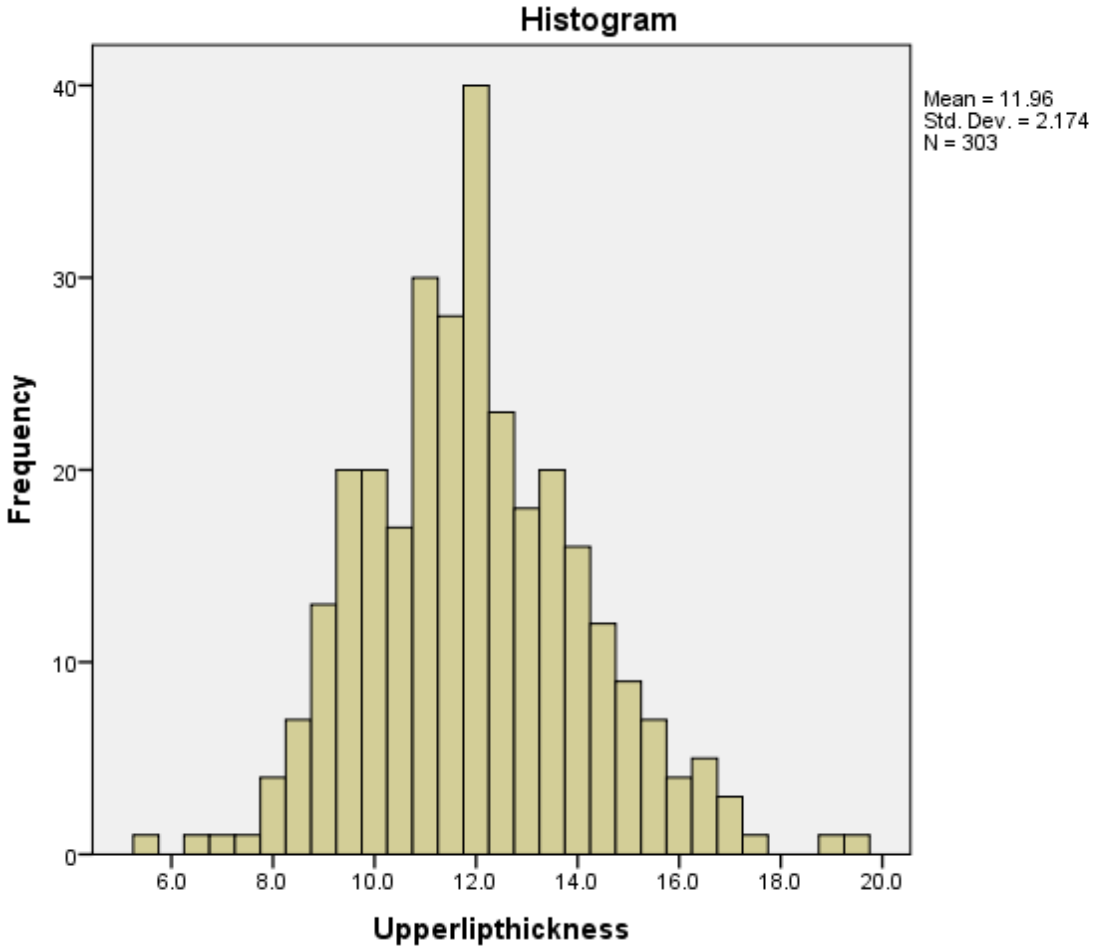


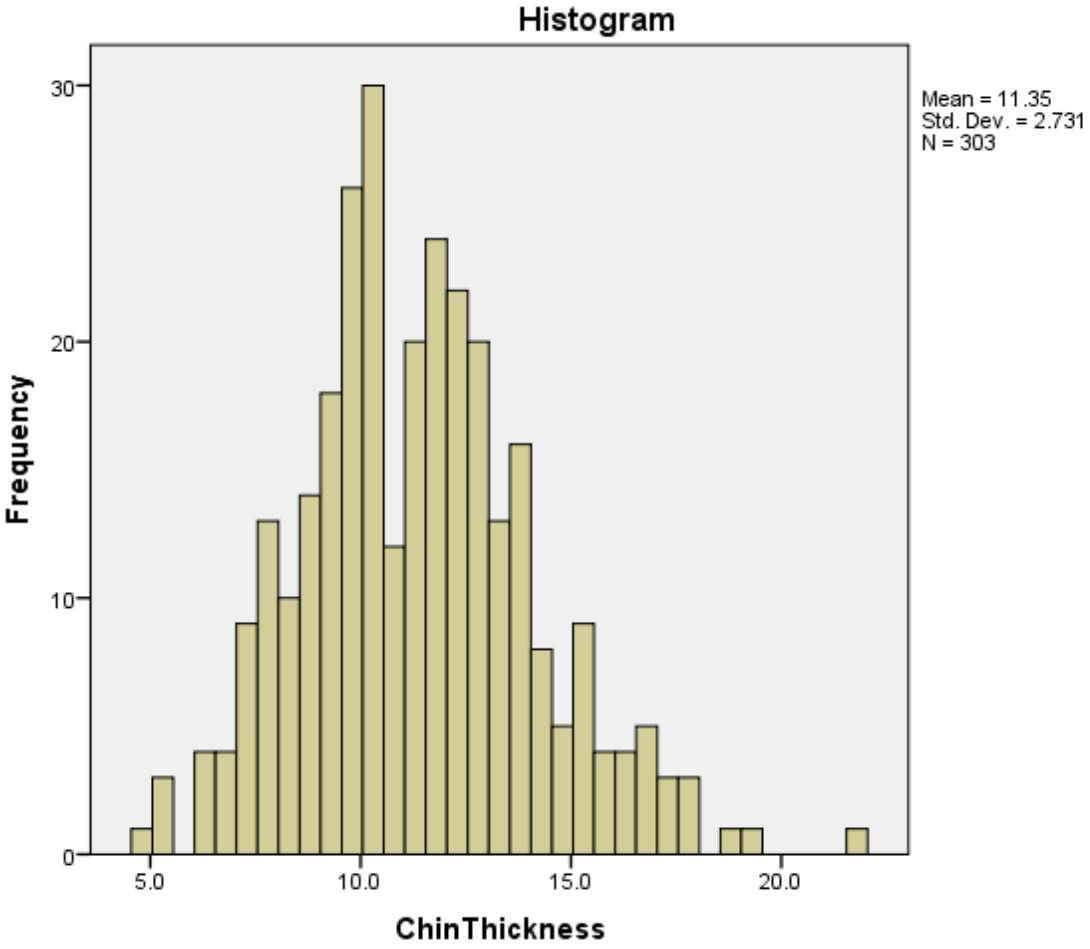


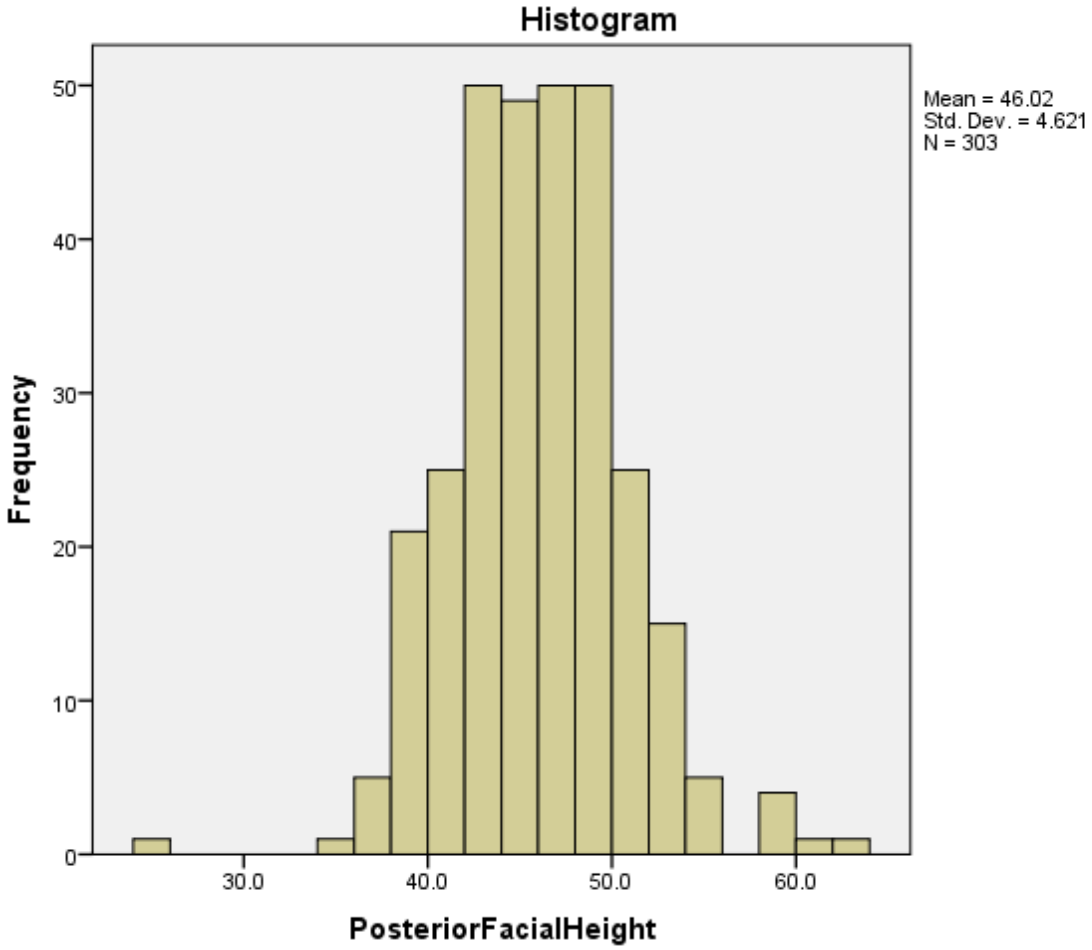


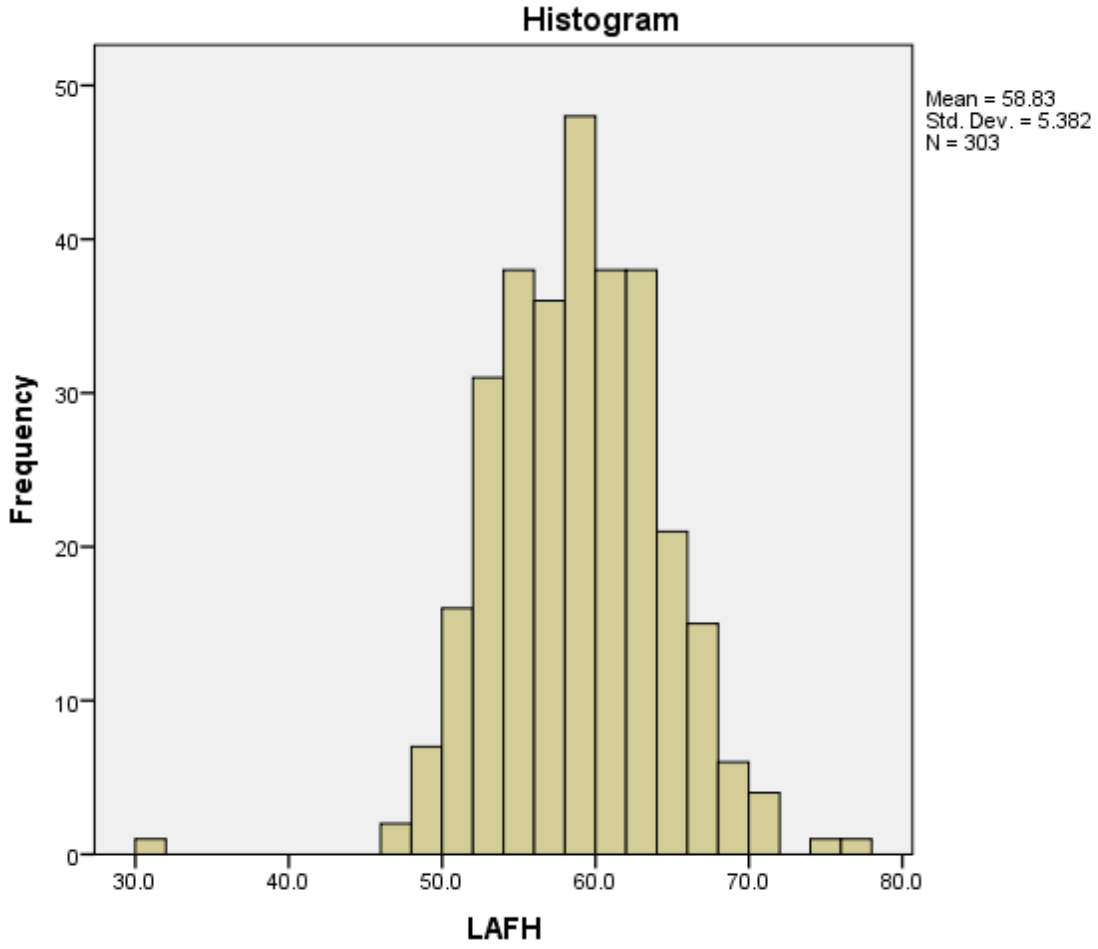


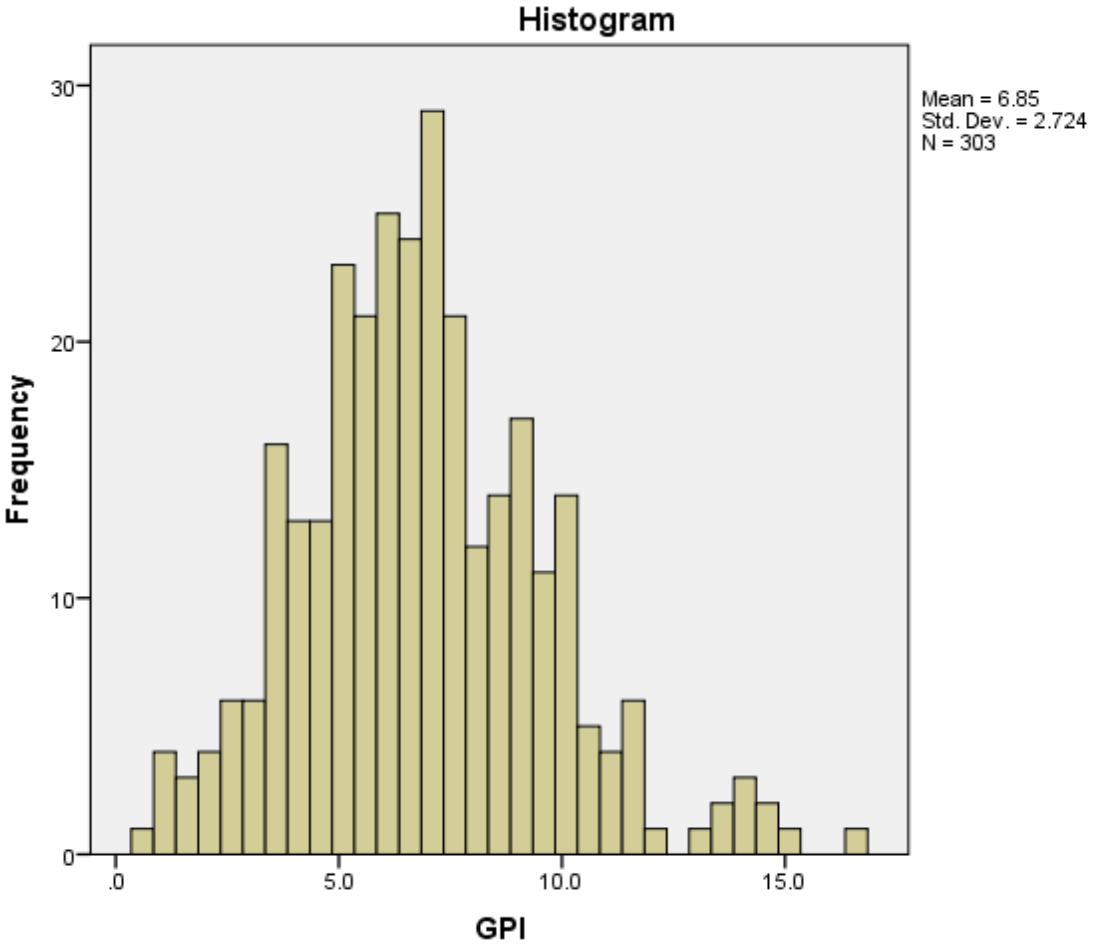


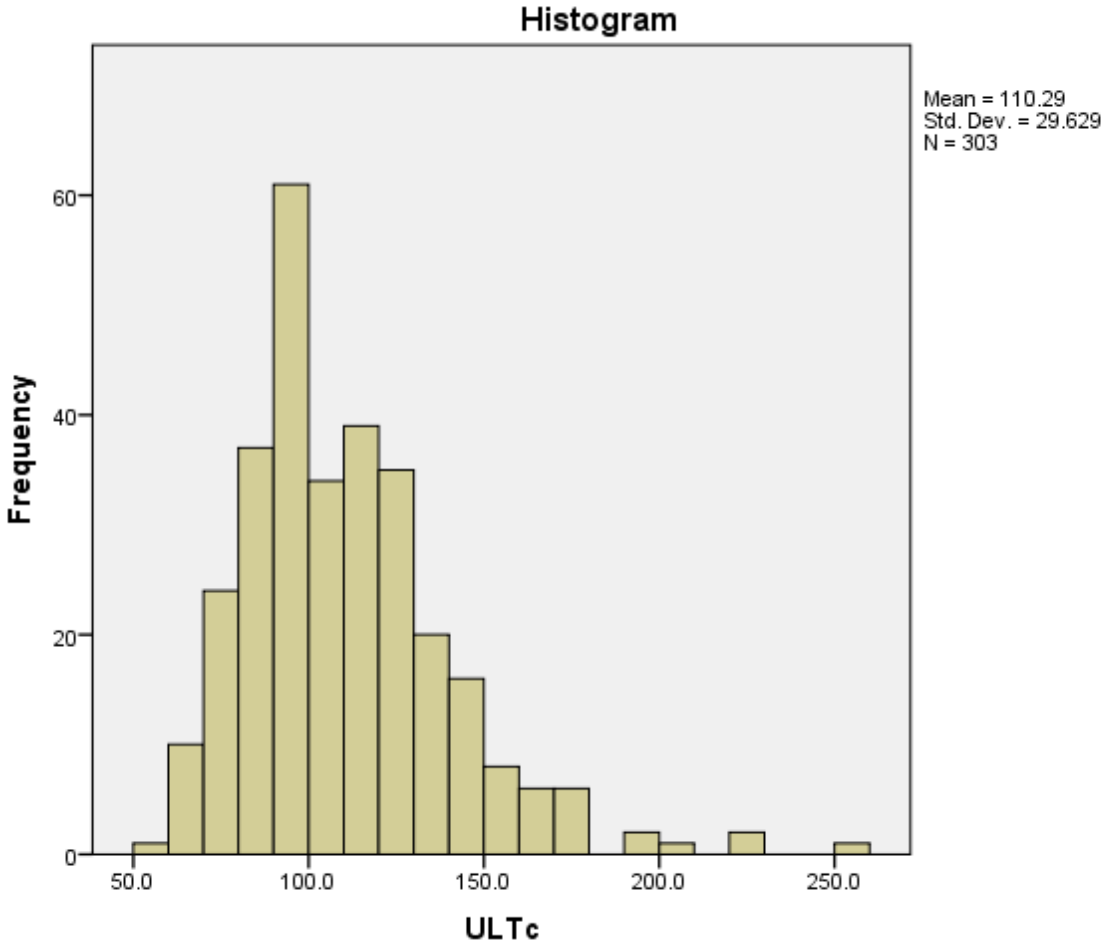


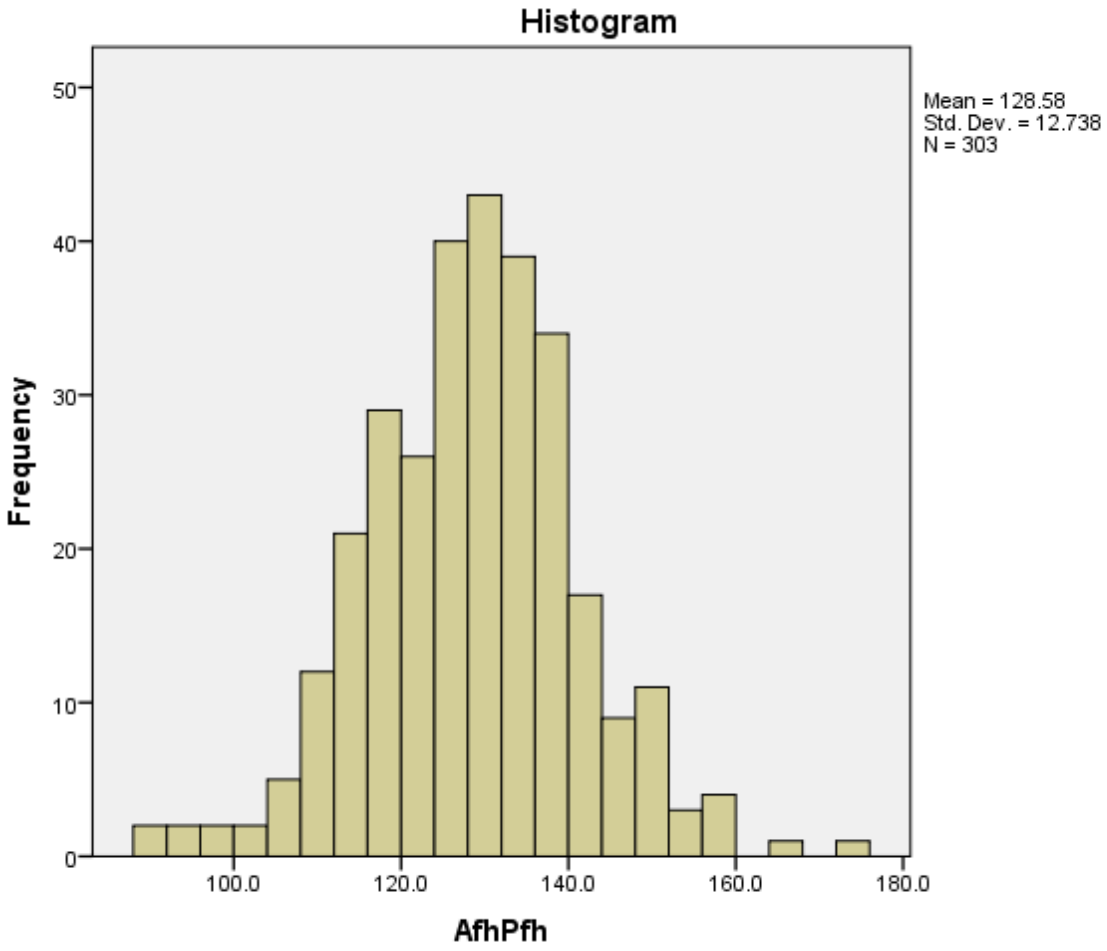












T-Test

Group Statistics

	GENDERCODE	N	Mean	Std. Deviation	Std. Error Mean
GMSN	Female	185	96.332	5.3107	.3904
	Males	118	94.803	25.9128	2.3855
GMFH	Female	185	104.530	5.1285	.3771
	Males	118	104.312	20.2219	1.8616

