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Assessment of White Esthetics Using Digital Smile Designing Software: An in Vivo Comparative Study

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Abstract

Aim: To assess the white esthetics using digital smile designing software Planmeca Romexis®

Setting and Design: An in-vivo comparison to assess the influence of gender and age on seven parameters of white esthetics.

Materials and Methods: Three hundred subjects (150 males and 150 females) age group ranging from 18 years to 45 years with a pleasing smile were randomly selected based on inclusion and exclusion criteria. Using digital smile designing software Planmeca Romexis® seven parameters of white esthetics that is Smile arc, Smile index(mm), Maxillary incisor exposure(mm), Maxillary Central incisor ratio(%), Antero- Superior teeth ratio(%), Buccal corridor ratio(%) and Shade of the tooth was assessed and quantified.

Statistical Analysis Used: The data was subjected to statistical analysis using SPSS version 20.0 software.

Results: Parallel smile arc and average smile line with 75-100% exposure of maxillary central incisors were the most prevalent type among males and females. The mean value for SI was 4.70mm for males and 4.91mm for females. Maxillary central incisor W/H ratio was found to be in the ideal range (65%-85%) and statistical significance was seen among males, where the older age group had a higher W/H ratio than the younger age group. The golden proportion was not found to exist between perceived maxillary anterior teeth of natural dentition. The buccal corridor ratio was found to have significant sexual dimorphism. Where medium narrow smile fullness was prevalent in males and medium broad smile fullness was prevalent in females. The most prevalent tooth shade among females was A1 and among males was A2.

Conclusions: The information obtained regarding tooth norms in south Karnataka (Bengaluru) may prove useful to clinicians when restoring anterior teeth and also can be used to design templates for smile designing software exclusively for the local population.

Keywords: Planmeca Romexis®, Smile analysis, White esthetics

Introduction

A smile is the chosen vehicle of all ambiguities. It plays a significant role in facial attractiveness. Author Augustine "og" Mandino II has aptly said that "A smile remains the most in expensive gift I (you) can bestow on anyone and yet its powers can vanquish kingdoms". But whereas a defective smile can be considered as a physical handicap as the mouth acts as a focal point where a large share of attention is directed.[1] this demand for a pleasant smile drives us to a field of dental esthetics and thus the role of Prosthodontist becomes significant.

Dental Esthetics is defined as application of the principles of esthetics to the natural or artificial teeth and restorations. The two main objectives of dental esthetics are to create teeth of pleasing inherent proportion and to create a pleasing tooth arrangement in harmony with the patient's lips, gingiva and face. Prosthodontist have to make every effort to develop a harmonious balance between the various soft and hard tissue structures that will produce an attractive smile. This will be possible only when they are aware of the principles that manage a balance between the teeth and soft tissues during a person's smile.

The principles of smile design require an integration of esthetic concepts that harmonizes facial esthetics with the dental facial composition and the dental composition. Applying these principles, necessary measures for harmonic smile correction could be accurately determined.[2]

Modern dentistry has evolved further to meet high esthetic demands and expectations of the modern day patient. To achieve this, today's dentists need to go beyond their boundaries of traditional dentistry and acquire set of artistic/communication skills and vision to become "Smile Designers" and this is where Digital Smile Design plays a pivotal role. The DSD allows for careful analysis of the patient's facial and dental characteristics along with any critical factors that may have been overlooked during clinical, photographic, or diagnostic cast–based evaluation procedures.[3]

Tooth components like Dental midline, Incisal length, Tooth dimensions, Axial inclination, Incisal embrasures, Interdental contact area, Interdental contact points, Sex, Personality and Age along with few smile parameters like Smile arch, Smile index, Buccal corridor space and Tooth shade are generally referred as white esthetics. These smile variables play important role in designing esthetic smile. In general the Indian population is genetically diverse due to its geographical location and historical background, giving rise to many dental and facial variations. Therefore, information regarding tooth norms in the local population of south Karnataka (Bengaluru) may prove useful to clinicians when restoring anterior teeth.

Hence, the present study was designed to assess the white esthetics using digital smile designing software Planmeca Romexis®

The objective of the study was to assess and quantify the influence of gender and age on seven parameters of white esthetics; Smile arc(SA), Smile index(SI) in millimeter, Maxillary incisor exposure(MIE) in millimeter, Maxillary Central incisor ratio(MIR) in percentage, Antero- Superior (A-S) teeth ratio in percentage, Buccal corridor ratio(BCR) in percentage and Tooth shade.