GMBaN	Female	185	78.410	5.1324	.3773
	Males	118	78.082	15.7120	1.4464
GSgM	Female	185	162.001	6.1871	.4549
	Males	118	163.216	5.9353	.5464
IOpSN	Female	185	98.279	9.9180	.7292
	Males	118	96.316	20.7337	1.9087
IOpFH	Female	185	106.477	9.5952	.7055
	Males	118	104.241	21.8043	2.0072
IOpBaN	Female	185	80.356	9.7489	.7168
	Males	118	78.014	17.8286	1.6413
OIOp	Female	185	132.671	9.2836	.6825
	Males	118	129.443	26.1806	2.4101
SgGM	Female	185	3.435	1.4781	.1087
	Males	118	3.330	1.4203	.1307
GSgN	Female	185	2.026	.8417	.0619
	Males	118	2.413	1.2188	.1122
FSHt	Female	185	19.910	7.3716	.5420
	Males	118	21.472	6.9546	.6402
FSWd	Female	185	6.838	2.1687	.1594
	Males	118	7.379	2.3189	.2135
IOpO	Female	185	17.815	5.5181	.4057
	Males	118	18.413	5.3097	.4888
MaSN	Female	185	31.160	3.9804	.2926
	Males	118	32.369	4.2177	.3883

MaFH	Female	185	21.069	2.6937	.1980
	Males	118	21.124	2.4846	.2287
MaHt	Female	185	5.614	1.3733	.1010
	Males	118	5.771	2.5553	.2352
MaWd	Female	185	15.302	2.7205	.2000
	Males	118	15.019	2.7876	.2566
Upperlipthickness	Female	185	11.576	2.1069	.1549
	Males	118	12.562	2.1491	.1978
ChinThickness	Female	185	11.530	2.3544	.1731
	Males	118	11.074	3.2260	.2970
PosteriorFacialHeight	Female	185	45.713	4.4790	.3293
	Males	118	46.497	4.8157	.4433
LAFH	Female	185	58.437	5.5242	.4062
	Males	118	59.445	5.1128	.4707
GPI	Female	185	6.341	2.3651	.1739
	Males	118	7.659	3.0480	.2806
ULTc	Female	185	103.336	22.9563	1.6878
	Males	118	121.191	35.2265	3.2429
AfhPfh	Female	185	128.486	12.4892	.9182
	Males	118	128.716	13.1709	1.2125

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
GMSN	Equal variances assumed	4.451	.036	.778	301	.437	1.5293	1.9652	-2.3379	5.3966
	Equal variances not assumed			.633	123.297	.528	1.5293	2.4172	-3.2553	6.3140
GMFH	Equal variances assumed	1.440	.231	.140	301	.889	.2184	1.5587	-2.8488	3.2857
	Equal variances not assumed			.115	126.661	.909	.2184	1.8994	-3.5402	3.9770
GMBaN	Equal variances assumed	1.085	.298	.263	301	.793	.3281	1.2472	-2.1262	2.7823
	Equal variances not assumed			.219	133.076	.827	.3281	1.4948	-2.6286	3.2847
GSgM	Equal variances assumed	.460	.498	-1.693	301	.091	-1.2150	.7175	-2.6270	.1970
	Equal variances not assumed			-1.709	256.913	.089	-1.2150	.7110	-2.6151	.1850
IOpSN	Equal variances assumed	1.127	.289	1.105	301	.270	1.9628	1.7759	-1.5320	5.4576
	Equal variances not assumed			.961	151.592	.338	1.9628	2.0432	-2.0741	5.9997
IOpFH	Equal variances assumed	1.659	.199	1.223	301	.222	2.2366	1.8293	-1.3632	5.8364
	Equal variances not assumed			1.051	146.270	.295	2.2366	2.1276	-1.9682	6.4414
IOpBaN	Equal variances assumed	1.597	.207	1.475	301	.141	2.3427	1.5879	-.7821	5.4674
	Equal variances not assumed			1.308	162.133	.193	2.3427	1.7909	-1.1939	5.8792
OIOp	Equal variances assumed	1.062	.304	1.534	301	.126	3.2276	2.1046	-.9140	7.3691
	Equal variances not assumed			1.289	135.964	.200	3.2276	2.5049	-1.7260	8.1812
SgGM	Equal variances assumed	.743	.389	.615	301	.539	.1055	.1715	-.2321	.4430
	Equal variances not assumed			.620	256.620	.536	.1055	.1700	-.2293	.4403

GSgN	Equal variances assumed	9.790	.002	-3.266	301	.001	-.3868	.1184	-.6198	-.1537
	Equal variances not assumed			-3.019	187.954	.003	-.3868	.1281	-.6395	-.1340
FSHt	Equal variances assumed	.239	.625	-1.838	301	.067	-1.5618	.8497	-3.2339	.1104
	Equal variances not assumed			-1.862	259.902	.064	-1.5618	.8388	-3.2135	.0900
FSWd	Equal variances assumed	2.374	.124	-2.059	301	.040	-.5404	.2625	-1.0571	-.0238
	Equal variances not assumed			-2.028	237.047	.044	-.5404	.2664	-1.0653	-.0155
IOpO	Equal variances assumed	.310	.578	-.933	301	.352	-.5976	.6407	-1.8583	.6632
	Equal variances not assumed			-.941	256.364	.348	-.5976	.6352	-1.8485	.6534
MaSN	Equal variances assumed	.164	.685	-2.518	301	.012	-1.2086	.4800	-2.1532	-.2641
	Equal variances not assumed			-2.486	238.706	.014	-1.2086	.4862	-2.1664	-.2508
MaFH	Equal variances assumed	.406	.524	-.177	301	.860	-.0545	.3080	-.6607	.5516
	Equal variances not assumed			-.180	263.885	.857	-.0545	.3025	-.6503	.5412
MaHt	Equal variances assumed	14.866	.000	-.694	301	.488	-.1571	.2263	-.6025	.2883
	Equal variances not assumed			-.614	160.616	.540	-.1571	.2560	-.6627	.3484
MaWd	Equal variances assumed	.185	.667	.873	301	.383	.2827	.3236	-.3541	.9195
	Equal variances not assumed			.869	244.876	.386	.2827	.3254	-.3582	.9235
Upperlipthickness	Equal variances assumed	.097	.756	-3.942	301	.000	-.9862	.2502	-1.4785	-.4939
	Equal variances not assumed			-3.925	245.711	.000	-.9862	.2513	-1.4811	-.4913
ChinThickness	Equal variances assumed	10.319	.001	1.420	301	.157	.4560	.3212	-.1761	1.0881
	Equal variances not assumed			1.327	195.646	.186	.4560	.3437	-.2219	1.1339
PosteriorFacial Height	Equal variances assumed	.928	.336	-1.442	301	.150	-.7836	.5434	-1.8531	.2858
	Equal variances not assumed			-1.419	236.041	.157	-.7836	.5522	-1.8716	.3043
LAFH	Equal variances assumed	1.105	.294	-1.594	301	.112	-1.0082	.6324	-2.2527	.2364
	Equal variances not assumed			-1.622	263.288	.106	-1.0082	.6217	-2.2323	.2159

GPI	Equal variances assumed	4.817	.029	-4.220	301	.000	-1.3182	.3124	-1.9330	-.7035
	Equal variances not assumed			-3.993	204.907	.000	-1.3182	.3301	-1.9691	-.6674
ULTc	Equal variances assumed	13.581	.000	-5.343	301	.000	-17.8545	3.3416	-24.4303	-11.2786
	Equal variances not assumed			-4.884	180.547	.000	-17.8545	3.6558	-25.0680	-10.6409
AfhPfh	Equal variances assumed	.105	.746	-.153	301	.878	-.2302	1.5031	-3.1881	2.7278
	Equal variances not assumed			-.151	239.579	.880	-.2302	1.5209	-3.2263	2.7660

Oneway

Descriptives

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
GMSN	6-7	9	94.444	4.6250	1.5417	90.889	98.000	83.5	98.8
	8-10	88	91.448	29.5151	3.1463	85.194	97.701	-101.7	106.3
	11-13	136	97.161	5.3687	.4604	96.251	98.071	82.3	110.6
	14 and up	70	98.526	4.8373	.5782	97.372	99.679	88.3	110.5
	Total	303	95.736	16.6698	.9577	93.852	97.621	-101.7	110.6
GMFH	6-7	9	101.978	4.8682	1.6227	98.236	105.720	94.3	108.9
	8-10	88	101.884	23.2031	2.4735	96.968	106.800	-107.6	115.2
	11-13	136	105.229	5.0481	.4329	104.373	106.085	93.2	119.8
	14 and up	70	106.460	4.2023	.5023	105.458	107.462	97.1	115.6
	Total	303	104.445	13.2084	.7588	102.952	105.938	-107.6	119.8

	6-7	9	75.633	4.0648	1.3549	72.509	78.758	66.3	79.1
	8-10	88	75.761	17.8794	1.9059	71.973	79.550	-82.8	88.8
GMBaN	11-13	136	78.921	5.0248	.4309	78.069	79.773	65.4	91.3
	14 and up	70	80.551	4.4190	.5282	79.498	81.605	70.2	92.7
	Total	303	78.283	10.5695	.6072	77.088	79.477	-82.8	92.7
	6-7	9	155.222	3.3484	1.1161	152.648	157.796	151.2	162.0
	8-10	88	161.006	6.8977	.7353	159.544	162.467	143.3	175.8
GSgM	11-13	136	163.180	5.2557	.4507	162.289	164.071	149.4	177.9
	14 and up	70	163.881	5.9516	.7113	162.462	165.301	149.9	176.2
	Total	303	162.474	6.1093	.3510	161.784	163.165	143.3	177.9
	6-7	9	101.000	10.4385	3.4795	92.976	109.024	88.6	122.0
	8-10	88	95.690	23.3856	2.4929	90.735	100.645	-98.4	129.7
IOpSN	11-13	136	98.688	9.2402	.7923	97.121	100.255	81.9	121.1
	14 and up	70	97.080	10.8303	1.2945	94.498	99.662	75.3	124.5
	Total	303	97.515	15.0797	.8663	95.810	99.219	-98.4	129.7
	6-7	9	108.522	9.7673	3.2558	101.014	116.030	95.0	128.3
	8-10	88	104.003	24.5265	2.6145	98.807	109.200	-104.4	138.4
IOpFH	11-13	136	106.755	9.4512	.8104	105.152	108.358	85.6	132.8
	14 and up	70	105.014	10.2593	1.2262	102.568	107.461	86.5	132.7
	Total	303	105.606	15.5395	.8927	103.850	107.363	-104.4	138.4
	6-7	9	82.189	9.8032	3.2677	74.653	89.724	71.0	102.1
	8-10	88	77.876	19.9339	2.1250	73.653	82.100	-79.5	112.3
IOpBaN	11-13	136	80.453	9.3279	.7999	78.871	82.035	63.2	104.5
	14 and up	70	79.101	10.4647	1.2508	76.606	81.597	61.2	105.5

	Total	303	79.444	13.5040	.7758	77.917	80.971	-79.5	112.3
	6-7	9	134.456	9.7982	3.2661	126.924	141.987	119.8	152.0
	8-10	88	129.167	29.8985	3.1872	122.832	135.502	-136.0	153.1
OIOp	11-13	136	132.571	8.8562	.7594	131.069	134.073	113.3	161.8
	14 and up	70	131.599	10.0457	1.2007	129.203	133.994	109.2	156.2
	Total	303	131.414	17.9036	1.0285	129.390	133.438	-136.0	161.8
	6-7	9	5.033	1.0954	.3651	4.191	5.875	3.6	6.8
	8-10	88	3.651	1.6762	.1787	3.296	4.006	.6	7.7
SgGM	11-13	136	3.240	1.2798	.1097	3.023	3.457	.3	7.4
	14 and up	70	3.159	1.3543	.1619	2.836	3.481	.7	6.8
	Total	303	3.394	1.4544	.0836	3.230	3.558	.3	7.7
	6-7	9	1.844	.5525	.1842	1.420	2.269	1.1	2.5
	8-10	88	1.881	.9513	.1014	1.679	2.082	-2.4	4.2
GSgN	11-13	136	2.126	.8958	.0768	1.974	2.278	.2	5.1
	14 and up	70	2.690	1.1913	.1424	2.406	2.974	.9	6.4
	Total	303	2.177	1.0212	.0587	2.061	2.292	-2.4	6.4
	6-7	9	18.389	7.5866	2.5289	12.557	24.220	4.4	29.5
	8-10	88	17.258	6.8115	.7261	15.815	18.701	1.9	33.3
FSHt	11-13	136	21.314	6.8640	.5886	20.150	22.478	4.7	36.1
	14 and up	70	23.346	6.9718	.8333	21.683	25.008	3.9	37.7
	Total	303	20.518	7.2407	.4160	19.700	21.337	1.9	37.7
	6-7	9	5.589	1.8638	.6213	4.156	7.022	2.4	7.9
FSWd	8-10	88	6.420	1.9884	.2120	5.999	6.842	2.4	12.3
	11-13	136	7.322	2.1949	.1882	6.950	7.694	2.4	15.8

	14 and up	70	7.496	2.4536	.2933	6.911	8.081	3.1	13.8
	Total	303	7.049	2.2402	.1287	6.796	7.302	2.4	15.8
	6-7	9	16.833	5.4436	1.8145	12.649	21.018	9.9	24.8
	8-10	88	18.053	5.6534	.6027	16.856	19.251	6.9	32.1
IOpO	11-13	136	17.931	5.1695	.4433	17.054	18.808	4.7	29.7
	14 and up	70	18.424	5.7441	.6866	17.055	19.794	5.7	31.9
	Total	303	18.048	5.4369	.3123	17.433	18.662	4.7	32.1
	6-7	9	30.433	2.8526	.9509	28.241	32.626	25.2	32.7
	8-10	88	30.839	4.1863	.4463	29.952	31.726	14.1	40.9
MaSN	11-13	136	31.969	3.8492	.3301	31.316	32.622	21.0	44.4
	14 and up	70	32.123	4.5223	.5405	31.045	33.201	21.3	43.5
	Total	303	31.631	4.1101	.2361	31.166	32.095	14.1	44.4
	6-7	9	19.656	1.8915	.6305	18.202	21.109	18.0	24.1
	8-10	88	20.539	2.8052	.2990	19.944	21.133	10.8	27.1
MaFH	11-13	136	21.130	2.5004	.2144	20.706	21.554	14.7	27.3
	14 and up	70	21.891	2.4372	.2913	21.310	22.473	14.9	28.4
	Total	303	21.090	2.6102	.1500	20.795	21.386	10.8	28.4
	6-7	9	4.044	1.1282	.3761	3.177	4.912	2.0	5.9
	8-10	88	6.018	2.8462	.3034	5.415	6.621	-9.5	12.2
MaHt	11-13	136	5.613	1.3725	.1177	5.380	5.846	2.6	12.0
	14 and up	70	5.574	1.2508	.1495	5.276	5.873	2.7	8.5
	Total	303	5.675	1.9195	.1103	5.458	5.892	-9.5	12.2
	6-7	9	15.044	2.8205	.9402	12.876	17.212	11.0	18.4
MaWd	8-10	88	15.800	2.8913	.3082	15.187	16.413	9.0	22.7

	11-13	136	15.126	2.5589	.2194	14.692	15.560	9.0	22.3
	14 and up	70	14.576	2.8024	.3350	13.908	15.244	8.9	23.2
	Total	303	15.192	2.7457	.1577	14.882	15.502	8.9	23.2
	6-7	9	10.656	1.2531	.4177	9.692	11.619	8.6	12.5
	8-10	88	11.635	2.2936	.2445	11.149	12.121	5.5	17.1
Upperlipthickness	11-13	136	12.357	1.9257	.1651	12.031	12.684	8.7	19.5
	14 and up	70	11.763	2.4304	.2905	11.183	12.342	7.4	19.2
	Total	303	11.960	2.1739	.1249	11.714	12.205	5.5	19.5
	6-7	9	9.411	2.4111	.8037	7.558	11.264	4.8	13.2
	8-10	88	10.843	2.6871	.2864	10.274	11.413	5.5	18.0
ChinThickness	11-13	136	11.515	2.6667	.2287	11.062	11.967	5.3	21.7
	14 and up	70	11.926	2.7834	.3327	11.262	12.589	5.4	19.4
	Total	303	11.352	2.7311	.1569	11.043	11.661	4.8	21.7
	6-7	9	40.878	2.3915	.7972	39.039	42.716	38.6	46.0
	8-10	88	44.156	4.5203	.4819	43.198	45.113	24.8	54.5
PosteriorFacialHeight	11-13	136	45.863	3.9117	.3354	45.200	46.527	36.7	58.1
	14 and up	70	49.321	4.2556	.5086	48.307	50.336	41.6	62.0
	Total	303	46.018	4.6210	.2655	45.496	46.541	24.8	62.0
	6-7	9	52.367	2.9694	.9898	50.084	54.649	46.3	55.9
	8-10	88	56.695	4.7701	.5085	55.685	57.706	31.9	65.8
LAFH	11-13	136	59.237	4.8748	.4180	58.410	60.063	48.7	76.3
	14 and up	70	61.551	5.6090	.6704	60.214	62.889	48.7	74.4
	Total	303	58.829	5.3817	.3092	58.221	59.438	31.9	76.3
GPI	6-7	9	5.844	1.8702	.6234	4.407	7.282	3.4	7.9

	8-10	88	6.253	2.2494	.2398	5.777	6.730	.9	10.4
	11-13	136	6.669	2.5004	.2144	6.245	7.093	.6	14.6
	14 and up	70	8.100	3.3513	.4006	7.301	8.899	2.6	16.8
	Total	303	6.854	2.7243	.1565	6.546	7.162	.6	16.8
	6-7	9	121.489	41.2011	13.7337	89.819	153.159	87.5	222.4
	8-10	88	111.451	29.1414	3.1065	105.277	117.626	60.6	254.4
ULTc	11-13	136	112.319	27.9809	2.3993	107.574	117.064	63.5	199.7
	14 and up	70	103.446	31.1321	3.7210	96.023	110.869	55.5	229.8
	Total	303	110.289	29.6290	1.7021	106.940	113.639	55.5	254.4
	6-7	9	128.256	7.8098	2.6033	122.252	134.259	116.8	140.7
	8-10	88	129.017	10.5610	1.1258	126.779	131.255	101.6	159.1
AfhPfh	11-13	136	129.932	13.7655	1.1804	127.597	132.266	90.8	173.3
	14 and up	70	125.427	13.3331	1.5936	122.248	128.606	89.9	154.8
	Total	303	128.576	12.7379	.7318	127.136	130.016	89.9	173.3

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
	Between Groups	2454.222	3	818.074	3.003	.031
GMSN	Within Groups	81466.199	299	272.462		
	Total	83920.421	302			
	Between Groups	999.651	3	333.217	1.928	.125
GMFH	Within Groups	51687.779	299	172.869		
	Total	52687.431	302			
GMBaN	Between Groups	1038.366	3	346.122	3.165	.025

	Within Groups	32699.512	299	109.363		
	Total	33737.877	302			
	Between Groups	869.494	3	289.831	8.331	.000
GSgM	Within Groups	10402.105	299	34.790		
	Total	11271.599	302			
	Between Groups	602.922	3	200.974	.883	.450
IOpSN	Within Groups	68070.794	299	227.662		
	Total	68673.716	302			
	Between Groups	506.651	3	168.884	.697	.554
IOpFH	Within Groups	72419.467	299	242.206		
	Total	72926.118	302			
	Between Groups	430.789	3	143.596	.786	.503
IOpBaN	Within Groups	54641.717	299	182.748		
	Total	55072.506	302			
	Between Groups	712.097	3	237.366	.739	.530
OIOp	Within Groups	96090.905	299	321.374		
	Total	96803.002	302			
	Between Groups	37.092	3	12.364	6.144	.000
SgGM	Within Groups	601.717	299	2.012		
	Total	638.809	302			
	Between Groups	27.501	3	9.167	9.536	.000
GSgN	Within Groups	287.422	299	.961		
	Total	314.924	302			
FSHt	Between Groups	1621.936	3	540.645	11.375	.000

	Within Groups	14211.380	299	47.530		
	Total	15833.317	302			
	Between Groups	78.062	3	26.021	5.412	.001
FSWd	Within Groups	1437.555	299	4.808		
	Total	1515.617	302			
	Between Groups	25.058	3	8.353	.281	.839
IOpO	Within Groups	8902.018	299	29.773		
	Total	8927.076	302			
	Between Groups	100.642	3	33.547	2.006	.113
MaSN	Within Groups	5001.102	299	16.726		
	Total	5101.745	302			
	Between Groups	90.450	3	30.150	4.583	.004
MaFH	Within Groups	1967.132	299	6.579		
	Total	2057.582	302			
	Between Groups	35.521	3	11.840	3.286	.021
MaHt	Within Groups	1077.223	299	3.603		
	Total	1112.744	302			
	Between Groups	59.910	3	19.970	2.694	.046
MaWd	Within Groups	2216.831	299	7.414		
	Total	2276.741	302			
	Between Groups	48.790	3	16.263	3.528	.015
Upperlipthickness	Within Groups	1378.439	299	4.610		
	Total	1427.229	302			
ChinThickness	Between Groups	83.327	3	27.776	3.828	.010