Subjects and Methods

A total of 300 subjects (150 males and 150 females) aged about 18-45yrs with a pleasing smile were selected for cross sectional photographic study. The present study was conducted in Department of Prosthodontics, Vokkaligara Sangha Dental College and Hospital, Bengaluru. Out patients reporting to Department of Prosthodontics with apparently healthy systemic and periodontal health were

taken as subjects and were informed about the purpose of the study and a written informed consent was taken.

The subjects with a full complement of natural teeth, willing to participate in the study were included. Subjects with periodontal and gingival diseases, restored anterior maxillary teeth, attrition in the maxillary anterior teeth, impacted, crowding, spacing, angulated or who has or who are undergoing orthodontic treatment were excluded from this study.

Subjects were divided into 3 study groups:

Group 1: 18-25yrs; 50+50(male + female)

Group 2: 26-35yrs; 50+50(male + female)

Group 3: 36-45yrs; 50+50(male + female)

For evaluation of study parameters, extra oral photographs of all the subjects were taken in a similar environment and lighting condition using Nikon D5200SLR camera which was mounted on tripod stand at a fixed distance of 20cms from the subject measured using metallic scale of 30cms. Focal length of 38mm was set. The lens was positioned parallel to the true perpendicular of the face in natural head position (NHP), and the camera was raised to the level of patient's lower facial third.(Figure 2) Two Extra oral photographs of the close up smile line (one frontal view of the posed smile, one of the unposed smile) (Figure 3&4) were taken. The subjects were then asked to smile normally and the unposed smile photographs were taken. Subsequently, they were asked to say cheese and photographs of the posed smile were taken. The same operator has taken all the photographs needed for the study using Nikon D5200 SLR camera. The photographs of the smiles of all the subjects were then transferred to computer software Adobe Photoshop 7.0.1(Figure 5) and were cropped with vertical limitis (tip of the nose and soft-tissue pogonion and perpendicular drawn from the zygomatic prominence). All images were then adjusted to a standardized image size of 16×5 inches. Measurement between two points (subnasale to soft tissue menton) were considered representative to check magnification error. After the manipulation of images to standard size, all the images were then transferred to smile designing software Planmeca Romexis®. Each patient's photos were uploaded with unique patient identification number along with other information like name, gender and date of birth. Later using this software measurement for each parameter was obtained for this study. (Figure 6)

Impressions of the maxillary arch of all the subjects were made using irreversible hydrocolloid impression materials (Algitex, DPI India) and poured immediately with stone (Type III dental stone, Kalabhai, Kalstone). A digital Vernier caliper (Safeseed®) with accuracy 0.02mm/0.0011N (<100mm) was used in order to measure the right and left maxillary central incisor ratio (%).

Determination of smile arc: The smile arc was determined by drawing a hypothetical curve along the edges of the maxillary anterior teeth and the inner contour of the lower lip in the posed smile photographs of the subjects. It was then evaluated as following: (Figure 7)

- Parallel (when the incisal edges of the maxillary anterior teeth followed the curvature of the lower lip)
- Straight (when the incisal edges of the maxillary anterior teeth had no curvature or was in straight line to the lower lip line)
- Reverse (when the incisal edges of the maxillary anterior teeth had a reverse curve to the lower lip line)

Determination of smile index: Smile index was described by Ackerman et al. (1998) as

Smile index= Width (Intercommissural width on smiling) / Height (Interlabial gap on smiling)

- To determine Intercommissural width on smiling the ruler tool in PLANMECA ROMEXIS® was used to draw horizontal line from the corner of the lips on one side to the same point on the contralateral side. The

distance between the two points was measured in millimetres.

- To determine Interlabial gap on smiling the ruler tool of PLANMECA ROMEXIS® was used to draw a vertical line between the upper and lower lips at midline. The distance between the two points was measured in millimetres.
- Later smile index was evaluated in millimetres using mathematical equation. (Figure 8)

Determination of maxillary incisor exposure on smiling: The amount of vertical display of the right and left maxillary central incisors in a posed smile photograph was measured in millimeters by drawing a vertical line superiorly from the visible portion of the crown and inferiorly till incisal edge of the maxillary central incisor using the ruler tool of Planmeca Romexis®. (Figure 9)

Determination of maxillary central incisor ratio: The maxillary central incisor ratio is measured as width/height ×100 [5]

On an unposed smile photograph with the ruler tool of PLANMECA ROMEXIS® a vertical line was drawn from cervical line to the incisal edge and horizontal line was drawn from mesial to distal contact point to measure length and width of central incisor in millimetres. The width of each central incisor was then divided by its height and the percentage ratio of each maxillary central incisor was calculated. (Figure 10)