	Within Groups	2169.269	299	7.255		
	Total	2252.596	302			
	Between Groups	1310.143	3	436.714	25.410	.000
PosteriorFacialHeight	Within Groups	5138.767	299	17.187		
	Total	6448.910	302			
	Between Groups	1317.859	3	439.286	17.680	.000
LAFH	Within Groups	7428.989	299	24.846		
	Total	8746.849	302			
	Between Groups	154.240	3	51.413	7.365	.000
GPI	Within Groups	2087.151	299	6.980		
	Total	2241.391	302			
	Between Groups	5086.433	3	1695.478	1.950	.122
ULTc	Within Groups	260033.413	299	869.677		
	Total	265119.846	302			
	Between Groups	962.040	3	320.680	1.996	.115
AfhPfh	Within Groups	48038.719	299	160.665		
	Total	49000.759	302			

Discriminant – All Independents

Group Statistics

GENDERCODE		Mean	Std. Deviation	Valid N (listwise)	
				Unweighted	Weighted
Males	GMSN	94.803	25.9128	118	118.000
	GMFH	104.312	20.2219	118	118.000

	GMBaN	78.082	15.7120	118	118.000
	GSgM	163.216	5.9353	118	118.000
	IOpSN	96.316	20.7337	118	118.000
	IOpFH	104.241	21.8043	118	118.000
	IOpBaN	78.014	17.8286	118	118.000
	OIOp	129.443	26.1806	118	118.000
	SgGM	3.330	1.4203	118	118.000
	GSgN	2.413	1.2188	118	118.000
	FSHt	21.472	6.9546	118	118.000
	FSWd	7.379	2.3189	118	118.000
	IOpO	18.413	5.3097	118	118.000
	MaSN	32.369	4.2177	118	118.000
	MaFH	21.124	2.4846	118	118.000
	MaHt	5.771	2.5553	118	118.000
	MaWd	15.019	2.7876	118	118.000
	Upperlipthickness	12.562	2.1491	118	118.000
	ChinThickness	11.074	3.2260	118	118.000
	PosteriorFacialHeight	46.497	4.8157	118	118.000
	LAFH	59.445	5.1128	118	118.000
	GPI	7.659	3.0480	118	118.000
	ULTc	121.191	35.2265	118	118.000
	AfhPfh	128.716	13.1709	118	118.000
Female	GMSN	96.332	5.3107	185	185.000

	GMFH	104.530	5.1285	185	185.000
	GMBaN	78.410	5.1324	185	185.000
	GSgM	162.001	6.1871	185	185.000
	IOpSN	98.279	9.9180	185	185.000
	IOpFH	106.477	9.5952	185	185.000
	IOpBaN	80.356	9.7489	185	185.000
	OIOp	132.671	9.2836	185	185.000
	SgGM	3.435	1.4781	185	185.000
	GSgN	2.026	.8417	185	185.000
	FSHt	19.910	7.3716	185	185.000
	FSWd	6.838	2.1687	185	185.000
	IOpO	17.815	5.5181	185	185.000
	MaSN	31.160	3.9804	185	185.000
	MaFH	21.069	2.6937	185	185.000
	MaHt	5.614	1.3733	185	185.000
	MaWd	15.302	2.7205	185	185.000
	Upperlipthickness	11.576	2.1069	185	185.000
	ChinThickness	11.530	2.3544	185	185.000
	PosteriorFacialHeight	45.713	4.4790	185	185.000
	LAFH	58.437	5.5242	185	185.000
	GPI	6.341	2.3651	185	185.000
	ULTc	103.336	22.9563	185	185.000
	AfhPfh	128.486	12.4892	185	185.000
Total	GMSN	95.736	16.6698	303	303.000

GMFH	104.445	13.2084	303	303.000
GMBaN	78.283	10.5695	303	303.000
GSgM	162.474	6.1093	303	303.000
IOpSN	97.515	15.0797	303	303.000
IOpFH	105.606	15.5395	303	303.000
IOpBaN	79.444	13.5040	303	303.000
OIOp	131.414	17.9036	303	303.000
SgGM	3.394	1.4544	303	303.000
GSgN	2.177	1.0212	303	303.000
FSHt	20.518	7.2407	303	303.000
FSWd	7.049	2.2402	303	303.000
IOpO	18.048	5.4369	303	303.000
MaSN	31.631	4.1101	303	303.000
MaFH	21.090	2.6102	303	303.000
MaHt	5.675	1.9195	303	303.000
MaWd	15.192	2.7457	303	303.000
Upperlipthickness	11.960	2.1739	303	303.000
ChinThickness	11.352	2.7311	303	303.000
PosteriorFacialHeight	46.018	4.6210	303	303.000
LAFH	58.829	5.3817	303	303.000
GPI	6.854	2.7243	303	303.000
ULTc	110.289	29.6290	303	303.000
AfhPfh	128.576	12.7379	303	303.000

Tests of Equality of Group Means

	Wilks' Lambda	F	df1	df2	Sig.
GMSN	.998	.606	1	301	.437
GMFH	1.000	.020	1	301	.889
GMBaN	1.000	.069	1	301	.793
GSgM	.991	2.867	1	301	.091
IOpSN	.996	1.222	1	301	.270
IOpFH	.995	1.495	1	301	.222
IOpBaN	.993	2.177	1	301	.141
OIOp	.992	2.352	1	301	.126
SgGM	.999	.378	1	301	.539
GSgN	.966	10.666	1	301	.001
FSHt	.989	3.378	1	301	.067
FSWd	.986	4.238	1	301	.040
IOpO	.997	.870	1	301	.352
MaSN	.979	6.340	1	301	.012
MaFH	1.000	.031	1	301	.860
MaHt	.998	.482	1	301	.488
MaWd	.997	.763	1	301	.383
Upperlipthickness	.951	15.541	1	301	.000
ChinThickness	.993	2.015	1	301	.157
PosteriorFacialHeight	.993	2.079	1	301	.150
LAFH	.992	2.541	1	301	.112
GPI	.944	17.808	1	301	.000

ULTc	.913	28.548	1	301	.000
AfhPfh	1.000	.023	1	301	.878

Analysis 1

Box's Test of Equality of Covariance Matrices

Log Determinants

GENDERCODE	Rank	Log Determinant
Males	23	49.268
Female	23	28.751
Pooled within-groups	23	46.754

The ranks and natural logarithms of determinants printed are those of the group covariance matrices.

Test Results

Box's M		3018.274
F	Approx.	10.009
	df1	276
	df2	192432.101
	Sig.	.000

Tests null hypothesis of equal population covariance matrices.

Variables Failing Tolerance Test[a]

	Within-Groups Variance	Tolerance	Minimum Tolerance
IOpBaN	181.652	.000	.000

All variables passing the tolerance criteria are entered simultaneously.

a. Minimum tolerance level is .001.

Summary of Canonical Discriminant Functions

Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	.303[a]	100.0	100.0	.482

a. First 1 canonical discriminant functions were used in the analysis.

Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.768	76.574	23	.000

Standardized Canonical Discriminant Function Coefficients

	Function
	1
GMSN	-.166
GMFH	2.481
GMBaN	-1.814
GSgM	1.416

IOpSN	.490
IOpFH	-.604
OIOp	-.427
SgGM	1.602
GSgN	-1.216
FSHt	.099
FSWd	.053
IOpO	-.078
MaSN	.293
MaFH	-.404
MaHt	.172
MaWd	-.226
Upperlipthickness	-.469
ChinThickness	.820
PosteriorFacialHeight	.716
LAFH	-.545
GPI	1.353
ULTc	1.281
AfhPfh	.565

Structure Matrix

	Function
	1
ULTc	.560
GPI	.442
Upperlipthickness	.413
GSgN	.342
MaSN	.264
FSWd	.216
FSHt	.193
GSgM	.177
LAFH	.167
OIOp	-.161
IOpBaN[a]	-.154
PosteriorFacialHeight	.151
ChinThickness	-.149
IOpFH	-.128
IOpSN	-.116
IOpO	.098
MaWd	-.091
GMSN	-.082
MaHt	.073
SgGM	-.064

GMBaN	-.028
MaFH	.019
AfhPfh	.016
GMFH	-.015

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions

Variables ordered by absolute size of correlation within function.

a. This variable not used in the analysis.

Functions at Group Centroids

GENDERCODE	Function
	1
Males	.687
Female	-.438

Unstandardized canonical discriminant functions evaluated at group means

Classification Statistics

Prior Probabilities for Groups

GENDERCODE	Prior	Cases Used in Analysis	
		Unweighted	Weighted
Males	.389	118	118.000
Female	.611	185	185.000
Total	1.000	303	303.000

Classification Function Coefficients

	GENDERCODE	
	Males	Female
GMSN	-.413	-.402
GMFH	3.927	3.716
GMBaN	1.893	2.086
GSgM	90.765	90.503
IOpSN	10.219	10.183
IOpFH	-11.977	-11.934
OIOp	2.752	2.779
SgGM	379.733	378.496
GSgN	-247.463	-246.102
FSHt	.163	.147
FSWd	-8.593	-8.620
IOpO	10.340	10.356
MaSN	-12.169	-12.250

MaFH	8.965	9.138
MaHt	-.429	-.530
MaWd	-1.841	-1.749
Upperlipthickness	-18.894	-18.646
ChinThickness	14.500	14.162
PosteriorFacialHeight	149.125	148.951
LAFH	-114.878	-114.764
GPI	61.712	61.138
ULTc	1.861	1.810
AfhPfh	53.310	53.260
(Constant)	-11788.929	-11726.920

Fisher's linear discriminant functions

Classification Results[a]

		GENDERCODE	Predicted Group Membership		Total
			Males	Female	
Original	Count	Males	61	57	118
		Female	20	165	185
	%	Males	51.7	48.3	100.0
		Female	10.8	89.2	100.0

a. 74.6% of original grouped cases correctly classified.

Discriminant - Stepwise

Analysis Case Processing Summary

Unweighted Cases		N	Percent
Valid		303	100.0
Excluded	Missing or out-of-range group codes	0	.0
	At least one missing discriminating variable	0	.0
	Both missing or out-of-range group codes and at least one missing discriminating variable	0	.0
	Total	0	.0
Total		303	100.0

Group Statistics

GENDERCODE		Mean	Std. Deviation	Valid N (listwise)	
				Unweighted	Weighted
Males	GMSN	94.803	25.9128	118	118.000
	GMFH	104.312	20.2219	118	118.000
	GMBaN	78.082	15.7120	118	118.000
	GSgM	163.216	5.9353	118	118.000
	IOpSN	96.316	20.7337	118	118.000
	IOpFH	104.241	21.8043	118	118.000
	IOpBaN	78.014	17.8286	118	118.000
	OIOp	129.443	26.1806	118	118.000

	SgGM	3.330	1.4203	118	118.000
	GSgN	2.413	1.2188	118	118.000
	FSHt	21.472	6.9546	118	118.000
	FSWd	7.379	2.3189	118	118.000
	IOpO	18.413	5.3097	118	118.000
	MaSN	32.369	4.2177	118	118.000
	MaFH	21.124	2.4846	118	118.000
	MaHt	5.771	2.5553	118	118.000
	MaWd	15.019	2.7876	118	118.000
	Upperlipthickness	12.562	2.1491	118	118.000
	ChinThickness	11.074	3.2260	118	118.000
	PosteriorFacialHeight	46.497	4.8157	118	118.000
	LAFH	59.445	5.1128	118	118.000
	GPI	7.659	3.0480	118	118.000
	ULTc	121.191	35.2265	118	118.000
	AfhPfh	128.716	13.1709	118	118.000
	GMSN	96.332	5.3107	185	185.000
	GMFH	104.530	5.1285	185	185.000
	GMBaN	78.410	5.1324	185	185.000
Female	GSgM	162.001	6.1871	185	185.000
	IOpSN	98.279	9.9180	185	185.000
	IOpFH	106.477	9.5952	185	185.000
	IOpBaN	80.356	9.7489	185	185.000

	OIOp	132.671	9.2836	185	185.000
	SgGM	3.435	1.4781	185	185.000
	GSgN	2.026	.8417	185	185.000
	FSHt	19.910	7.3716	185	185.000
	FSWd	6.838	2.1687	185	185.000
	IOpO	17.815	5.5181	185	185.000
	MaSN	31.160	3.9804	185	185.000
	MaFH	21.069	2.6937	185	185.000
	MaHt	5.614	1.3733	185	185.000
	MaWd	15.302	2.7205	185	185.000
	Upperlipthickness	11.576	2.1069	185	185.000
	ChinThickness	11.530	2.3544	185	185.000
	PosteriorFacialHeight	45.713	4.4790	185	185.000
	LAFH	58.437	5.5242	185	185.000
	GPI	6.341	2.3651	185	185.000
	ULTc	103.336	22.9563	185	185.000
	AfhPfh	128.486	12.4892	185	185.000
	GMSN	95.736	16.6698	303	303.000
	GMFH	104.445	13.2084	303	303.000
	GMBaN	78.283	10.5695	303	303.000
Total	GSgM	162.474	6.1093	303	303.000
	IOpSN	97.515	15.0797	303	303.000
	IOpFH	105.606	15.5395	303	303.000
	IOpBaN	79.444	13.5040	303	303.000

OIOp	131.414	17.9036	303	303.000
SgGM	3.394	1.4544	303	303.000
GSgN	2.177	1.0212	303	303.000
FSHt	20.518	7.2407	303	303.000
FSWd	7.049	2.2402	303	303.000
IOpO	18.048	5.4369	303	303.000
MaSN	31.631	4.1101	303	303.000
MaFH	21.090	2.6102	303	303.000
MaHt	5.675	1.9195	303	303.000
MaWd	15.192	2.7457	303	303.000
Upperlipthickness	11.960	2.1739	303	303.000
ChinThickness	11.352	2.7311	303	303.000
PosteriorFacialHeight	46.018	4.6210	303	303.000
LAFH	58.829	5.3817	303	303.000
GPI	6.854	2.7243	303	303.000
ULTc	110.289	29.6290	303	303.000
AfhPfh	128.576	12.7379	303	303.000

Tests of Equality of Group Means

	Wilks' Lambda	F	df1	df2	Sig.
GMSN	.998	.606	1	301	.437
GMFH	1.000	.020	1	301	.889
GMBaN	1.000	.069	1	301	.793
GSgM	.991	2.867	1	301	.091
IOpSN	.996	1.222	1	301	.270
IOpFH	.995	1.495	1	301	.222
IOpBaN	.993	2.177	1	301	.141
OIOp	.992	2.352	1	301	.126
SgGM	.999	.378	1	301	.539
GSgN	.966	10.666	1	301	.001
FSHt	.989	3.378	1	301	.067
FSWd	.986	4.238	1	301	.040
IOpO	.997	.870	1	301	.352
MaSN	.979	6.340	1	301	.012
MaFH	1.000	.031	1	301	.860
MaHt	.998	.482	1	301	.488
MaWd	.997	.763	1	301	.383
Upperlipthickness	.951	15.541	1	301	.000
ChinThickness	.993	2.015	1	301	.157
PosteriorFacialHeight	.993	2.079	1	301	.150
LAFH	.992	2.541	1	301	.112
GPI	.944	17.808	1	301	.000

ULTc	.913	28.548	1	301	.000
AfhPfh	1.000	.023	1	301	.878

Analysis 1

Box's Test of Equality of Covariance Matrices

Log Determinants

GENDERCODE	Rank	Log Determinant
Males	3	10.795
Female	3	9.176
Pooled within-groups	3	9.944

The ranks and natural logarithms of determinants printed are those of the group covariance matrices.

Test Results

Box's M		41.812
F	Approx.	6.888
	df1	6
	df2	415964.898
	Sig.	.000

Tests null hypothesis of equal population covariance matrices.

Stepwise Statistics

Variables Entered/Removed[a,b,c,d]

Step	Entered	Wilks' Lambda							
		Statistic	df1	df2	df3	Exact F			
						Statistic	df1	df2	Sig.
1	ULTc	.913	1	1	301.000	28.548	1	301.000	.000
2	GPI	.873	2	1	301.000	21.916	2	300.000	.000
3	ChinThickness	.855	3	1	301.000	16.953	3	299.000	.000

At each step, the variable that minimizes the overall Wilks' Lambda is entered.

a. Maximum number of steps is 48.

b. Maximum significance of F to enter is .05.

c. Minimum significance of F to remove is .10.

d. F level, tolerance, or VIN insufficient for further computation.

Variables in the Analysis

Step		Tolerance	Sig. of F to Remove	Wilks' Lambda
1	ULTc	1.000	.000	
2	ULTc	.997	.000	.944
	GPI	.997	.000	.913
3	ULTc	.498	.000	.935
	GPI	.973	.001	.885
	ChinThickness	.497	.013	.873

Variables Not in the Analysis

Step		Tolerance	Min. Tolerance	Sig. of F to Enter	Wilks' Lambda
0	GMSN	1.000	1.000	.437	.998
	GMFH	1.000	1.000	.889	1.000
	GMBaN	1.000	1.000	.793	1.000
	GSgM	1.000	1.000	.091	.991
	IOpSN	1.000	1.000	.270	.996
	IOpFH	1.000	1.000	.222	.995
	IOpBaN	1.000	1.000	.141	.993
	OIOp	1.000	1.000	.126	.992
	SgGM	1.000	1.000	.539	.999
	GSgN	1.000	1.000	.001	.966
	FSHt	1.000	1.000	.067	.989
	FSWd	1.000	1.000	.040	.986
	IOpO	1.000	1.000	.352	.997
	MaSN	1.000	1.000	.012	.979
	MaFH	1.000	1.000	.860	1.000
	MaHt	1.000	1.000	.488	.998
	MaWd	1.000	1.000	.383	.997
	Upperlipthickness	1.000	1.000	.000	.951
	ChinThickness	1.000	1.000	.157	.993
	PosteriorFacialHeight	1.000	1.000	.150	.993

1	LAFH	1.000	1.000	.112	.992
	GPI	1.000	1.000	.000	.944
	ULTc	1.000	1.000	.000	.913
	AfhPfh	1.000	1.000	.878	1.000
	GMSN	.999	.999	.387	.911
	GMFH	.998	.998	.698	.913
	GMBaN	.999	.999	.667	.913
	GSgM	.994	.994	.046	.901
	IOpSN	.988	.988	.104	.905
	IOpFH	.990	.990	.091	.905
	IOpBaN	.991	.991	.058	.902
	OIOp	.994	.994	.066	.903
	SgGM	.994	.994	.322	.910
	GSgN	.995	.995	.006	.891
	FSHt	.996	.996	.039	.900
	FSWd	.994	.994	.019	.897
	IOpO	.996	.996	.225	.909
	MaSN	.992	.992	.050	.902
	MaFH	1.000	1.000	.935	.913
	MaHt	1.000	1.000	.450	.912
	MaWd	.997	.997	.276	.910
	Upperlipthickness	.895	.895	.027	.899
	ChinThickness	.509	.509	.002	.885
	PosteriorFacialHeight	.979	.979	.033	.900

	LAFH	.991	.991	.044	.901
	GPI	.997	.997	.000	.873
	AfhPfh	.996	.996	.870	.913
	GMSN	.965	.963	.123	.866
	GMFH	.967	.967	.303	.869
	GMBaN	.953	.951	.218	.868
	GSgM	.822	.822	.637	.872
	IOpSN	.983	.983	.183	.867
	IOpFH	.985	.985	.164	.867
	IOpBaN	.984	.984	.121	.866
	OIOp	.992	.991	.106	.865
	SgGM	.897	.897	.857	.872
	GSgN	.165	.165	.106	.865
2	FSHt	.962	.962	.173	.867
	FSWd	.906	.906	.209	.868
	IOpO	.989	.989	.382	.870
	MaSN	.979	.979	.134	.866
	MaFH	.978	.975	.639	.872
	MaHt	.997	.995	.573	.872
	MaWd	.983	.982	.130	.866
	Upperlipthickness	.878	.878	.093	.864
	ChinThickness	.497	.497	.013	.855
	PosteriorFacialHeight	.926	.926	.202	.868
	LAFH	.943	.943	.233	.868

	AfhPfh	.995	.993	.966	.873
	GMSN	.964	.496	.154	.849
	GMFH	.961	.494	.408	.853
	GMBaN	.949	.495	.286	.851
	GSgM	.822	.495	.631	.854
	IOpSN	.981	.496	.228	.850
	IOpFH	.983	.496	.204	.850
	IOpBaN	.983	.496	.138	.848
	OIOp	.988	.495	.150	.849
	SgGM	.896	.493	.931	.855
	GSgN	.165	.164	.116	.848
3	FSHt	.959	.496	.220	.850
	FSWd	.901	.494	.286	.851
	IOpO	.980	.491	.270	.851
	MaSN	.978	.495	.159	.849
	MaFH	.977	.497	.624	.854
	MaHt	.993	.495	.690	.854
	MaWd	.982	.497	.153	.849
	Upperlipthickness	.169	.096	.205	.850
	PosteriorFacialHeight	.843	.453	.582	.854
	LAFH	.933	.492	.350	.852
	AfhPfh	.962	.480	.676	.854

Wilks' Lambda

Number of Variables	Lambda	df1	df2	df3	Exact F			
					Statistic	df1	df2	Sig.
1	.913	1	1	301	28.548	1	301.000	.000
2	.873	2	1	301	21.916	2	300.000	.000
3	.855	3	1	301	16.953	3	299.000	.000

Summary of Canonical Discriminant Functions

Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	.170[a]	100.0	100.0	.381

a. First 1 canonical discriminant functions were used in the analysis.

Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.855	47.048	3	.000

Standardized Canonical Discriminant Function Coefficients

	Function
	1
ChinThickness	.533
GPI	.491

ULTc	1.093

Structure Matrix

	Function
	1
ULTc	.747
Upperlipthickness[a]	.630
GPI	.590
GSgN[a]	.554
ChinThickness	-.198
GSgM[a]	.170
MaSN[a]	.140
FSWd[a]	.134
PosteriorFacialHeight[a]	.125
GMBaN[a]	.121
GMSN[a]	.104
GMFH[a]	.104
MaFH[a]	.098
SgGM[a]	-.098
MaWd[a]	.094
LAFH[a]	.085
FSHt[a]	.074
AfhPfh[a]	-.041
MaHt[a]	.037
IOpO[a]	-.036

IOpSN[a]	.027
IOpFH[a]	.021
IOpBaN[a]	.018
OIOp[a]	.004

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions

Variables ordered by absolute size of correlation within function.

a. This variable not used in the analysis.

Functions at Group Centroids

GENDERCODE	Function
	1
Males	.515
Female	-.328

Unstandardized canonical discriminant functions evaluated at group means

Classification Statistics

Prior Probabilities for Groups

GENDERCODE	Prior	Cases Used in Analysis	
		Unweighted	Weighted
Males	.389	118	118.000
Female	.611	185	185.000
Total	1.000	303	303.000

Classification Function Coefficients

	GENDERCODE	
	Males	Female
ChinThickness	4.993	4.829
GPI	.439	.283
ULTc	.485	.452
(Constant)	-59.643	-52.592

Fisher's linear discriminant functions

Classification Results[a]

		GENDERCODE	Predicted Group Membership		Total
			Males	Female	
Original	Count	Males	45	73	118
		Female	24	161	185
	%	Males	38.1	61.9	100.0
		Female	13.0	87.0	100.0

a. 68.0% of original grouped cases correctly classified.

APPENDIX E

Data for the 6.5-8.5 Age Groups

Group Statistics

GENDERCODE		Mean	Std. Deviation	Valid N (listwise)	
				Unweighted	Weighted
Males	GMSN	97.157	2.0468	7	7.000
	GMFH	105.829	3.5617	7	7.000
	GMBaN	78.214	1.6787	7	7.000
	GSgM	155.286	3.6260	7	7.000
	IOpSN	102.914	17.1263	7	7.000
	IOpFH	111.571	14.9088	7	7.000
	IOpBaN	83.986	16.7192	7	7.000
	OIOp	135.771	13.2817	7	7.000
	SgGM	5.243	1.3327	7	7.000
	GSgN	2.100	.4726	7	7.000
	FSHt	18.029	5.2598	7	7.000
	FSWd	5.357	1.1674	7	7.000
	IOpO	16.686	7.1306	7	7.000
	MaSN	30.443	2.7312	7	7.000
	MaFH	20.571	2.0686	7	7.000
	MaHt	4.100	.4282	7	7.000
	MaWd	14.214	2.1559	7	7.000
	Upperlipthickness	11.214	1.2061	7	7.000

Female	ChinThickness	9.857	3.4995	7	7.000
	PosteriorFacialHeight	44.186	3.1541	7	7.000
	LAFH	55.671	3.0918	7	7.000
	GPI	6.629	1.3124	7	7.000
	ULTc	125.443	46.2326	7	7.000
	AfhPfh	126.171	6.2614	7	7.000
	GMSN	92.115	4.6918	13	13.000
	GMFH	99.592	3.6206	13	13.000
	GMBaN	73.877	4.1497	13	13.000
	GSgM	156.762	2.8462	13	13.000
	IOpSN	97.808	7.3829	13	13.000
	IOpFH	105.292	6.5314	13	13.000
	IOpBaN	79.562	6.3601	13	13.000
	OIOp	129.415	7.1988	13	13.000
	SgGM	4.392	.7805	13	13.000
	GSgN	1.354	.7264	13	13.000
	FSHt	15.169	9.0916	13	13.000
	FSWd	5.369	1.8746	13	13.000
	IOpO	19.015	4.2113	13	13.000
	MaSN	30.746	3.6161	13	13.000
	MaFH	20.285	2.9611	13	13.000
	MaHt	5.069	1.5381	13	13.000
	MaWd	15.138	2.6225	13	13.000
	Upperlipthickness	10.400	1.9900	13	13.000

	ChinThickness	10.300	1.7142	13	13.000
	PosteriorFacialHeight	41.946	3.2103	13	13.000
	LAFH	54.808	4.2525	13	13.000
	GPI	4.346	2.2153	13	13.000
	ULTc	102.192	19.4326	13	13.000
	AfhPfh	130.792	7.3215	13	13.000
	GMSN	93.880	4.6166	20	20.000
	GMFH	101.775	4.6475	20	20.000
	GMBaN	75.395	4.0337	20	20.000
	GSgM	156.245	3.1289	20	20.000
	IOpSN	99.595	11.5454	20	20.000
	IOpFH	107.490	10.3235	20	20.000
	IOpBaN	81.110	10.8862	20	20.000
	OIOp	131.640	9.9051	20	20.000
Total	SgGM	4.690	1.0578	20	20.000
	GSgN	1.615	.7329	20	20.000
	FSHt	16.170	7.9309	20	20.000
	FSWd	5.365	1.6278	20	20.000
	IOpO	18.200	5.3439	20	20.000
	MaSN	30.640	3.2613	20	20.000
	MaFH	20.385	2.6284	20	20.000
	MaHt	4.730	1.3330	20	20.000
	MaWd	14.815	2.4528	20	20.000

Upperlipthickness	10.685	1.7661	20	20.000
ChinThickness	10.145	2.4021	20	20.000
PosteriorFacialHeight	42.730	3.2942	20	20.000
LAFH	55.110	3.8235	20	20.000
GPI	5.145	2.2116	20	20.000
ULTc	110.330	32.2946	20	20.000
AfhPfh	129.175	7.1658	20	20.000

Tests of Equality of Group Means

	Wilks' Lambda	F	df1	df2	Sig.
GMSN	.714	7.196	1	18	.015
GMFH	.569	13.645	1	18	.002
GMBaN	.723	6.892	1	18	.017
GSgM	.947	1.013	1	18	.328
IOpSN	.953	.885	1	18	.359
IOpFH	.911	1.750	1	18	.202
IOpBaN	.960	.741	1	18	.401
OIOp	.901	1.969	1	18	.178
SgGM	.845	3.298	1	18	.086
GSgN	.752	5.943	1	18	.025
FSHt	.969	.578	1	18	.457
FSWd	1.000	.000	1	18	.988
IOpO	.954	.858	1	18	.366
MaSN	.998	.037	1	18	.849

MaFH	.997	.051	1	18	.823
MaHt	.873	2.609	1	18	.124
MaWd	.966	.634	1	18	.436
Upperlipthickness	.949	.965	1	18	.339
ChinThickness	.992	.148	1	18	.705
PosteriorFacialHeight	.889	2.240	1	18	.152
LAFH	.988	.223	1	18	.643
GPI	.745	6.163	1	18	.023
ULTc	.876	2.551	1	18	.128
AfhPfh	.900	1.991	1	18	.175

Analysis 1

Box's Test of Equality of Covariance Matrices

Log Determinants

GENDERCODE	Rank	Log Determinant
Males	.[a]	.[b]
Female	.[c]	.[b]
Pooled within-groups	18	7.525

The ranks and natural logarithms of determinants printed are those of the group covariance matrices.

a. Rank < 7

b. Too few cases to be non-singular

c. Rank < 13

Test Results[a]

Tests null hypothesis of equal population covariance matrices.

a. No test can be performed with fewer than two nonsingular group covariance matrices.

Variables Failing Tolerance Test[a]

	Within-Groups Variance	Tolerance	Minimum Tolerance
IOpFH	102.530	.000	.000
IOpBaN	120.144	.000	.000
ChinThickness	6.041	.000	.000
GPI	3.846	.000	.000
ULTc	964.234	.000	.000
AfhPfh	48.805	.000	.000

All variables passing the tolerance criteria are entered simultaneously.

a. Minimum tolerance level is .001.

Summary of Canonical Discriminant Functions

Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	13.728[a]	100.0	100.0	.965

a. First 1 canonical discriminant functions were used in the analysis.

Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.068	24.208	18	.148

Standardized Canonical Discriminant Function Coefficients

	Function
	1
GMSN	8.251
GMFH	-10.722
GMBaN	9.794
GSgM	3.621
IOpSN	-1.868
OIOp	17.902
SgGM	6.870
GSgN	-6.497
FSHt	-1.979
FSWd	-3.603
IOpO	20.869
MaSN	-3.260
MaFH	.397
MaHt	-6.351
MaWd	-1.601
Upperlipthickness	-2.533
PosteriorFacialHeight	.660

LAFH	2.448

Structure Matrix

	Function
	1
ULTc[a]	.301
GMFH	.235
ChinThickness[a]	-.218
GMSN	.171
GMBaN	.167
GSgN	.155
SgGM	.116
MaHt	-.103
AfhPfh[a]	-.099
PosteriorFacialHeight	.095
OIOp	.089
IOpFH[a]	.085
GSgM	-.064
GPI[a]	.063
Upperlipthickness	.063
IOpSN	.060
IOpO	-.059
IOpBaN[a]	.056
MaWd	-.051

FSHt	.048
LAFH	.030
MaFH	.014
MaSN	-.012
FSWd	-.001

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions

Variables ordered by absolute size of correlation within function.

a. This variable not used in the analysis.

Functions at Group Centroids

GENDERCODE	Function
	1
Males	4.790
Female	-2.579

Unstandardized canonical discriminant functions evaluated at group means

Classification Statistics

Classification Processing Summary

Processed		20
Excluded	Missing or out-of-range group codes	0
	At least one missing discriminating variable	0
Used in Output		20

Prior Probabilities for Groups

GENDERCODE	Prior	Cases Used in Analysis	
		Unweighted	Weighted
Males	.350	7	7.000
Female	.650	13	13.000
Total	1.000	20	20.000

Classification Function Coefficients

	GENDERCODE	
	Males	Female
GMSN	310.367	295.199
GMFH	-1394.443	-1372.502
GMBaN	2260.996	2240.515

GSgM	979.535	971.004
IOpSN	-18.507	-17.318
OIOp	1194.046	1180.391
SgGM	4364.703	4314.029
GSgN	-6643.820	-6570.485
FSHt	-267.131	-265.313
FSWd	-888.375	-872.497
IOpO	2524.334	2495.662
MaSN	-158.908	-151.732
MaFH	-452.589	-453.674
MaHt	-3158.822	-3122.257
MaWd	-462.308	-457.545
Upperlipthickness	-829.870	-819.310
PosteriorFacialHeight	110.813	109.289
LAFH	288.180	283.560
(Constant)	-195593.359	-191545.435

Fisher's linear discriminant functions

Classification Results[a]

		GENDERCODE	Predicted Group Membership		Total
			Males	Female	
Original	Count	Males	7	0	7
		Female	0	13	13
	%	Males	100.0	.0	100.0
		Female	.0	100.0	100.0

a. 100.0% of original grouped cases correctly classified.

Discriminant

Group Statistics

GENDERCODE		Mean	Std. Deviation	Valid N (listwise)	
				Unweighted	Weighted
Males	GMSN	97.157	2.0468	7	7.000
	GMFH	105.829	3.5617	7	7.000
	GMBaN	78.214	1.6787	7	7.000
	GSgM	155.286	3.6260	7	7.000
	IOpSN	102.914	17.1263	7	7.000
	IOpFH	111.571	14.9088	7	7.000
	IOpBaN	83.986	16.7192	7	7.000
	OIOp	135.771	13.2817	7	7.000
	SgGM	5.243	1.3327	7	7.000

Female	GSgN	2.100	.4726	7	7.000
	FSHt	18.029	5.2598	7	7.000
	FSWd	5.357	1.1674	7	7.000
	IOpO	16.686	7.1306	7	7.000
	MaSN	30.443	2.7312	7	7.000
	MaFH	20.571	2.0686	7	7.000
	MaHt	4.100	.4282	7	7.000
	MaWd	14.214	2.1559	7	7.000
	Upperlipthickness	11.214	1.2061	7	7.000
	ChinThickness	9.857	3.4995	7	7.000
	PosteriorFacialHeight	44.186	3.1541	7	7.000
	LAFH	55.671	3.0918	7	7.000
	GPI	6.629	1.3124	7	7.000
	ULTc	125.443	46.2326	7	7.000
	AfhPfh	126.171	6.2614	7	7.000
	GMSN	92.115	4.6918	13	13.000
	GMFH	99.592	3.6206	13	13.000
	GMBaN	73.877	4.1497	13	13.000
	GSgM	156.762	2.8462	13	13.000
	IOpSN	97.808	7.3829	13	13.000
	IOpFH	105.292	6.5314	13	13.000
	IOpBaN	79.562	6.3601	13	13.000
	OIOp	129.415	7.1988	13	13.000

Total	SgGM	4.392	.7805	13	13.000
	GSgN	1.354	.7264	13	13.000
	FSHt	15.169	9.0916	13	13.000
	FSWd	5.369	1.8746	13	13.000
	IOpO	19.015	4.2113	13	13.000
	MaSN	30.746	3.6161	13	13.000
	MaFH	20.285	2.9611	13	13.000
	MaHt	5.069	1.5381	13	13.000
	MaWd	15.138	2.6225	13	13.000
	Upperlipthickness	10.400	1.9900	13	13.000
	ChinThickness	10.300	1.7142	13	13.000
	PosteriorFacialHeight	41.946	3.2103	13	13.000
	LAFH	54.808	4.2525	13	13.000
	GPI	4.346	2.2153	13	13.000
	ULTc	102.192	19.4326	13	13.000
	AfhPfh	130.792	7.3215	13	13.000
	GMSN	93.880	4.6166	20	20.000
	GMFH	101.775	4.6475	20	20.000
	GMBaN	75.395	4.0337	20	20.000
	GSgM	156.245	3.1289	20	20.000
	IOpSN	99.595	11.5454	20	20.000
	IOpFH	107.490	10.3235	20	20.000
	IOpBaN	81.110	10.8862	20	20.000
	OIOp	131.640	9.9051	20	20.000

SgGM	4.690	1.0578	20	20.000
GSgN	1.615	.7329	20	20.000
FSHt	16.170	7.9309	20	20.000
FSWd	5.365	1.6278	20	20.000
IOpO	18.200	5.3439	20	20.000
MaSN	30.640	3.2613	20	20.000
MaFH	20.385	2.6284	20	20.000
MaHt	4.730	1.3330	20	20.000
MaWd	14.815	2.4528	20	20.000
Upperlipthickness	10.685	1.7661	20	20.000
ChinThickness	10.145	2.4021	20	20.000
PosteriorFacialHeight	42.730	3.2942	20	20.000
LAFH	55.110	3.8235	20	20.000
GPI	5.145	2.2116	20	20.000
ULTc	110.330	32.2946	20	20.000
AfhPfh	129.175	7.1658	20	20.000

Tests of Equality of Group Means

	Wilks' Lambda	F	df1	df2	Sig.
GMSN	.714	7.196	1	18	.015
GMFH	.569	13.645	1	18	.002
GMBaN	.723	6.892	1	18	.017

GSgM	.947	1.013	1	18	.328
IOpSN	.953	.885	1	18	.359
IOpFH	.911	1.750	1	18	.202
IOpBaN	.960	.741	1	18	.401
OIOp	.901	1.969	1	18	.178
SgGM	.845	3.298	1	18	.086
GSgN	.752	5.943	1	18	.025
FSHt	.969	.578	1	18	.457
FSWd	1.000	.000	1	18	.988
IOpO	.954	.858	1	18	.366
MaSN	.998	.037	1	18	.849
MaFH	.997	.051	1	18	.823
MaHt	.873	2.609	1	18	.124
MaWd	.966	.634	1	18	.436
Upperlipthickness	.949	.965	1	18	.339
ChinThickness	.992	.148	1	18	.705
PosteriorFacialHeight	.889	2.240	1	18	.152
LAFH	.988	.223	1	18	.643
GPI	.745	6.163	1	18	.023
ULTc	.876	2.551	1	18	.128
AfhPfh	.900	1.991	1	18	.175

Analysis 1

Box's Test of Equality of Covariance Matrices

Log Determinants

GENDERCODE	Rank	Log Determinant
Males	2	7.526
Female	2	6.231
Pooled within-groups	2	7.005

The ranks and natural logarithms of determinants printed are those of the group covariance matrices.

Test Results

Box's M		6.148
F	Approx.	1.760
	df1	3
	df2	3651.339
	Sig.	.153

Tests null hypothesis of equal population covariance matrices.

Stepwise Statistics

Variables Entered/Removed[a,b,c,d]

Step	Entered	Wilks' Lambda							
		Statistic	df1	df2	df3	Exact F			
						Statistic	df1	df2	Sig.
1	GMFH	.569	1	1	18.000	13.645	1	18.000	.002
2	IOpFH	.434	2	1	18.000	11.080	2	17.000	.001

At each step, the variable that minimizes the overall Wilks' Lambda is entered.

a. Maximum number of steps is 48.

b. Maximum significance of F to enter is .05.

c. Minimum significance of F to remove is .10.

d. F level, tolerance, or VIN insufficient for further computation.

Variables in the Analysis

Step		Tolerance	Sig. of F to Remove	Wilks' Lambda
1	GMFH	1.000	.002	
2	GMFH	.829	.000	.911
	IOpFH	.829	.035	.569

Variables Not in the Analysis

Step		Tolerance	Min. Tolerance	Sig. of F to Enter	Wilks' Lambda
0	GMSN	1.000	1.000	.015	.714
	GMFH	1.000	1.000	.002	.569
	GMBaN	1.000	1.000	.017	.723
	GSgM	1.000	1.000	.328	.947
	IOpSN	1.000	1.000	.359	.953
	IOpFH	1.000	1.000	.202	.911
	IOpBaN	1.000	1.000	.401	.960
	OIOp	1.000	1.000	.178	.901
	SgGM	1.000	1.000	.086	.845
	GSgN	1.000	1.000	.025	.752
	FSHt	1.000	1.000	.457	.969
	FSWd	1.000	1.000	.988	1.000
	IOpO	1.000	1.000	.366	.954

	MaSN	1.000	1.000	.849	.998
	MaFH	1.000	1.000	.823	.997
	MaHt	1.000	1.000	.124	.873
	MaWd	1.000	1.000	.436	.966
	Upperlipthickness	1.000	1.000	.339	.949
	ChinThickness	1.000	1.000	.705	.992
	PosteriorFacialHeight	1.000	1.000	.152	.889
	LAFH	1.000	1.000	.643	.988
	GPI	1.000	1.000	.023	.745
	ULTc	1.000	1.000	.128	.876
	AfhPfh	1.000	1.000	.175	.900
	GMSN	.608	.608	.733	.565
	GMBaN	.420	.420	.834	.567
	GSgM	1.000	1.000	.461	.550
	IOpSN	.793	.793	.045	.446
	IOpFH	.829	.829	.035	.434
	IOpBaN	.783	.783	.047	.448
1	OIOp	.908	.908	.069	.466
	SgGM	.984	.984	.110	.487
	GSgN	.842	.842	.450	.549
	FSHt	.966	.966	.298	.533
	FSWd	.965	.965	.620	.560
	IOpO	.942	.942	.188	.512
	MaSN	.988	.988	.881	.568

	MaFH	.999	.999	.926	.569
	MaHt	.999	.999	.278	.530
	MaWd	.987	.987	.788	.566
	Upperlipthickness	.773	.773	.526	.555
	ChinThickness	.907	.907	.261	.527
	PosteriorFacialHeight	.873	.873	.890	.568
	LAFH	.947	.947	.779	.566
	GPI	.790	.790	.523	.555
	ULTc	.999	.999	.286	.531
	AfhPfh	.969	.969	.578	.558
	GMSN	.581	.487	.907	.434
	GMBaN	.416	.370	.722	.431
	GSgM	.717	.594	.646	.428
	IOpSN	.068	.068	.916	.434
	IOpBaN	.043	.043	.736	.431
	OIOp	.188	.172	.850	.433
2	SgGM	.537	.452	.874	.433
	GSgN	.826	.686	.698	.430
	FSHt	.961	.812	.452	.419
	FSWd	.944	.784	.479	.420
	IOpO	.247	.217	.335	.409
	MaSN	.911	.763	.669	.429
	MaFH	.994	.824	.955	.434

MaHt	.977	.810	.516	.422
MaWd	.987	.819	.824	.433
Upperlipthickness	.760	.635	.427	.417
ChinThickness	.784	.717	.774	.432
PosteriorFacialHeight	.857	.762	.708	.430
LAFH	.945	.786	.748	.431
GPI	.788	.691	.515	.422
ULTc	.736	.610	.939	.434
AfhPfh	.925	.791	.373	.412

Wilks' Lambda

Step	Number of Variables	Lambda	df1	df2	df3	Exact F			
						Statistic	df1	df2	Sig.
1	1	.569	1	1	18	13.645	1	18.000	.002
2	2	.434	2	1	18	11.080	2	17.000	.001

Summary of Canonical Discriminant Functions

Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	1.304[a]	100.0	100.0	.752

a. First 1 canonical discriminant functions were used in the analysis.

Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.434	14.186	2	.001

Standardized Canonical Discriminant Function Coefficients

	Function
	1
GMFH	1.057
IOpFH	.711

Structure Matrix

	Function
	1
GMFH	.763
GMBaN[a]	.620
GMSN[a]	.584
Upperlipthickness[a]	.439
GSgN[a]	.384
IOpO[a]	-.356
ULTc[a]	.352
GSgM[a]	-.339
SgGM[a]	.336
OIOp[a]	.317
GPI[a]	.316
IOpFH	.273
FSWd[a]	-.237
IOpSN[a]	.203
LAFH[a]	.203
IOpBaN[a]	.201
PosteriorFacialHeight[a]	.192
MaHt[a]	-.115
MaSN[a]	.098
FSHt[a]	-.094
MaWd[a]	-.090

MaFH[a]	.066
ChinThickness[a]	.006
AfhPfh[a]	.002

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions

Variables ordered by absolute size of correlation within function.

a. This variable not used in the analysis.

Functions at Group Centroids

GENDERCODE	Function
	1
Males	1.476
Female	-.795

Unstandardized canonical discriminant functions evaluated at group means

Classification Statistics

Classification Processing Summary

Processed		20
Excluded	Missing or out-of-range group codes	0
	At least one missing discriminating variable	0
Used in Output		20

Prior Probabilities for Groups

GENDERCODE	Prior	Cases Used in Analysis	
		Unweighted	Weighted
Males	.350	7	7.000
Female	.650	13	13.000
Total	1.000	20	20.000

Classification Function Coefficients

	GENDERCODE	
	Males	Female
GMFH	11.378	10.712
IOpFH	2.764	2.604
(Constant)	-757.290	-670.938

Fisher's linear discriminant functions

Classification Results[a]

		GENDERCODE	Predicted Group Membership		Total
			Males	Female	
Original	Count	Males	6	1	7
		Female	1	12	13
	%	Males	85.7	14.3	100.0

	Female	7.7	92.3	100.0

a. 90.0% of original grouped cases correctly classified.

APPENDIX F

Data for the 8.6-10.5 Age Groups

Group Statistics

GENDERCODE		Mean	Std. Deviation	Valid N (listwise)	
				Unweighted	Weighted
Males	GMSN	81.075	55.2696	24	24.000
	GMFH	96.854	43.8130	24	24.000
	GMBaN	71.675	33.2247	24	24.000
	GSgM	160.829	5.7726	24	24.000
	IOpSN	88.267	40.8033	24	24.000
	IOpFH	96.263	43.5518	24	24.000
	IOpBaN	71.054	33.1021	24	24.000
	OIOp	119.900	54.9791	24	24.000
	SgGM	3.746	1.2901	24	24.000
	GSgN	1.863	1.2021	24	24.000
	FSHt	17.650	5.2741	24	24.000
	FSWd	6.208	1.6024	24	24.000
	IOpO	18.713	4.9511	24	24.000
	MaSN	30.788	3.7538	24	24.000
	MaFH	20.225	2.3122	24	24.000
	MaHt	5.379	3.9827	24	24.000
	MaWd	15.458	2.6221	24	24.000
	Upperlipthickness	12.267	2.5113	24	24.000

Female	ChinThickness	10.504	3.0504	24	24.000
	PosteriorFacialHeight	44.796	3.2993	24	24.000
	LAFH	57.958	3.8626	24	24.000
	GPI	6.708	2.0293	24	24.000
	ULTc	123.542	37.9126	24	24.000
	AfhPfh	129.792	10.0067	24	24.000
	GMSN	94.647	5.1135	36	36.000
	GMFH	103.003	5.2779	36	36.000
	GMBaN	76.689	5.1995	36	36.000
	GSgM	162.167	8.2225	36	36.000
	IOpSN	99.544	10.6437	36	36.000
	IOpFH	107.892	9.9786	36	36.000
	IOpBaN	81.589	10.6348	36	36.000
	OIOp	134.469	9.3093	36	36.000
	SgGM	3.314	2.0223	36	36.000
	GSgN	1.842	.7758	36	36.000
	FSHt	16.675	6.5258	36	36.000
	FSWd	6.528	1.9635	36	36.000
	IOpO	16.903	5.7005	36	36.000
	MaSN	30.603	4.2370	36	36.000
	MaFH	20.672	2.9630	36	36.000
	MaHt	5.750	1.8063	36	36.000
	MaWd	16.567	3.3071	36	36.000
	Upperlipthickness	11.103	2.1094	36	36.000

	ChinThickness	10.778	2.3288	36	36.000
	PosteriorFacialHeight	43.128	5.1228	36	36.000
	LAFH	55.714	6.0573	36	36.000
	GPI	6.303	2.2783	36	36.000
	ULTc	105.311	21.2352	36	36.000
	AfhPfh	129.717	10.7563	36	36.000
	GMSN	89.218	35.3737	60	60.000
	GMFH	100.543	27.8220	60	60.000
	GMBaN	74.683	21.2720	60	60.000
	GSgM	161.632	7.3167	60	60.000
	IOpSN	95.033	27.3365	60	60.000
	IOpFH	103.240	28.8356	60	60.000
	IOpBaN	77.375	22.8328	60	60.000
	OIOp	128.642	35.7989	60	60.000
Total	SgGM	3.487	1.7665	60	60.000
	GSgN	1.850	.9594	60	60.000
	FSHt	17.065	6.0281	60	60.000
	FSWd	6.400	1.8201	60	60.000
	IOpO	17.627	5.4435	60	60.000
	MaSN	30.677	4.0188	60	60.000
	MaFH	20.493	2.7094	60	60.000
	MaHt	5.602	2.8552	60	60.000
	MaWd	16.123	3.0771	60	60.000

Upperlipthickness	11.568	2.3299	60	60.000
ChinThickness	10.668	2.6197	60	60.000
PosteriorFacialHeight	43.795	4.5266	60	60.000
LAFH	56.612	5.3676	60	60.000
GPI	6.465	2.1736	60	60.000
ULTc	112.603	30.1488	60	60.000
AfhPfh	129.747	10.3764	60	60.000

Tests of Equality of Group Means

	Wilks' Lambda	F	df1	df2	Sig.
GMSN	.964	2.162	1	58	.147
GMFH	.988	.700	1	58	.406
GMBaN	.986	.797	1	58	.376
GSgM	.992	.477	1	58	.493
IOpSN	.958	2.514	1	58	.118
IOpFH	.960	2.398	1	58	.127
IOpBaN	.948	3.179	1	58	.080
OIOp	.960	2.443	1	58	.123
SgGM	.985	.859	1	58	.358
GSgN	1.000	.007	1	58	.935
FSHt	.994	.373	1	58	.544
FSWd	.992	.439	1	58	.510

IOpO	.973	1.608	1	58	.210
MaSN	.999	.030	1	58	.863
MaFH	.993	.388	1	58	.536
MaHt	.996	.240	1	58	.626
MaWd	.968	1.897	1	58	.174
Upperlipthickness	.939	3.761	1	58	.057
ChinThickness	.997	.155	1	58	.695
PosteriorFacialHeight	.967	1.988	1	58	.164
LAFH	.957	2.585	1	58	.113
GPI	.992	.497	1	58	.484
ULTc	.911	5.683	1	58	.020
AfhPfh	1.000	.001	1	58	.978

Analysis 1

Box's Test of Equality of Covariance Matrices

Log Determinants

GENDERCODE	Rank	Log Determinant
Males	18	27.891
Female	18	14.316
Pooled within-groups	18	35.788

The ranks and natural logarithms of determinants printed are those of the group covariance matrices.

Test Results

Box's M		933.133
F	Approx.	3.494
	df1	171
	df2	7538.354
	Sig.	.000

Tests null hypothesis of equal population covariance matrices.

Variables Failing Tolerance Test[a]

	Within-Groups Variance	Tolerance	Minimum Tolerance
IOpBaN	502.771	.000	.000
MaFH	7.418	.200	.001
PosteriorFacialHeight	20.153	.465	.001
LAFH	28.057	.481	.001
ULTc	842.105	.050	.001
AfhPfh	109.526	.767	.001

All variables passing the tolerance criteria are entered simultaneously.

a. Minimum tolerance level is .001.

Summary of Canonical Discriminant Functions

Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	.853[a]	100.0	100.0	.678

a. First 1 canonical discriminant functions were used in the analysis.

Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.540	30.217	18	.035

Standardized Canonical Discriminant Function Coefficients

	Function
	1
GMSN	-.405
GMFH	15.101
GMBaN	-8.486
GSgM	.695
IOpSN	13.322
IOpFH	-15.272

OIOp	-4.367
SgGM	1.390
GSgN	-1.543
FSHt	-.163
FSWd	-.647
IOpO	-.314
MaSN	-1.038
MaHt	1.108
MaWd	-.232
Upperlipthickness	.624
ChinThickness	-.052
GPI	.991

Structure Matrix

	Function
	1
ULTc[a]	.313
Upperlipthickness	.276
IOpBaN[a]	-.252
IOpSN	-.225
OIOp	-.222
IOpFH	-.220
PosteriorFacialHeight[a]	-.217

GMSN	-.209
MaWd	-.196
IOpO	.180
LAFH[a]	-.143
SgGM	.132
MaFH[a]	-.130
GMBaN	-.127
GMFH	-.119
AfhPfh[a]	.103
GPI	.100
GSgM	-.098
FSWd	-.094
FSHt	.087
MaHt	-.070
ChinThickness	-.056
MaSN	.025
GSgN	.012

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions

Variables ordered by absolute size of correlation within function.

a. This variable not used in the analysis.

Functions at Group Centroids

GENDERCODE	Function
	1
Males	1.112
Female	-.741

Unstandardized canonical discriminant functions evaluated at group means

Classification Statistics

Prior Probabilities for Groups

GENDERCODE	Prior	Cases Used in Analysis	
		Unweighted	Weighted
Males	.400	24	24.000
Female	.600	36	36.000
Total	1.000	60	60.000

Classification Function Coefficients

	GENDERCODE	
	Males	Female
GMSN	.082	.103
GMFH	-16.806	-17.810
GMBaN	15.468	16.206
GSgM	89.039	88.864

IOpSN	-31.934	-32.849
IOpFH	31.808	32.801
OIOp	7.016	7.245
SgGM	384.360	382.903
GSgN	-234.908	-231.953
FSHt	8.916	8.966
FSWd	-29.457	-28.801
IOpO	11.646	11.754
MaSN	11.707	12.182
MaHt	-4.632	-5.346
MaWd	.137	.278
Upperlipthickness	-3.201	-3.709
ChinThickness	-9.689	-9.652
GPI	57.736	56.895
(Constant)	-8336.211	-8317.534

Fisher's linear discriminant functions

Classification Results[a]

		GENDERCODE	Predicted Group Membership		Total
			Males	Female	
Original	Count	Males	18	6	24
		Female	4	32	36
	%	Males	75.0	25.0	100.0

	Female	11.1	88.9	100.0

a. 83.3% of original grouped cases correctly classified.

Discriminant

Group Statistics

GENDERCODE		Mean	Std. Deviation	Valid N (listwise)	
				Unweighted	Weighted
Males	GMSN	81.075	55.2696	24	24.000
	GMFH	96.854	43.8130	24	24.000
	GMBaN	71.675	33.2247	24	24.000
	GSgM	160.829	5.7726	24	24.000
	IOpSN	88.267	40.8033	24	24.000
	IOpFH	96.263	43.5518	24	24.000
	IOpBaN	71.054	33.1021	24	24.000
	OIOp	119.900	54.9791	24	24.000
	SgGM	3.746	1.2901	24	24.000
	GSgN	1.863	1.2021	24	24.000
	FSHt	17.650	5.2741	24	24.000
	FSWd	6.208	1.6024	24	24.000
	IOpO	18.713	4.9511	24	24.000
	MaSN	30.788	3.7538	24	24.000

Female	MaFH	20.225	2.3122	24	24.000
	MaHt	5.379	3.9827	24	24.000
	MaWd	15.458	2.6221	24	24.000
	Upperlipthickness	12.267	2.5113	24	24.000
	ChinThickness	10.504	3.0504	24	24.000
	PosteriorFacialHeight	44.796	3.2993	24	24.000
	LAFH	57.958	3.8626	24	24.000
	GPI	6.708	2.0293	24	24.000
	ULTc	123.542	37.9126	24	24.000
	AfhPfh	129.792	10.0067	24	24.000
	GMSN	94.647	5.1135	36	36.000
	GMFH	103.003	5.2779	36	36.000
	GMBaN	76.689	5.1995	36	36.000
	GSgM	162.167	8.2225	36	36.000
	IOpSN	99.544	10.6437	36	36.000
	IOpFH	107.892	9.9786	36	36.000
	IOpBaN	81.589	10.6348	36	36.000
	OIOp	134.469	9.3093	36	36.000
	SgGM	3.314	2.0223	36	36.000
	GSgN	1.842	.7758	36	36.000
	FSHt	16.675	6.5258	36	36.000
	FSWd	6.528	1.9635	36	36.000
	IOpO	16.903	5.7005	36	36.000
	MaSN	30.603	4.2370	36	36.000

	MaFH	20.672	2.9630	36	36.000
	MaHt	5.750	1.8063	36	36.000
	MaWd	16.567	3.3071	36	36.000
	Upperlipthickness	11.103	2.1094	36	36.000
	ChinThickness	10.778	2.3288	36	36.000
	PosteriorFacialHeight	43.128	5.1228	36	36.000
	LAFH	55.714	6.0573	36	36.000
	GPI	6.303	2.2783	36	36.000
	ULTc	105.311	21.2352	36	36.000
	AfhPfh	129.717	10.7563	36	36.000
	GMSN	89.218	35.3737	60	60.000
	GMFH	100.543	27.8220	60	60.000
	GMBaN	74.683	21.2720	60	60.000
	GSgM	161.632	7.3167	60	60.000
	IOpSN	95.033	27.3365	60	60.000
	IOpFH	103.240	28.8356	60	60.000
Total	IOpBaN	77.375	22.8328	60	60.000
	OIOp	128.642	35.7989	60	60.000
	SgGM	3.487	1.7665	60	60.000
	GSgN	1.850	.9594	60	60.000
	FSHt	17.065	6.0281	60	60.000
	FSWd	6.400	1.8201	60	60.000
	IOpO	17.627	5.4435	60	60.000

MaSN	30.677	4.0188	60	60.000
MaFH	20.493	2.7094	60	60.000
MaHt	5.602	2.8552	60	60.000
MaWd	16.123	3.0771	60	60.000
Upperlipthickness	11.568	2.3299	60	60.000
ChinThickness	10.668	2.6197	60	60.000
PosteriorFacialHeight	43.795	4.5266	60	60.000
LAFH	56.612	5.3676	60	60.000
GPI	6.465	2.1736	60	60.000
ULTc	112.603	30.1488	60	60.000
AfhPfh	129.747	10.3764	60	60.000

Tests of Equality of Group Means

	Wilks' Lambda	F	df1	df2	Sig.
GMSN	.964	2.162	1	58	.147
GMFH	.988	.700	1	58	.406
GMBaN	.986	.797	1	58	.376
GSgM	.992	.477	1	58	.493
IOpSN	.958	2.514	1	58	.118
IOpFH	.960	2.398	1	58	.127
IOpBaN	.948	3.179	1	58	.080
OIOp	.960	2.443	1	58	.123

SgGM	.985	.859	1	58	.358
GSgN	1.000	.007	1	58	.935
FSHt	.994	.373	1	58	.544
FSWd	.992	.439	1	58	.510
IOpO	.973	1.608	1	58	.210
MaSN	.999	.030	1	58	.863
MaFH	.993	.388	1	58	.536
MaHt	.996	.240	1	58	.626
MaWd	.968	1.897	1	58	.174
Upperlipthickness	.939	3.761	1	58	.057
ChinThickness	.997	.155	1	58	.695
PosteriorFacialHeight	.967	1.988	1	58	.164
LAFH	.957	2.585	1	58	.113
GPI	.992	.497	1	58	.484
ULTc	.911	5.683	1	58	.020
AfhPfh	1.000	.001	1	58	.978

Analysis 1

Box's Test of Equality of Covariance Matrices

Log Determinants

GENDERCODE	Rank	Log Determinant
Males	1	7.271
Female	1	6.111
Pooled within-groups	1	6.736

The ranks and natural logarithms of determinants printed are those of the group covariance matrices.

Test Results

Box's M		9.563
F	Approx.	9.400
	df1	1
	df2	8988.163
	Sig.	.002

Tests null hypothesis of equal population covariance matrices.

Stepwise Statistics

Variables Entered/Removed[a,b,c,d]

Step	Entered	Wilks' Lambda							
		Statistic	df1	df2	df3	Exact F			
						Statistic	df1	df2	Sig.
1	ULTc	.911	1	1	58.000	5.683	1	58.000	.020

At each step, the variable that minimizes the overall Wilks' Lambda is entered.

a. Maximum number of steps is 48.

b. Maximum significance of F to enter is .05.

c. Minimum significance of F to remove is .10.

d. F level, tolerance, or VIN insufficient for further computation.

Variables in the Analysis

Step		Tolerance	Sig. of F to Remove
1	ULTc	1.000	.020

Variables Not in the Analysis

Step		Tolerance	Min. Tolerance	Sig. of F to Enter	Wilks' Lambda
0	GMSN	1.000	1.000	.147	.964
	GMFH	1.000	1.000	.406	.988
	GMBaN	1.000	1.000	.376	.986
	GSgM	1.000	1.000	.493	.992
	IOpSN	1.000	1.000	.118	.958
	IOpFH	1.000	1.000	.127	.960
	IOpBaN	1.000	1.000	.080	.948
	OIOp	1.000	1.000	.123	.960
	SgGM	1.000	1.000	.358	.985
	GSgN	1.000	1.000	.935	1.000
	FSHt	1.000	1.000	.544	.994
	FSWd	1.000	1.000	.510	.992
	IOpO	1.000	1.000	.210	.973
	MaSN	1.000	1.000	.863	.999
	MaFH	1.000	1.000	.536	.993
	MaHt	1.000	1.000	.626	.996
	MaWd	1.000	1.000	.174	.968
	Upperlipthickness	1.000	1.000	.057	.939
	ChinThickness	1.000	1.000	.695	.997
	PosteriorFacialHeight	1.000	1.000	.164	.967

	LAFH	1.000	1.000	.113	.957
	GPI	1.000	1.000	.484	.992
	ULTc	1.000	1.000	.020	.911
	AfhPfh	1.000	1.000	.978	1.000
	GMSN	.994	.994	.124	.873
	GMFH	.983	.983	.279	.892
	GMBaN	.978	.978	.238	.889
	GSgM	.988	.988	.686	.908
	IOpSN	.984	.984	.078	.862
	IOpFH	.990	.990	.094	.867
	IOpBaN	.988	.988	.057	.854
	OIOp	.993	.993	.100	.868
	SgGM	.984	.984	.555	.905
1	GSgN	.996	.996	.946	.911
	FSHt	.980	.980	.795	.910
	FSWd	.981	.981	.349	.897
	IOpO	1.000	1.000	.240	.889
	MaSN	.941	.941	.692	.908
	MaFH	.990	.990	.414	.900
	MaHt	.993	.993	.514	.904
	MaWd	.975	.975	.098	.868
	Upperlipthickness	.868	.868	.280	.892
	ChinThickness	.646	.646	.232	.888

PosteriorFacialHeight	.997	.997	.150	.878
LAFH	1.000	1.000	.128	.874
GPI	.996	.996	.418	.900
AfhPfh	.998	.998	.937	.911

Wilks' Lambda

Step	Number of Variables	Lambda	df1	df2	df3	Exact F			
						Statistic	df1	df2	Sig.
1	1	.911	1	1	58	5.683	1	58.000	.020

Summary of Canonical Discriminant Functions

Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	.098[a]	100.0	100.0	.299

a. First 1 canonical discriminant functions were used in the analysis.

Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.911	5.375	1	.020

Standardized Canonical Discriminant Function Coefficients

	Function
	1
ULTc	1.000

Structure Matrix

	Function
	1
ULTc	1.000
ChinThickness[a]	-.595
Upperlipthickness[a]	.363
MaSN[a]	.244
MaWd[a]	.158
GMBaN[a]	.148
FSHt[a]	.141
FSWd[a]	.136
GMFH[a]	.130
SgGM[a]	.128
IOpSN[a]	.126
GSgM[a]	-.110
IOpBaN[a]	.109
IOpFH[a]	.102
MaFH[a]	.101

MaHt[a]	.085
OIOp[a]	.084
GMSN[a]	.074
GPI[a]	-.065
GSgN[a]	.064
PosteriorFacialHeight[a]	-.055
AfhPfh[a]	.047
LAFH[a]	-.011
IOpO[a]	.006

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions

Variables ordered by absolute size of correlation within function.

a. This variable not used in the analysis.

Functions at Group Centroids

GENDERCODE	Function
	1
Males	.377
Female	-.251

Unstandardized canonical discriminant functions evaluated at group means

Classification Statistics

Prior Probabilities for Groups

GENDERCODE	Prior	Cases Used in Analysis	
		Unweighted	Weighted
Males	.400	24	24.000
Female	.600	36	36.000
Total	1.000	60	60.000

Classification Function Coefficients

	GENDERCODE	
	Males	Female
ULTc	.147	.125
(Constant)	-9.978	-7.096

Fisher's linear discriminant functions

Classification Results[a]

		GENDERCODE	Predicted Group Membership		Total
			Males	Female	
Original	Count	Males	7	17	24
		Female	3	33	36

%	Males	29.2	70.8	100.0
	Female	8.3	91.7	100.0

a. 66.7% of original grouped cases correctly classified.

APPENDIX G

Data for the 10.6-12.5 Age Groups

Discriminant - Group 3(10.6-12.5)

Group Statistics

GENDERCODE		Mean	Std. Deviation	Valid N (listwise)	
				Unweighted	Weighted
Males	GMSN	97.283	5.0563	47	47.000
	GMFH	105.209	4.5753	47	47.000
	GMBaN	78.857	4.6493	47	47.000
	GSgM	163.285	5.4795	47	47.000
	IOpSN	96.645	9.3210	47	47.000
	IOpFH	104.564	9.9019	47	47.000
	IOpBaN	78.219	9.9655	47	47.000
	OIOp	131.011	9.0316	47	47.000
	SgGM	3.270	1.4640	47	47.000
	GSgN	2.153	.9336	47	47.000
	FSHt	21.238	6.1521	47	47.000
	FSWd	7.430	2.1794	47	47.000
	IOpO	18.774	5.4723	47	47.000
	MaSN	32.323	4.2776	47	47.000
	MaFH	20.877	2.6291	47	47.000
	MaHt	6.264	2.6120	47	47.000

Female	MaWd	14.557	2.7797	47	47.000
	Upperlipthickness	12.553	1.7383	47	47.000
	ChinThickness	11.234	3.5245	47	47.000
	PosteriorFacialHeight	44.985	4.0507	47	47.000
	LAFH	58.911	4.9034	47	47.000
	GPI	6.785	2.6717	47	47.000
	ULTc	120.030	32.1548	47	47.000
	AfhPfh	131.821	14.4854	47	47.000
	GMSN	97.231	5.9430	59	59.000
	GMFH	105.759	5.7169	59	59.000
	GMBaN	79.314	5.6950	59	59.000
	GSgM	162.003	5.6955	59	59.000
	IOpSN	99.263	10.2906	59	59.000
	IOpFH	107.802	10.2660	59	59.000
	IOpBaN	81.344	10.4339	59	59.000
	OIOp	133.705	9.7064	59	59.000
	SgGM	3.547	1.3620	59	59.000
	GSgN	2.141	.9029	59	59.000
	FSHt	20.024	6.4506	59	59.000
	FSWd	6.905	2.0504	59	59.000
	IOpO	17.212	5.7324	59	59.000
	MaSN	30.995	3.7058	59	59.000
	MaFH	20.773	2.5967	59	59.000
	MaHt	5.761	1.2987	59	59.000

	MaWd	15.610	2.4469	59	59.000
	Upperlipthickness	12.115	1.9015	59	59.000
	ChinThickness	11.732	2.2873	59	59.000
	PosteriorFacialHeight	46.086	3.6446	59	59.000
	LAFH	58.688	4.4990	59	59.000
	GPI	6.464	2.2989	59	59.000
	ULTc	106.697	24.9707	59	59.000
	AfhPfh	127.907	11.6860	59	59.000
	GMSN	97.254	5.5418	106	106.000
	GMFH	105.515	5.2249	106	106.000
	GMBaN	79.111	5.2381	106	106.000
	GSgM	162.572	5.6109	106	106.000
	IOpSN	98.102	9.9129	106	106.000
	IOpFH	106.366	10.1873	106	106.000
	IOpBaN	79.958	10.2994	106	106.000
Total	OIOp	132.510	9.4650	106	106.000
	SgGM	3.425	1.4081	106	106.000
	GSgN	2.146	.9123	106	106.000
	FSHt	20.562	6.3193	106	106.000
	FSWd	7.138	2.1147	106	106.000
	IOpO	17.905	5.6462	106	106.000
	MaSN	31.584	4.0052	106	106.000
	MaFH	20.819	2.5991	106	106.000

MaHt	5.984	1.9959	106	106.000
MaWd	15.143	2.6398	106	106.000
Upperlipthickness	12.309	1.8354	106	106.000
ChinThickness	11.511	2.8972	106	106.000
PosteriorFacialHeight	45.598	3.8507	106	106.000
LAFH	58.787	4.6612	106	106.000
GPI	6.607	2.4641	106	106.000
ULTc	112.608	29.0118	106	106.000
AfhPfh	129.642	13.0834	106	106.000

Tests of Equality of Group Means

	Wilks' Lambda	F	df1	df2	Sig.
GMSN	1.000	.002	1	104	.962
GMFH	.997	.289	1	104	.592
GMBaN	.998	.197	1	104	.658
GSgM	.987	1.370	1	104	.244
IOpSN	.983	1.839	1	104	.178
IOpFH	.975	2.685	1	104	.104
IOpBaN	.977	2.441	1	104	.121
OIOp	.980	2.143	1	104	.146
SgGM	.990	1.014	1	104	.316
GSgN	1.000	.005	1	104	.944

FSHt	.991	.966	1	104	.328
FSWd	.985	1.620	1	104	.206
IOpO	.981	2.023	1	104	.158
MaSN	.973	2.931	1	104	.090
MaFH	1.000	.041	1	104	.839
MaHt	.984	1.671	1	104	.199
MaWd	.960	4.291	1	104	.041
Upperlipthickness	.986	1.496	1	104	.224
ChinThickness	.993	.772	1	104	.382
PosteriorFacialHeight	.980	2.164	1	104	.144
LAFH	.999	.059	1	104	.808
GPI	.996	.441	1	104	.508
ULTc	.947	5.777	1	104	.018
AfhPfh	.978	2.372	1	104	.127

Analysis 1

Box's Test of Equality of Covariance Matrices

Log Determinants

GENDERCODE	Rank	Log Determinant
Males	22	33.122
Female	22	27.565
Pooled within-groups	22	34.731

The ranks and natural logarithms of determinants printed are those of the group covariance matrices.

Test Results

Box's M		489.658
F	Approx.	1.493
	df1	253
	df2	29706.944
	Sig.	.000

Tests null hypothesis of equal population covariance matrices.

Variables Failing Tolerance Test[a]

	Within-Groups Variance	Tolerance	Minimum Tolerance
IOpFH	102.143	.000	.000
IOpBaN	104.641	.000	.000

All variables passing the tolerance criteria are entered simultaneously.

a. Minimum tolerance level is .001.

Summary of Canonical Discriminant Functions

Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	.339[a]	100.0	100.0	.503

a. First 1 canonical discriminant functions were used in the analysis.

Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.747	27.153	22	.205

Standardized Canonical Discriminant Function Coefficients

	Function
	1
GMSN	.143
GMFH	-.679
GMBaN	.459
GSgM	1.710
IOpSN	-.178

OIOp	-.740
SgGM	1.650
GSgN	-.577
FSHt	-.089
FSWd	.250
IOpO	-.571
MaSN	.298
MaFH	-.065
MaHt	.235
MaWd	-.605
Upperlipthickness	-.763
ChinThickness	1.439
PosteriorFacialHeight	1.077
LAFH	-.738
GPI	.359
ULTc	1.857
AfhPfh	1.255

Structure Matrix

	Function
	1
ULTc	.405
MaWd	-.349

MaSN	.288
IOpFH[a]	-.275
IOpBaN[a]	-.263
AfhPfh	.259
PosteriorFacialHeight	-.248
OIOp	-.247
IOpO	.240
IOpSN	-.228
MaHt	.218
FSWd	.214
Upperlipthickness	.206
GSgM	.197
SgGM	-.170
FSHt	.166
ChinThickness	-.148
GPI	.112
GMFH	-.090
GMBaN	-.075
LAFH	.041
MaFH	.034
GSgN	.012
GMSN	.008

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions

Variables ordered by absolute size of correlation within function.

a. This variable not used in the analysis.

Functions at Group Centroids

GENDERCODE	Function
	1
Males	.646
Female	-.515

Unstandardized canonical discriminant functions evaluated at group means

Classification Statistics

Classification Processing Summary

Processed		106
Excluded	Missing or out-of-range group codes	0
	At least one missing discriminating variable	0
Used in Output		106

Prior Probabilities for Groups

GENDERCODE	Prior	Cases Used in Analysis	
		Unweighted	Weighted
Males	.443	47	47.000
Female	.557	59	59.000
Total	1.000	106	106.000

Classification Function Coefficients

	GENDERCODE	
	Males	Female
GMSN	55.193	55.163
GMFH	-28.628	-28.478
GMBaN	-12.829	-12.930
GSgM	109.984	109.629
IOpSN	-3.233	-3.212
OIOp	16.203	16.294
SgGM	438.168	436.807
GSgN	-267.043	-266.311
FSHt	-7.202	-7.185
FSWd	-3.086	-3.224
IOpO	28.156	28.274
MaSN	-38.347	-38.434
MaFH	33.637	33.666

MaHt	10.576	10.439
MaWd	-19.314	-19.044
Upperlipthickness	-62.115	-61.631
ChinThickness	54.339	53.763
PosteriorFacialHeight	285.066	284.740
LAFH	-198.743	-198.560
GPI	50.684	50.515
ULTc	5.955	5.879
AfhPfh	94.079	93.967
(Constant)	-17990.745	-17922.411

Fisher's linear discriminant functions

Classification Results[a]

		GENDERCODE	Predicted Group Membership		Total
			Males	Female	
Original	Count	Males	30	17	47
		Female	13	46	59
	%	Males	63.8	36.2	100.0
		Female	22.0	78.0	100.0

a. 71.7% of original grouped cases correctly classified.

Discriminant

Analysis Case Processing Summary

Unweighted Cases		N	Percent
Valid		106	100.0
Excluded	Missing or out-of-range group codes	0	.0
	At least one missing discriminating variable	0	.0
	Both missing or out-of-range group codes and at least one missing discriminating variable	0	.0
	Total	0	.0
Total		106	100.0

Group Statistics

GENDERCODE		Mean	Std. Deviation	Valid N (listwise)	
				Unweighted	Weighted
Males	GMSN	97.283	5.0563	47	47.000
	GMFH	105.209	4.5753	47	47.000
	GMBaN	78.857	4.6493	47	47.000
	GSgM	163.285	5.4795	47	47.000
	IOpSN	96.645	9.3210	47	47.000
	IOpFH	104.564	9.9019	47	47.000
	IOpBaN	78.219	9.9655	47	47.000

	OIOp	131.011	9.0316	47	47.000
	SgGM	3.270	1.4640	47	47.000
	GSgN	2.153	.9336	47	47.000
	FSHt	21.238	6.1521	47	47.000
	FSWd	7.430	2.1794	47	47.000
	IOpO	18.774	5.4723	47	47.000
	MaSN	32.323	4.2776	47	47.000
	MaFH	20.877	2.6291	47	47.000
	MaHt	6.264	2.6120	47	47.000
	MaWd	14.557	2.7797	47	47.000
	Upperlipthickness	12.553	1.7383	47	47.000
	ChinThickness	11.234	3.5245	47	47.000
	PosteriorFacialHeight	44.985	4.0507	47	47.000
	LAFH	58.911	4.9034	47	47.000
	GPI	6.785	2.6717	47	47.000
	ULTc	120.030	32.1548	47	47.000
	AfhPfh	131.821	14.4854	47	47.000
	GMSN	97.231	5.9430	59	59.000
	GMFH	105.759	5.7169	59	59.000
	GMBaN	79.314	5.6950	59	59.000
Female	GSgM	162.003	5.6955	59	59.000
	IOpSN	99.263	10.2906	59	59.000
	IOpFH	107.802	10.2660	59	59.000

Total	IOpBaN	81.344	10.4339	59	59.000
	OIOp	133.705	9.7064	59	59.000
	SgGM	3.547	1.3620	59	59.000
	GSgN	2.141	.9029	59	59.000
	FSHt	20.024	6.4506	59	59.000
	FSWd	6.905	2.0504	59	59.000
	IOpO	17.212	5.7324	59	59.000
	MaSN	30.995	3.7058	59	59.000
	MaFH	20.773	2.5967	59	59.000
	MaHt	5.761	1.2987	59	59.000
	MaWd	15.610	2.4469	59	59.000
	Upperlipthickness	12.115	1.9015	59	59.000
	ChinThickness	11.732	2.2873	59	59.000
	PosteriorFacialHeight	46.086	3.6446	59	59.000
	LAFH	58.688	4.4990	59	59.000
	GPI	6.464	2.2989	59	59.000
	ULTc	106.697	24.9707	59	59.000
	AfhPfh	127.907	11.6860	59	59.000
	GMSN	97.254	5.5418	106	106.000
	GMFH	105.515	5.2249	106	106.000
	GMBaN	79.111	5.2381	106	106.000
	GSgM	162.572	5.6109	106	106.000
	IOpSN	98.102	9.9129	106	106.000
	IOpFH	106.366	10.1873	106	106.000

IOpBaN	79.958	10.2994	106	106.000
OIOp	132.510	9.4650	106	106.000
SgGM	3.425	1.4081	106	106.000
GSgN	2.146	.9123	106	106.000
FSHt	20.562	6.3193	106	106.000
FSWd	7.138	2.1147	106	106.000
IOpO	17.905	5.6462	106	106.000
MaSN	31.584	4.0052	106	106.000
MaFH	20.819	2.5991	106	106.000
MaHt	5.984	1.9959	106	106.000
MaWd	15.143	2.6398	106	106.000
Upperlipthickness	12.309	1.8354	106	106.000
ChinThickness	11.511	2.8972	106	106.000
PosteriorFacialHeight	45.598	3.8507	106	106.000
LAFH	58.787	4.6612	106	106.000
GPI	6.607	2.4641	106	106.000
ULTc	112.608	29.0118	106	106.000
AfhPfh	129.642	13.0834	106	106.000

Tests of Equality of Group Means

	Wilks' Lambda	F	df1	df2	Sig.
GMSN	1.000	.002	1	104	.962
GMFH	.997	.289	1	104	.592
GMBaN	.998	.197	1	104	.658
GSgM	.987	1.370	1	104	.244
IOpSN	.983	1.839	1	104	.178
IOpFH	.975	2.685	1	104	.104
IOpBaN	.977	2.441	1	104	.121
OIOp	.980	2.143	1	104	.146
SgGM	.990	1.014	1	104	.316
GSgN	1.000	.005	1	104	.944
FSHt	.991	.966	1	104	.328
FSWd	.985	1.620	1	104	.206
IOpO	.981	2.023	1	104	.158
MaSN	.973	2.931	1	104	.090
MaFH	1.000	.041	1	104	.839
MaHt	.984	1.671	1	104	.199
MaWd	.960	4.291	1	104	.041
Upperlipthickness	.986	1.496	1	104	.224
ChinThickness	.993	.772	1	104	.382
PosteriorFacialHeight	.980	2.164	1	104	.144
LAFH	.999	.059	1	104	.808
GPI	.996	.441	1	104	.508

ULTc	.947	5.777	1	104	.018
AfhPfh	.978	2.372	1	104	.127

Analysis 1

Box's Test of Equality of Covariance Matrices

Log Determinants

GENDERCODE	Rank	Log Determinant
Males	1	6.941
Female	1	6.435
Pooled within-groups	1	6.691

The ranks and natural logarithms of determinants printed are those of the group covariance matrices.

Test Results

Box's M		3.310
F	Approx.	3.278
	df1	1
	df2	31311.225

Sig.	.070

Tests null hypothesis of equal population covariance matrices.

Stepwise Statistics

Variables Entered/Removed[a,b,c,d]

Step	Entered	Wilks' Lambda							
		Statistic	df1	df2	df3	Exact F			
						Statistic	df1	df2	Sig.
1	ULTc	.947	1	1	104.000	5.777	1	104.000	.018

At each step, the variable that minimizes the overall Wilks' Lambda is entered.

a. Maximum number of steps is 48.

b. Maximum significance of F to enter is .05.

c. Minimum significance of F to remove is .10.

d. F level, tolerance, or VIN insufficient for further computation.

Variables in the Analysis

Step		Tolerance	Sig. of F to Remove
1	ULTc	1.000	.018

Variables Not in the Analysis

Step		Tolerance	Min. Tolerance	Sig. of F to Enter	Wilks' Lambda
0	GMSN	1.000	1.000	.962	1.000
	GMFH	1.000	1.000	.592	.997
	GMBaN	1.000	1.000	.658	.998
	GSgM	1.000	1.000	.244	.987
	IOpSN	1.000	1.000	.178	.983
	IOpFH	1.000	1.000	.104	.975
	IOpBaN	1.000	1.000	.121	.977
	OIOp	1.000	1.000	.146	.980
	SgGM	1.000	1.000	.316	.990
	GSgN	1.000	1.000	.944	1.000
	FSHt	1.000	1.000	.328	.991
	FSWd	1.000	1.000	.206	.985
	IOpO	1.000	1.000	.158	.981
	MaSN	1.000	1.000	.090	.973
	MaFH	1.000	1.000	.839	1.000
	MaHt	1.000	1.000	.199	.984

	MaWd	1.000	1.000	.041	.960
	Upperlipthickness	1.000	1.000	.224	.986
	ChinThickness	1.000	1.000	.382	.993
	PosteriorFacialHeight	1.000	1.000	.144	.980
	LAFH	1.000	1.000	.808	.999
	GPI	1.000	1.000	.508	.996
	ULTc	1.000	1.000	.018	.947
	AfhPfh	1.000	1.000	.127	.978
	GMSN	.998	.998	.871	.947
	GMFH	.999	.999	.556	.944
	GMBaN	.995	.995	.794	.947
	GSgM	.993	.993	.184	.931
	IOpSN	1.000	1.000	.187	.931
	IOpFH	.998	.998	.092	.921
	IOpBaN	1.000	1.000	.135	.927
1	OIOp	.995	.995	.117	.925
	SgGM	.996	.996	.264	.936
	GSgN	.994	.994	.912	.947
	FSHt	.980	.980	.198	.932
	FSWd	.980	.980	.117	.925
	IOpO	1.000	1.000	.167	.930
	MaSN	1.000	1.000	.091	.921
	MaFH	.991	.991	.979	.947

MaHt	.994	.994	.152	.929
MaWd	.994	.994	.070	.918
Upperlipthickness	.972	.972	.420	.941
ChinThickness	.384	.384	.118	.925
PosteriorFacialHeight	.930	.930	.404	.941
LAFH	.988	.988	.620	.945
GPI	.988	.988	.700	.946
AfhPfh	.981	.981	.239	.935

Wilks' Lambda

Step	Number of Variables	Lambda	df1	df2	df3	Exact F			
						Statistic	df1	df2	Sig.
1	1	.947	1	1	104	5.777	1	104.000	.018

Summary of Canonical Discriminant Functions

Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	.056[a]	100.0	100.0	.229

a. First 1 canonical discriminant functions were used in the analysis.

Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.947	5.595	1	.018

Standardized Canonical Discriminant Function Coefficients

	Function
	1
ULTc	1.000

Structure Matrix

	Function
	1
ULTc	1.000
ChinThickness[a]	-.785
PosteriorFacialHeight[a]	-.265

Upperlipthickness[a]	.166
FSWd[a]	-.143
FSHt[a]	-.142
AfhPfh[a]	.137
GPI[a]	.111
LAFH[a]	-.111
MaFH[a]	.096
GSgM[a]	-.086
MaHt[a]	-.080
MaWd[a]	-.078
GSgN[a]	.076
GMBaN[a]	-.072
OIOp[a]	.069
SgGM[a]	.062
GMSN[a]	-.050
IOpFH[a]	.049
GMFH[a]	.030
MaSN[a]	-.020
IOpSN[a]	.006
IOpO[a]	-.006
IOpBaN[a]	-.004

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions

Variables ordered by absolute size of correlation within function.

a. This variable not used in the analysis.

Functions at Group Centroids

GENDERCODE	Function
	1
Males	.262
Female	-.208

Unstandardized canonical discriminant functions evaluated at group means

Classification Statistics

Classification Processing Summary

Processed		106
Excluded	Missing or out-of-range group codes	0
	At least one missing discriminating variable	0
Used in Output		106

Prior Probabilities for Groups

GENDERCODE	Prior	Cases Used in Analysis	
		Unweighted	Weighted
Males	.443	47	47.000

Female	.557	59	59.000
Total	1.000	106	106.000

Classification Function Coefficients

	GENDERCODE	
	Males	Female
ULTc	.149	.133
(Constant)	-9.761	-7.656

Fisher's linear discriminant functions

Classification Results[a]

		GENDERCODE	Predicted Group Membership		Total
			Males	Female	
Original	Count	Males	15	32	47
		Female	12	47	59
	%	Males	31.9	68.1	100.0
		Female	20.3	79.7	100.0

a. 58.5% of original grouped cases correctly classified.

APPENDIX H

Data for the 12.6-14.5 Age Groups

Discriminant - Group 4 (12.6-14.5)

Group Statistics

GENDERCODE		Mean	Std. Deviation	Valid N (listwise)	
				Unweighted	Weighted
	GMSN	99.033	6.1319	24	24.000
	GMFH	107.050	4.8145	24	24.000
	GMBaN	80.617	5.6213	24	24.000
	GSgM	165.154	4.5227	24	24.000
	IOpSN	98.375	9.1577	24	24.000
	IOpFH	106.400	8.7800	24	24.000
	IOpBaN	79.988	9.1239	24	24.000
	OIOp	132.600	7.7548	24	24.000
Males	SgGM	2.925	.8674	24	24.000
	GSgN	2.792	1.2115	24	24.000
	FSHt	24.050	7.9769	24	24.000
	FSWd	7.996	2.5820	24	24.000
	IOpO	18.204	4.9347	24	24.000
	MaSN	33.008	4.2827	24	24.000
	MaFH	21.488	2.3523	24	24.000
	MaHt	5.638	.8622	24	24.000
	MaWd	14.879	2.6960	24	24.000

	Upperlipthickness	13.167	2.3262	24	24.000
	ChinThickness	11.529	2.8486	24	24.000
	PosteriorFacialHeight	47.821	4.1905	24	24.000
	LAFH	60.425	5.2179	24	24.000
	GPI	8.621	2.9734	24	24.000
	ULTc	119.500	30.1145	24	24.000
	AfhPfh	126.913	11.9201	24	24.000
	GMSN	97.272	4.9610	36	36.000
	GMFH	105.069	4.5904	36	36.000
	GMBaN	79.189	4.7971	36	36.000
	GSgM	164.353	5.3766	36	36.000
	IOpSN	98.867	7.9462	36	36.000
	IOpFH	106.661	8.1085	36	36.000
	IOpBaN	80.789	7.7327	36	36.000
	OIOp	132.069	7.5316	36	36.000
Female	SgGM	2.856	1.1853	36	36.000
	GSgN	2.117	.8351	36	36.000
	FSHt	22.644	7.7759	36	36.000
	FSWd	7.703	2.3172	36	36.000
	IOpO	18.319	5.0065	36	36.000
	MaSN	32.033	3.6322	36	36.000
	MaFH	21.711	2.6652	36	36.000
	MaHt	5.711	1.0292	36	36.000
	MaWd	15.181	2.2000	36	36.000

	Upperlipthickness	12.081	1.8696	36	36.000
	ChinThickness	11.869	2.1255	36	36.000
	PosteriorFacialHeight	46.058	4.2854	36	36.000
	LAFH	58.772	5.0114	36	36.000
	GPI	6.561	2.4084	36	36.000
	ULTc	104.933	23.5572	36	36.000
	AfhPfh	128.661	15.8486	36	36.000
	GMSN	97.977	5.4785	60	60.000
	GMFH	105.862	4.7427	60	60.000
	GMBaN	79.760	5.1446	60	60.000
	GSgM	164.673	5.0279	60	60.000
	IOpSN	98.670	8.3791	60	60.000
	IOpFH	106.557	8.3109	60	60.000
	IOpBaN	80.468	8.2510	60	60.000
	OIOp	132.282	7.5606	60	60.000
Total	SgGM	2.883	1.0620	60	60.000
	GSgN	2.387	1.0474	60	60.000
	FSHt	23.207	7.8202	60	60.000
	FSWd	7.820	2.4094	60	60.000
	IOpO	18.273	4.9361	60	60.000
	MaSN	32.423	3.8998	60	60.000
	MaFH	21.622	2.5265	60	60.000
	MaHt	5.682	.9589	60	60.000

MaWd	15.060	2.3931	60	60.000
Upperlipthickness	12.515	2.1144	60	60.000
ChinThickness	11.733	2.4231	60	60.000
PosteriorFacialHeight	46.763	4.3009	60	60.000
LAFH	59.433	5.1165	60	60.000
GPI	7.385	2.8147	60	60.000
ULTc	110.760	27.1021	60	60.000
AfhPfh	127.962	14.3227	60	60.000

Tests of Equality of Group Means

	Wilks' Lambda	F	df1	df2	Sig.
GMSN	.975	1.501	1	58	.226
GMFH	.957	2.578	1	58	.114
GMBaN	.981	1.111	1	58	.296
GSgM	.994	.362	1	58	.550
IOpSN	.999	.049	1	58	.826
IOpFH	1.000	.014	1	58	.906
IOpBaN	.998	.134	1	58	.716
OIOp	.999	.070	1	58	.793
SgGM	.999	.061	1	58	.806
GSgN	.899	6.542	1	58	.013
FSHt	.992	.461	1	58	.500

FSWd	.996	.210	1	58	.648
IOpO	1.000	.008	1	58	.930
MaSN	.985	.899	1	58	.347
MaFH	.998	.111	1	58	.740
MaHt	.999	.084	1	58	.774
MaWd	.996	.225	1	58	.637
Upperlipthickness	.936	3.992	1	58	.050
ChinThickness	.995	.281	1	58	.598
PosteriorFacialHeight	.959	2.479	1	58	.121
LAFH	.975	1.516	1	58	.223
GPI	.869	8.720	1	58	.005
ULTc	.929	4.400	1	58	.040
AfhPfh	.996	.212	1	58	.647

Analysis 1

Box's Test of Equality of Covariance Matrices

Log Determinants

GENDERCODE	Rank	Log Determinant
Males	22	15.027
Female	22	24.907
Pooled within-groups	22	30.029

The ranks and natural logarithms of determinants printed are those of the group covariance matrices.

Test Results

Box's M		524.312
F	Approx.	1.152
	df1	253
	df2	7484.263
	Sig.	.052

Tests null hypothesis of equal population covariance matrices.

Variables Failing Tolerance Test[a]

	Within-Groups Variance	Tolerance	Minimum Tolerance
IOpFH	70.244	.000	.000
IOpBaN	69.094	.000	.000

All variables passing the tolerance criteria are entered simultaneously.

a. Minimum tolerance level is .001.

Summary of Canonical Discriminant Functions

Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	.760[a]	100.0	100.0	.657

a. First 1 canonical discriminant functions were used in the analysis.

Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.568	26.571	22	.228

Standardized Canonical Discriminant Function Coefficients

	Function
	1
GMSN	-.918
GMFH	.291
GMBaN	.399
GSgM	1.328
IOpSN	-.092
OIOp	.322
SgGM	2.076

GSgN	-2.432
FSHt	.145
FSWd	-.113
IOpO	.322
MaSN	.499
MaFH	-.309
MaHt	-.052
MaWd	-.225
Upperlipthickness	-1.247
ChinThickness	2.057
PosteriorFacialHeight	-2.065
LAFH	2.276
GPI	2.799
ULTc	2.566
AfhPfh	-2.929

Structure Matrix

	Function
	1
GPI	.445
GSgN	.385
ULTc	.316
Upperlipthickness	.301

GMFH	.242
PosteriorFacialHeight	.237
LAFH	.185
GMSN	.185
GMBaN	.159
MaSN	.143
FSHt	.102
GSgM	.091
ChinThickness	-.080
MaWd	-.072
AfhPfh	-.069
FSWd	.069
IOpBaN[a]	-.057
MaFH	-.050
MaHt	-.044
OIOp	.040
SgGM	.037
IOpSN	-.033
IOpFH[a]	-.019
IOpO	-.013

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions

Variables ordered by absolute size of correlation within function.

a. This variable not used in the analysis.

Functions at Group Centroids

GENDERCODE	Function
	1
Males	1.050
Female	-.700

Unstandardized canonical discriminant functions evaluated at group means

Classification Statistics

Classification Processing Summary

Processed		60
Excluded	Missing or out-of-range group codes	0
	At least one missing discriminating variable	0
Used in Output		60

Prior Probabilities for Groups

GENDERCODE	Prior	Cases Used in Analysis	
		Unweighted	Weighted
Males	.400	24	24.000
Female	.600	36	36.000
Total	1.000	60	60.000

Classification Function Coefficients

	GENDERCODE	
	Males	Female
GMSN	16.096	16.390
GMFH	-5.172	-5.281
GMBaN	2.963	2.827
GSgM	137.189	136.729
IOpSN	2.144	2.163
OIOp	43.161	43.087
SgGM	641.369	637.977
GSgN	-643.697	-639.448
FSHt	10.950	10.917
FSWd	1.094	1.175
IOpO	88.185	88.072
MaSN	-16.296	-16.520
MaFH	11.591	11.804
MaHt	25.272	25.367
MaWd	-3.310	-3.147
Upperlipthickness	-30.991	-29.933
ChinThickness	67.387	65.910
PosteriorFacialHeight	201.236	202.087
LAFH	-162.883	-163.665
GPI	156.923	155.073
ULTc	6.746	6.576

AfhPfh	70.069	70.424
(Constant)	-21417.332	-21340.248

Fisher's linear discriminant functions

Classification Results[a]

		GENDERCODE	Predicted Group Membership		Total
			Males	Female	
Original	Count	Males	16	8	24
		Female	5	31	36
	%	Males	66.7	33.3	100.0
		Female	13.9	86.1	100.0

a. 78.3% of original grouped cases correctly classified.

Discriminant

Analysis Case Processing Summary

Unweighted Cases		N	Percent
Valid		60	100.0
Excluded	Missing or out-of-range group codes	0	.0
	At least one missing discriminating variable	0	.0

	Both missing or out-of-range group codes and at least one missing discriminating variable	0	.0
	Total	0	.0
Total		60	100.0

Group Statistics

GENDERCODE		Mean	Std. Deviation	Valid N (listwise)	
				Unweighted	Weighted
Males	GMSN	99.033	6.1319	24	24.000
	GMFH	107.050	4.8145	24	24.000
	GMBaN	80.617	5.6213	24	24.000
	GSgM	165.154	4.5227	24	24.000
	IOpSN	98.375	9.1577	24	24.000
	IOpFH	106.400	8.7800	24	24.000
	IOpBaN	79.988	9.1239	24	24.000
	OIOp	132.600	7.7548	24	24.000
	SgGM	2.925	.8674	24	24.000
	GSgN	2.792	1.2115	24	24.000
	FSHt	24.050	7.9769	24	24.000
	FSWd	7.996	2.5820	24	24.000
	IOpO	18.204	4.9347	24	24.000
	MaSN	33.008	4.2827	24	24.000

Female	MaFH	21.488	2.3523	24	24.000
	MaHt	5.638	.8622	24	24.000
	MaWd	14.879	2.6960	24	24.000
	Upperlipthickness	13.167	2.3262	24	24.000
	ChinThickness	11.529	2.8486	24	24.000
	PosteriorFacialHeight	47.821	4.1905	24	24.000
	LAFH	60.425	5.2179	24	24.000
	GPI	8.621	2.9734	24	24.000
	ULTc	119.500	30.1145	24	24.000
	AfhPfh	126.913	11.9201	24	24.000
	GMSN	97.272	4.9610	36	36.000
	GMFH	105.069	4.5904	36	36.000
	GMBaN	79.189	4.7971	36	36.000
	GSgM	164.353	5.3766	36	36.000
	IOpSN	98.867	7.9462	36	36.000
	IOpFH	106.661	8.1085	36	36.000
	IOpBaN	80.789	7.7327	36	36.000
	OIOp	132.069	7.5316	36	36.000
	SgGM	2.856	1.1853	36	36.000
	GSgN	2.117	.8351	36	36.000
	FSHt	22.644	7.7759	36	36.000
	FSWd	7.703	2.3172	36	36.000
	IOpO	18.319	5.0065	36	36.000
	MaSN	32.033	3.6322	36	36.000

	MaFH	21.711	2.6652	36	36.000
	MaHt	5.711	1.0292	36	36.000
	MaWd	15.181	2.2000	36	36.000
	Upperlipthickness	12.081	1.8696	36	36.000
	ChinThickness	11.869	2.1255	36	36.000
	PosteriorFacialHeight	46.058	4.2854	36	36.000
	LAFH	58.772	5.0114	36	36.000
	GPI	6.561	2.4084	36	36.000
	ULTc	104.933	23.5572	36	36.000
	AfhPfh	128.661	15.8486	36	36.000
	GMSN	97.977	5.4785	60	60.000
	GMFH	105.862	4.7427	60	60.000
	GMBaN	79.760	5.1446	60	60.000
	GSgM	164.673	5.0279	60	60.000
	IOpSN	98.670	8.3791	60	60.000
	IOpFH	106.557	8.3109	60	60.000
Total	IOpBaN	80.468	8.2510	60	60.000
	OIOp	132.282	7.5606	60	60.000
	SgGM	2.883	1.0620	60	60.000
	GSgN	2.387	1.0474	60	60.000
	FSHt	23.207	7.8202	60	60.000
	FSWd	7.820	2.4094	60	60.000
	IOpO	18.273	4.9361	60	60.000

MaSN	32.423	3.8998	60	60.000
MaFH	21.622	2.5265	60	60.000
MaHt	5.682	.9589	60	60.000
MaWd	15.060	2.3931	60	60.000
Upperlipthickness	12.515	2.1144	60	60.000
ChinThickness	11.733	2.4231	60	60.000
PosteriorFacialHeight	46.763	4.3009	60	60.000
LAFH	59.433	5.1165	60	60.000
GPI	7.385	2.8147	60	60.000
ULTc	110.760	27.1021	60	60.000
AfhPfh	127.962	14.3227	60	60.000

Tests of Equality of Group Means

	Wilks' Lambda	F	df1	df2	Sig.
GMSN	.975	1.501	1	58	.226
GMFH	.957	2.578	1	58	.114
GMBaN	.981	1.111	1	58	.296
GSgM	.994	.362	1	58	.550
IOpSN	.999	.049	1	58	.826
IOpFH	1.000	.014	1	58	.906
IOpBaN	.998	.134	1	58	.716
OIOp	.999	.070	1	58	.793

SgGM	.999	.061	1	58	.806
GSgN	.899	6.542	1	58	.013
FSHt	.992	.461	1	58	.500
FSWd	.996	.210	1	58	.648
IOpO	1.000	.008	1	58	.930
MaSN	.985	.899	1	58	.347
MaFH	.998	.111	1	58	.740
MaHt	.999	.084	1	58	.774
MaWd	.996	.225	1	58	.637
Upperlipthickness	.936	3.992	1	58	.050
ChinThickness	.995	.281	1	58	.598
PosteriorFacialHeight	.959	2.479	1	58	.121
LAFH	.975	1.516	1	58	.223
GPI	.869	8.720	1	58	.005
ULTc	.929	4.400	1	58	.040
AfhPfh	.996	.212	1	58	.647

Analysis 1

Box's Test of Equality of Covariance Matrices

Log Determinants

GENDERCODE	Rank	Log Determinant
Males	1	2.179
Female	1	1.758
Pooled within-groups	1	1.947

The ranks and natural logarithms of determinants printed are those of the group covariance matrices.

Test Results

Box's M		1.260
F	Approx.	1.238
	df1	1
	df2	8988.163
	Sig.	.266

Tests null hypothesis of equal population covariance matrices.

Stepwise Statistics

Variables Entered/Removed[a,b,c,d]

Step	Entered	Wilks' Lambda							
		Statistic	df1	df2	df3	Exact F			
						Statistic	df1	df2	Sig.
1	GPI	.869	1	1	58.000	8.720	1	58.000	.005

At each step, the variable that minimizes the overall Wilks' Lambda is entered.

a. Maximum number of steps is 48.

b. Maximum significance of F to enter is .05.

c. Minimum significance of F to remove is .10.

d. F level, tolerance, or VIN insufficient for further computation.

Variables in the Analysis

Step		Tolerance	Sig. of F to Remove
1	GPI	1.000	.005

Variables Not in the Analysis

Step		Tolerance	Min. Tolerance	Sig. of F to Enter	Wilks' Lambda
0	GMSN	1.000	1.000	.226	.975
	GMFH	1.000	1.000	.114	.957
	GMBaN	1.000	1.000	.296	.981
	GSgM	1.000	1.000	.550	.994
	IOpSN	1.000	1.000	.826	.999
	IOpFH	1.000	1.000	.906	1.000
	IOpBaN	1.000	1.000	.716	.998
	OIOp	1.000	1.000	.793	.999
	SgGM	1.000	1.000	.806	.999
	GSgN	1.000	1.000	.013	.899
	FSHt	1.000	1.000	.500	.992
	FSWd	1.000	1.000	.648	.996
	IOpO	1.000	1.000	.930	1.000
	MaSN	1.000	1.000	.347	.985
	MaFH	1.000	1.000	.740	.998
	MaHt	1.000	1.000	.774	.999

	MaWd	1.000	1.000	.637	.996
	Upperlipthickness	1.000	1.000	.050	.936
	ChinThickness	1.000	1.000	.598	.995
	PosteriorFacialHeight	1.000	1.000	.121	.959
	LAFH	1.000	1.000	.223	.975
	GPI	1.000	1.000	.005	.869
	ULTc	1.000	1.000	.040	.929
	AfhPfh	1.000	1.000	.647	.996
	GMSN	.619	.619	.485	.862
	GMFH	.681	.681	.944	.869
	GMBaN	.620	.620	.373	.857
	GSgM	.667	.667	.217	.846
	IOpSN	.995	.995	.697	.867
	IOpFH	1.000	1.000	.949	.869
	IOpBaN	.998	.998	.648	.866
1	OIOp	1.000	1.000	.779	.868
	SgGM	.840	.840	.156	.839
	GSgN	.091	.091	.433	.860
	FSHt	.873	.873	.712	.867
	FSWd	.854	.854	.504	.862
	IOpO	.998	.998	.969	.869
	MaSN	.930	.930	.875	.869
	MaFH	.994	.994	.607	.865

MaHt	.955	.955	.389	.858
MaWd	.995	.995	.529	.863
Upperlipthickness	.982	.982	.140	.837
ChinThickness	.994	.994	.783	.868
PosteriorFacialHeight	.930	.930	.451	.861
LAFH	.999	.999	.302	.853
ULTc	.975	.975	.132	.835
AfhPfh	.970	.970	.960	.869

Wilks' Lambda

Step	Number of Variables	Lambda	df1	df2	df3	Exact F			
						Statistic	df1	df2	Sig.
1	1	.869	1	1	58	8.720	1	58.000	.005

Summary of Canonical Discriminant Functions

Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	.150[a]	100.0	100.0	.362

a. First 1 canonical discriminant functions were used in the analysis.

Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.869	8.053	1	.005

Standardized Canonical Discriminant Function Coefficients

	Function
	1
GPI	1.000

Structure Matrix

	Function
	1
GPI	1.000
GSgN[a]	.953
GMSN[a]	.617
GMBaN[a]	.616
GSgM[a]	.577
GMFH[a]	.565
SgGM[a]	-.400
FSWd[a]	.383
FSHt[a]	.357
MaSN[a]	.265
PosteriorFacialHeight[a]	.265

MaHt[a]	.213
AfhPfh[a]	-.174
ULTc[a]	.157
Upperlipthickness[a]	.134
ChinThickness[a]	-.078
MaFH[a]	.076
MaWd[a]	.071
IOpSN[a]	.068
IOpBaN[a]	.044
IOpO[a]	-.044
LAFH[a]	.035
IOpFH[a]	-.016
OIOp[a]	-.014

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions

Variables ordered by absolute size of correlation within function.

a. This variable not used in the analysis.

Functions at Group Centroids

GENDERCODE	Function
	1
Males	.467
Female	-.311

Unstandardized canonical discriminant functions evaluated at group means

Classification Statistics

Classification Processing Summary

Processed		60
Excluded	Missing or out-of-range group codes	0
	At least one missing discriminating variable	0
Used in Output		60

Prior Probabilities for Groups

GENDERCODE	Prior	Cases Used in Analysis	
		Unweighted	Weighted
Males	.400	24	24.000
Female	.600	36	36.000
Total	1.000	60	60.000

Classification Function Coefficients

	GENDERCODE	
	Males	Female
GPI	1.231	.937
(Constant)	-6.220	-3.583

Fisher's linear discriminant functions

Classification Results[a]

		GENDERCODE	Predicted Group Membership		Total
			Males	Female	
Original	Count	Males	10	14	24
		Females	7	29	36
	%	Males	41.7	58.3	100.0
		Females	19.4	80.6	100.0

a. 65.0% of original grouped cases correctly classified.

APPENDIX I

Data for the 14.6-17.9 Age Groups

Discriminant - Group 5(14.6-17.9)

Group Statistics

GENDERCODE		Mean	Std. Deviation	Valid N (listwise)	
				Unweighted	Weighted
Males	GMSN	100.731	5.1330	16	16.000
	GMFH	108.094	4.6515	16	16.000
	GMBaN	81.556	5.1325	16	16.000
	GSgM	167.156	5.8253	16	16.000
	IOpSN	101.450	11.3430	16	16.000
	IOpFH	108.813	11.6268	16	16.000
	IOpBaN	82.275	11.6305	16	16.000
	OIOp	131.650	10.2633	16	16.000
	SgGM	2.650	1.4119	16	16.000
	GSgN	3.569	1.4003	16	16.000
	FSHt	25.531	7.2543	16	16.000
	FSWd	8.944	2.3117	16	16.000
	IOpO	17.969	5.5301	16	16.000
	MaSN	34.756	4.1779	16	16.000
	MaFH	22.894	1.8383	16	16.000
	MaHt	5.844	1.4588	16	16.000

Female	MaWd	16.281	3.2183	16	16.000
	Upperlipthickness	12.713	2.5713	16	16.000
	ChinThickness	11.306	3.1295	16	16.000
	PosteriorFacialHeight	52.513	5.2235	16	16.000
	LAFH	63.425	5.6750	16	16.000
	GPI	10.663	3.8180	16	16.000
	ULTc	121.750	45.0827	16	16.000
	AfhPfh	121.800	15.2061	16	16.000
	GMSN	97.029	4.0847	41	41.000
	GMFH	105.195	3.7265	41	41.000
	GMBaN	79.376	3.6243	41	41.000
	GSgM	161.449	5.2852	41	41.000
	IOpSN	95.385	10.7878	41	41.000
	IOpFH	103.544	9.9777	41	41.000
	IOpBaN	77.724	10.2779	41	41.000
	OIOp	131.163	10.4038	41	41.000
	SgGM	3.585	1.3095	41	41.000
	GSgN	2.156	.7483	41	41.000
	FSHt	21.690	6.9241	41	41.000
	FSWd	6.722	2.2209	41	41.000
	IOpO	18.661	5.8326	41	41.000
	MaSN	31.251	4.5522	41	41.000
	MaFH	21.529	2.4524	41	41.000
	MaHt	5.371	1.2348	41	41.000

	MaWd	13.907	2.4292	41	41.000
	Upperlipthickness	11.144	2.3531	41	41.000
	ChinThickness	11.990	2.6366	41	41.000
	PosteriorFacialHeight	48.337	3.5924	41	41.000
	LAFH	61.322	5.6432	41	41.000
	GPI	6.637	2.3514	41	41.000
	ULTc	95.727	21.0802	41	41.000
	AfhPfh	127.354	13.3219	41	41.000
	GMSN	98.068	4.6681	57	57.000
	GMFH	106.009	4.1763	57	57.000
	GMBaN	79.988	4.1733	57	57.000
	GSgM	163.051	5.9780	57	57.000
	IOpSN	97.088	11.1870	57	57.000
	IOpFH	105.023	10.6313	57	57.000
	IOpBaN	79.002	10.7676	57	57.000
Total	OIOp	131.300	10.2750	57	57.000
	SgGM	3.323	1.3923	57	57.000
	GSgN	2.553	1.1556	57	57.000
	FSHt	22.768	7.1675	57	57.000
	FSWd	7.346	2.4431	57	57.000
	IOpO	18.467	5.7087	57	57.000
	MaSN	32.235	4.6906	57	57.000
	MaFH	21.912	2.3630	57	57.000

MaHt	5.504	1.3058	57	57.000
MaWd	14.574	2.8544	57	57.000
Upperlipthickness	11.584	2.4963	57	57.000
ChinThickness	11.798	2.7722	57	57.000
PosteriorFacialHeight	49.509	4.4845	57	57.000
LAFH	61.912	5.6818	57	57.000
GPI	7.767	3.3444	57	57.000
ULTc	103.032	31.6384	57	57.000
AfhPfh	125.795	13.9657	57	57.000

Tests of Equality of Group Means

	Wilks' Lambda	F	df1	df2	Sig.
GMSN	.871	8.164	1	55	.006
GMFH	.901	6.043	1	55	.017
GMBaN	.944	3.270	1	55	.076
GSgM	.813	12.678	1	55	.001
IOpSN	.940	3.535	1	55	.065
IOpFH	.950	2.924	1	55	.093
IOpBaN	.963	2.096	1	55	.153
OIOp	1.000	.025	1	55	.874
SgGM	.907	5.623	1	55	.021
GSgN	.693	24.378	1	55	.000

FSHt	.941	3.450	1	55	.069
FSWd	.830	11.262	1	55	.001
IOpO	.997	.167	1	55	.685
MaSN	.885	7.130	1	55	.010
MaFH	.931	4.046	1	55	.049
MaHt	.973	1.524	1	55	.222
MaWd	.858	9.114	1	55	.004
Upperlipthickness	.919	4.857	1	55	.032
ChinThickness	.987	.697	1	55	.407
PosteriorFacialHeight	.822	11.927	1	55	.001
LAFH	.972	1.593	1	55	.212
GPI	.702	23.327	1	55	.000
ULTc	.861	8.882	1	55	.004
AfhPfh	.968	1.848	1	55	.180

Analysis 1

Box's Test of Equality of Covariance Matrices

Log Determinants

GENDERCODE	Rank	Log Determinant
Males	.[a]	.[b]
Female	22	26.587
Pooled within-groups	22	33.057

The ranks and natural logarithms of determinants printed are those of the group covariance matrices.

a. Rank < 16

b. Too few cases to be non-singular

Test Results[a]

Tests null hypothesis of equal population covariance matrices.

a. No test can be performed with fewer than two nonsingular group covariance matrices.

Variables Failing Tolerance Test[a]

	Within-Groups Variance	Tolerance	Minimum Tolerance
IOpFH	109.271	.000	.000
IOpBaN	113.716	.000	.000

All variables passing the tolerance criteria are entered simultaneously.

a. Minimum tolerance level is .001.

Summary of Canonical Discriminant Function

Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	2.592[a]	100.0	100.0	.849

a. First 1 canonical discriminant functions were used in the analysis.

Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.278	56.261	22	.000

Standardized Canonical Discriminant Function Coefficients

	Function
	1
GMSN	-1.938
GMFH	1.395
GMBaN	.210
GSgM	1.180
IOpSN	1.011
OIOp	-1.488
SgGM	1.214
GSgN	.746
FSHt	.549
FSWd	.149
IOpO	-.638
MaSN	1.128
MaFH	-.311
MaHt	-.153
MaWd	-.178
Upperlipthickness	-.572
ChinThickness	.120

PosteriorFacialHeight	2.754
LAFH	-3.150
GPI	.291
ULTc	.714
AfhPfh	3.056

Structure Matrix

	Function
	1
GSgN	.414
GPI	.405
GSgM	.298
PosteriorFacialHeight	.289
FSWd	.281
MaWd	.253
ULTc	.250
GMSN	.239
MaSN	.224
GMFH	.206
SgGM	-.199
Upperlipthickness	.185
MaFH	.168
IOpSN	.157

FSHt	.156
GMBaN	.151
IOpFH[a]	.143
IOpBaN[a]	.121
AfhPfh	-.114
LAFH	.106
MaHt	.103
ChinThickness	-.070
IOpO	-.034
OIOp	.013

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions

Variables ordered by absolute size of correlation within function.

a. This variable not used in the analysis.

Functions at Group Centroids

GENDERCODE	Function
	1
Males	2.532
Female	-.988

Unstandardized canonical discriminant functions evaluated at group means

Classification Statistics

Classification Processing Summary

Processed		57
Excluded	Missing or out-of-range group codes	0
	At least one missing discriminating variable	0
Used in Output		57

Prior Probabilities for Groups

GENDERCODE	Prior	Cases Used in Analysis	
		Unweighted	Weighted
Males	.281	16	16.000
Female	.719	41	41.000
Total	1.000	57	57.000

Classification Function Coefficients

	GENDERCODE	
	Males	Female
GMSN	277.284	278.835
GMFH	-86.384	-87.612
GMBaN	-126.421	-126.601

GSgM	238.950	238.186
IOpSN	-6.055	-6.380
OIOp	50.035	50.540
SgGM	965.618	962.426
GSgN	-507.961	-510.666
FSHt	-5.319	-5.594
FSWd	-88.134	-88.368
IOpO	102.784	103.175
MaSN	-149.761	-150.653
MaFH	68.011	68.486
MaHt	110.729	111.143
MaWd	-28.270	-28.035
Upperlipthickness	-151.350	-150.516
ChinThickness	109.995	109.843
PosteriorFacialHeight	173.341	170.979
LAFH	-132.674	-130.713
GPI	161.027	160.665
ULTc	12.162	12.077
AfhPfh	67.497	66.721
(Constant)	-31917.100	-31703.422

Fisher's linear discriminant functions

Classification Results[a]

		GENDERCODE	Predicted Group Membership		Total
			Males	Female	
Original	Count	Males	14	2	16
		Female	1	40	41
	%	Males	87.5	12.5	100.0
		Female	2.4	97.6	100.0

a. 94.7% of original grouped cases correctly classified.

Discriminant

Analysis Case Processing Summary

Unweighted Cases		N	Percent
Valid		57	100.0
Excluded	Missing or out-of-range group codes	0	.0
	At least one missing discriminating variable	0	.0
	Both missing or out-of-range group codes and at least one missing discriminating variable	0	.0
	Total	0	.0
Total		57	100.0

Group Statistics

GENDERCODE		Mean	Std. Deviation	Valid N (listwise)	
				Unweighted	Weighted
Males	GMSN	100.731	5.1330	16	16.000
	GMFH	108.094	4.6515	16	16.000
	GMBaN	81.556	5.1325	16	16.000
	GSgM	167.156	5.8253	16	16.000
	IOpSN	101.450	11.3430	16	16.000
	IOpFH	108.813	11.6268	16	16.000
	IOpBaN	82.275	11.6305	16	16.000
	OIOp	131.650	10.2633	16	16.000
	SgGM	2.650	1.4119	16	16.000
	GSgN	3.569	1.4003	16	16.000
	FSHt	25.531	7.2543	16	16.000
	FSWd	8.944	2.3117	16	16.000
	IOpO	17.969	5.5301	16	16.000
	MaSN	34.756	4.1779	16	16.000
	MaFH	22.894	1.8383	16	16.000
	MaHt	5.844	1.4588	16	16.000
	MaWd	16.281	3.2183	16	16.000
	Upperlipthickness	12.713	2.5713	16	16.000
	ChinThickness	11.306	3.1295	16	16.000
	PosteriorFacialHeight	52.513	5.2235	16	16.000

Female	LAFH	63.425	5.6750	16	16.000
	GPI	10.663	3.8180	16	16.000
	ULTc	121.750	45.0827	16	16.000
	AfhPfh	121.800	15.2061	16	16.000
	GMSN	97.029	4.0847	41	41.000
	GMFH	105.195	3.7265	41	41.000
	GMBaN	79.376	3.6243	41	41.000
	GSgM	161.449	5.2852	41	41.000
	IOpSN	95.385	10.7878	41	41.000
	IOpFH	103.544	9.9777	41	41.000
	IOpBaN	77.724	10.2779	41	41.000
	OIOp	131.163	10.4038	41	41.000
	SgGM	3.585	1.3095	41	41.000
	GSgN	2.156	.7483	41	41.000
	FSHt	21.690	6.9241	41	41.000
	FSWd	6.722	2.2209	41	41.000
	IOpO	18.661	5.8326	41	41.000
	MaSN	31.251	4.5522	41	41.000
	MaFH	21.529	2.4524	41	41.000
	MaHt	5.371	1.2348	41	41.000
	MaWd	13.907	2.4292	41	41.000
	Upperlipthickness	11.144	2.3531	41	41.000
	ChinThickness	11.990	2.6366	41	41.000
	PosteriorFacialHeight	48.337	3.5924	41	41.000

	LAFH	61.322	5.6432	41	41.000
	GPI	6.637	2.3514	41	41.000
	ULTc	95.727	21.0802	41	41.000
	AfhPfh	127.354	13.3219	41	41.000
	GMSN	98.068	4.6681	57	57.000
	GMFH	106.009	4.1763	57	57.000
	GMBaN	79.988	4.1733	57	57.000
	GSgM	163.051	5.9780	57	57.000
	IOpSN	97.088	11.1870	57	57.000
	IOpFH	105.023	10.6313	57	57.000
	IOpBaN	79.002	10.7676	57	57.000
	OIOp	131.300	10.2750	57	57.000
	SgGM	3.323	1.3923	57	57.000
Total	GSgN	2.553	1.1556	57	57.000
	FSHt	22.768	7.1675	57	57.000
	FSWd	7.346	2.4431	57	57.000
	IOpO	18.467	5.7087	57	57.000
	MaSN	32.235	4.6906	57	57.000
	MaFH	21.912	2.3630	57	57.000
	MaHt	5.504	1.3058	57	57.000
	MaWd	14.574	2.8544	57	57.000
	Upperlipthickness	11.584	2.4963	57	57.000
	ChinThickness	11.798	2.7722	57	57.000

PosteriorFacialHeight	49.509	4.4845	57	57.000
LAFH	61.912	5.6818	57	57.000
GPI	7.767	3.3444	57	57.000
ULTc	103.032	31.6384	57	57.000
AfhPfh	125.795	13.9657	57	57.000

Tests of Equality of Group Means

	Wilks' Lambda	F	df1	df2	Sig.
GMSN	.871	8.164	1	55	.006
GMFH	.901	6.043	1	55	.017
GMBaN	.944	3.270	1	55	.076
GSgM	.813	12.678	1	55	.001
IOpSN	.940	3.535	1	55	.065
IOpFH	.950	2.924	1	55	.093
IOpBaN	.963	2.096	1	55	.153
OIOp	1.000	.025	1	55	.874
SgGM	.907	5.623	1	55	.021
GSgN	.693	24.378	1	55	.000
FSHt	.941	3.450	1	55	.069
FSWd	.830	11.262	1	55	.001
IOpO	.997	.167	1	55	.685
MaSN	.885	7.130	1	55	.010
MaFH	.931	4.046	1	55	.049
MaHt	.973	1.524	1	55	.222

MaWd	.858	9.114	1	55	.004
Upperlipthickness	.919	4.857	1	55	.032
ChinThickness	.987	.697	1	55	.407
PosteriorFacialHeight	.822	11.927	1	55	.001
LAFH	.972	1.593	1	55	.212
GPI	.702	23.327	1	55	.000
ULTc	.861	8.882	1	55	.004
AfhPfh	.968	1.848	1	55	.180

Analysis 1

Box's Test of Equality of Covariance Matrices

Log Determinants

GENDERCODE	Rank	Log Determinant
Males	4	15.323
Female	4	11.721
Pooled within-groups	4	13.286

The ranks and natural logarithms of determinants printed are those of the group covariance matrices.

Test Results

Box's M		32.025
F	Approx.	2.857
	df1	10
	df2	3843.012
	Sig.	.002

Tests null hypothesis of equal population covariance matrices.

Stepwise Statistics

Variables Entered/Removed[a,b,c,d]

Step	Entered	Wilks' Lambda							
		Statistic	df1	df2	df3	Exact F			
						Statistic	df1	df2	Sig.
1	GSgN	.693	1	1	55.000	24.378	1	55.000	.000
2	PosteriorFacialHeight	.607	2	1	55.000	17.504	2	54.000	.000
3	ULTc	.530	3	1	55.000	15.666	3	53.000	.000
4	FSHt	.458	4	1	55.000	15.404	4	52.000	.000

At each step, the variable that minimizes the overall Wilks' Lambda is entered.

a. Maximum number of steps is 48.

b. Maximum significance of F to enter is .05.

c. Minimum significance of F to remove is .10.

d. F level, tolerance, or VIN insufficient for further computation.

Variables in the Analysis

Step		Tolerance	Sig. of F to Remove	Wilks' Lambda
1	GSgN	1.000	.000	
2	GSgN	1.000	.000	.822
	PosteriorFacialHeight	1.000	.008	.693
3	GSgN	.997	.000	.704

	PosteriorFacialHeight	.989	.006	.611
	ULTc	.987	.008	.607
	GSgN	.955	.000	.634
	PosteriorFacialHeight	.989	.012	.518
4	ULTc	.889	.001	.561
	FSHt	.872	.006	.530

Variables Not in the Analysis

Step		Tolerance	Min. Tolerance	Sig. of F to Enter	Wilks' Lambda
	GMSN	1.000	1.000	.006	.871
	GMFH	1.000	1.000	.017	.901
	GMBaN	1.000	1.000	.076	.944
	GSgM	1.000	1.000	.001	.813
	IOpSN	1.000	1.000	.065	.940
	IOpFH	1.000	1.000	.093	.950
	IOpBaN	1.000	1.000	.153	.963
0	OIOp	1.000	1.000	.874	1.000
	SgGM	1.000	1.000	.021	.907
	GSgN	1.000	1.000	.000	.693
	FSHt	1.000	1.000	.069	.941
	FSWd	1.000	1.000	.001	.830
	IOpO	1.000	1.000	.685	.997
	MaSN	1.000	1.000	.010	.885

1	MaFH	1.000	1.000	.049	.931
	MaHt	1.000	1.000	.222	.973
	MaWd	1.000	1.000	.004	.858
	Upperlipthickness	1.000	1.000	.032	.919
	ChinThickness	1.000	1.000	.407	.987
	PosteriorFacialHeight	1.000	1.000	.001	.822
	LAFH	1.000	1.000	.212	.972
	GPI	1.000	1.000	.000	.702
	ULTc	1.000	1.000	.004	.861
	AfhPfh	1.000	1.000	.180	.968
	GMSN	.879	.879	.322	.680
	GMFH	.834	.834	.688	.691
	GMBaN	.816	.816	.777	.692
	GSgM	.785	.785	.241	.675
	IOpSN	.971	.971	.027	.632
	IOpFH	.971	.971	.038	.639
	IOpBaN	.976	.976	.071	.652
	OIOp	.996	.996	.689	.691
	SgGM	.821	.821	.799	.692
	FSHt	.968	.968	.025	.631
	FSWd	.939	.939	.075	.653
	IOpO	1.000	1.000	.671	.691
	MaSN	1.000	1.000	.028	.633
	MaFH	.984	.984	.256	.676

	MaHt	.986	.986	.596	.689
	MaWd	.940	.940	.130	.664
	Upperlipthickness	.984	.984	.196	.672
	ChinThickness	.953	.953	.113	.661
	PosteriorFacialHeight	1.000	1.000	.008	.607
	LAFH	.931	.931	.974	.693
	GPI	.085	.085	.762	.692
	ULTc	.997	.997	.009	.611
	AfhPfh	.973	.973	.075	.653
	GMSN	.846	.846	.662	.604
	GMFH	.822	.822	.944	.607
	GMBaN	.797	.797	.514	.602
	GSgM	.767	.767	.138	.582
	IOpSN	.970	.970	.046	.562
	IOpFH	.971	.971	.051	.564
	IOpBaN	.976	.976	.096	.575
2	OIOp	.994	.994	.786	.606
	SgGM	.798	.798	.499	.601
	FSHt	.967	.967	.043	.561
	FSWd	.932	.932	.146	.583
	IOpO	.999	.999	.676	.605
	MaSN	.974	.973	.096	.575
	MaFH	.983	.983	.256	.592
	MaHt	.985	.985	.677	.605

	MaWd	.886	.886	.408	.599
	Upperlipthickness	.900	.900	.629	.604
	ChinThickness	.836	.836	.014	.540
	LAFH	.912	.912	.691	.605
	GPI	.084	.084	.550	.603
	ULTc	.987	.987	.008	.530
	AfhPfh	.618	.618	.873	.606
	GMSN	.843	.843	.576	.527
	GMFH	.785	.785	.536	.526
	GMBaN	.760	.760	.958	.530
	GSgM	.763	.763	.116	.505
	IOpSN	.936	.936	.157	.510
	IOpFH	.950	.950	.143	.508
	IOpBaN	.957	.957	.227	.515
	OIOp	.987	.979	.974	.530
3	SgGM	.795	.795	.438	.524
	FSHt	.872	.872	.006	.458
	FSWd	.840	.840	.026	.482
	IOpO	.986	.973	.927	.530
	MaSN	.957	.957	.219	.515
	MaFH	.980	.980	.232	.515
	MaHt	.976	.976	.535	.526
	MaWd	.885	.885	.418	.523
	Upperlipthickness	.714	.714	.424	.523

	ChinThickness	.455	.455	.395	.523
	LAFH	.907	.907	.856	.530
	GPI	.084	.084	.487	.525
	AfhPfh	.614	.614	.963	.530
	GMSN	.841	.838	.679	.456
	GMFH	.785	.785	.537	.454
	GMBaN	.758	.758	.875	.457
	GSgM	.730	.719	.348	.450
	IOpSN	.925	.862	.113	.436
	IOpFH	.934	.857	.089	.432
	IOpBaN	.945	.861	.161	.440
	OIOp	.955	.844	.612	.455
	SgGM	.771	.759	.791	.457
4	FSWd	.656	.656	.329	.449
	IOpO	.929	.822	.463	.453
	MaSN	.946	.863	.160	.440
	MaFH	.890	.792	.050	.424
	MaHt	.976	.872	.588	.455
	MaWd	.885	.872	.456	.453
	Upperlipthickness	.713	.713	.503	.454
	ChinThickness	.449	.449	.614	.455
	LAFH	.871	.838	.486	.453
	GPI	.083	.082	.665	.456

AfhPfh	.595	.595	.673	.456

Wilks' Lambda

Step	Number of Variables	Lambda	df1	df2	df3	Exact F			
						Statistic	df1	df2	Sig.
1	1	.693	1	1	55	24.378	1	55.000	.000
2	2	.607	2	1	55	17.504	2	54.000	.000
3	3	.530	3	1	55	15.666	3	53.000	.000
4	4	.458	4	1	55	15.404	4	52.000	.000

Summary of Canonical Discriminant Functions

Eigenvalues

Function	Eigenvalue	% of Variance	Cumulative %	Canonical Correlation
1	1.185[a]	100.0	100.0	.736

a. First 1 canonical discriminant functions were used in the analysis.

Wilks' Lambda

Test of Function(s)	Wilks' Lambda	Chi-square	df	Sig.
1	.458	41.424	4	.000

Standardized Canonical Discriminant Function Coefficients

	Function
	1
GSgN	.733
FSHt	.537
PosteriorFacialHeight	.466
ULTc	.619

Structure Matrix

	Function
	1
GSgN	.612
GPI[a]	.574
PosteriorFacialHeight	.428
Upperlipthickness[a]	.381
ULTc	.369
GSgM[a]	.287
GMSN[a]	.281
LAFH[a]	.281
FSWd[a]	.264
GMBaN[a]	.250
SgGM[a]	-.249
MaWd[a]	.240
FSHt	.230

GMFH[a]	.200
MaFH[a]	-.110
IOpFH[a]	-.107
AfhPfh[a]	-.106
IOpO[a]	.085
IOpBaN[a]	-.084
OIOp[a]	-.075
MaSN[a]	.067
IOpSN[a]	-.062
MaHt[a]	.051
ChinThickness[a]	-.039

Pooled within-groups correlations between discriminating variables and standardized canonical discriminant functions

Variables ordered by absolute size of correlation within function.

a. This variable not used in the analysis.

Functions at Group Centroids

GENDERCODE	Function
	1
Males	1.712
Female	-.668

Unstandardized canonical discriminant functions evaluated at group means

Classification Statistics

Classification Processing Summary

Processed		57
Excluded	Missing or out-of-range group codes	0
	At least one missing discriminating variable	0
Used in Output		57

Prior Probabilities for Groups

GENDERCODE	Prior	Cases Used in Analysis	
		Unweighted	Weighted
Males	.281	16	16.000
Female	.719	41	41.000
Total	1.000	57	57.000

Classification Function Coefficients

	GENDERCODE	
	Males	Female
GSgN	5.182	3.384
FSHt	.938	.756
PosteriorFacialHeight	3.258	2.987
ULTc	.261	.211
(Constant)	-123.915	-94.485

Fisher's linear discriminant functions

Classification Results[a]

		GENDERCODE	Predicted Group Membership		Total
			Males	Female	
Original	Count	Males	10	6	16
		Female	2	39	41
	%	Males	62.5	37.5	100.0
		Female	4.9	95.1	100.0

a. 86.0% of original grouped cases correctly classified.

APPENDIX J

OFFICE for the PROTECTION of RESEARCH SUBJECTS APPROVAL

UNLV
UNIVERSITY OF NEVADA LAS VEGAS

Biomedical IRB
Notice of Excluded Activity

DATE: February 1, 2012

TO: **Dr. James Mah**, Dental Medicine

FROM: Office of Research Integrity – Human Subjects

RE: Notification of IRB Action
Protocol Title: **Qualitative and Quantitative Analysis if Archival Digital Radiographic Images and Dental Impressions**
Protocol# 1201-4029M

This memorandum is notification that the project referenced above has been reviewed as indicated in Federal regulatory statutes 45CFR46.

The protocol has been reviewed and deemed excluded from IRB review. It is not in need of further review or approval by the IRB.

Any changes to the excluded activity may cause this project to require a different level of IRB review. Should any changes need to be made, please submit a Modification Form.

If you have questions or require any assistance, please contact the Office of Research Integrity – Human Subjects at IRB@unlv.edu or call 895-2794.

Office of Research Integrity – Human Subjects
4505 Maryland Parkway • Box 451047 • Las Vegas, Nevada 89154-1047
(702) 895-2794 • FAX: (702) 895-0805

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CURRICULUM VITAE

Graduate College

University of Nevada, Las Vegas

Alyssa Elainia Sprowl

Degrees:

Bachelor of Science in Biology, 2005

Hampton University

Doctor of Dental Surgery, 2009

Meharry Medical College

Thesis Title: Sex Determination Using Discriminant Function Analysis In Hispanic Children and Adolescents: A Lateral Cephalometric Study

Thesis Examination Committee:

Chairperson, Graduate Coordinator, James Mah, D.D.S., M.S., D.M.Sc.

Committee Member, Clifford Seran, D.M.D.

Committee Member, Edward Herschaft, D.D.S., M.P.H.

Graduate Faculty Representative, Debra Martin, Ph.D.