Determination of maxillary central incisor ratio on the study model: On maxillary study model length and width of the clinical crown was measured using digital caliper for both right and left central incisors. The width of each central incisor was divided by its height and the percentage ratio of each maxillary central incisor was calculated. [4] (Figure 11&12)

Determination of anterior superior teeth ratio: Width of all six maxillary anteriors that is right central incisor(RCI), right lateral incisor(RLI), right canine(RC), left central incisor(LCI), left lateral incisor(LLI), and left canine(RC) was measured using ruler tool of Planmeca Romexis® on unposed smile photograph of the subjects. [4] The golden percentage of the subjects was then calculated by dividing the width of each central incisor, lateral incisor and canine by the total width of all six maxillary anterior teeth and then multiplying the resulting value by 100, in order to obtain the golden percentage for each tooth. If the values from canine to canine were 10%, 15%, 25%, 25%, 15%, and 10%, it indicates that the six maxillary anterior teeth are in golden percentage.[6](Figure 13)

Determination of buccal corridor ratio: For this measurement, a horizontal line was drawn from the most posterior maxillary tooth on one side to the same point on the contralateral side (maxillary interdental width). A second line was drawn from the narrowest point visible in the inner commissure of the buccal mucosa to the same point on the opposite side on an unposed smile photograph of the subjects using ruler tool of Planmeca Romexis®.

The buccal corridor ratio was then calculated according to the method given by Frush and Fisher (1958) as; buccal corridor ratio= inner commissure width- visible maxillary dentition width / inner commissure width × 100. [7] (Figure 14)

Determination of tooth shade: Tooth shade of all the subjects was evaluated using smile design templates that are available in PLANMECA ROMEXIS®. Smile design template was selected and superimposed on the smile area of unposed and posed smile photographs of the subjects and then using different shade map the correct shade for the subjects was determined.

Statistical methods: SPSS (Statistical Package for Social Sciences) version 20, [IBM SPASS statistics (IBM corp.

Armonk, NY, USA released 2011)] was used to perform the statistical analysis

Data was entered in the excel spread sheet. Descriptive statistics of the explanatory and outcome variables was calculated by mean, standard deviation for quantitative variables, frequency and proportions for qualitative variables.

Inferential statistics like Chi-square test was applied for categorical variables. Independent sample t test was applied to check the statistical difference of parameters between the groups. ANOVA was applied to check the statistical difference among the groups with post-hoc Bonferroni for pair wise comparison. The level of significance is set at 5%.

Results

Data was statistically analysed for MIE, MIR, SI, BCR and A-S teeth ratio using independent sample t-test and for smile arc and tooth shade using chi-square test.

Smile arc: Parallel smile arc is the most prevalent type of smile arc among males and females of all three age groups. Chi square test was applied and P value (0.10) showed no statistically significant association between females of three age groups. P value (0.93) showed no statistically significant association between males of three age groups. [Table1] (Figure 15)

Smile index: The mean value for SI was 4.70mm for males and 4.91mm for females. Unpaired t-test was applied and the p value (0.08) for 150 female participants and p value (0.75) for 150 male participants showed no statistically significant association between males and females of all three age groups. [Table2]

Maxillary incisor exposure on smiling: Average smile line with 75-100% exposure of maxillary central incisors is the most prevalent type of smile line among males and females of all three age groups. The p value (0.27) of MIE for 150 female participants and p value (0.45) for 150 male participants showed no statistically significant association between males and females of all three age groups. [Table2]

Maxillary central incisor ratio: Maxillary central incisor W/H ratio is found to be in ideal range (65%-85%) and statistical significance was seen among males, where older age group had higher W/H ratio than younger age group. The right MIR p value (0.047) for 150 male participants (cast) showed a statistically significant association among the three groups. Post hoc Bonferroni test showed a significant difference in right MIR between group 1 and group 2 (p=0.041). [Table2]

Anterior superior teeth ratio: The golden proportion is not found to exist between perceived maxillary anterior teeth on natural dentition. The p value (>0.05) of RC, RLI, RCI, LCI, LLI, LC for 150 female participants and p vale (>0.05) of RC, RLI, RCI, LCI, LLI for 150 male participants showed no statistically significant association between males and females of all three age groups. [Table3]

However it was found that the theory of Golden percentage is more applicable to the subjects of this study. Independent sample t-test was applied and p value was calculated. The p value (0.003) for RCI and p value (0.0037) for LCI showed statistical significance among males and females of all three groups.

The values for lateral incisor were in agreement with those suggested by Snow[6] who recommended a value of 15% as the golden percentage for lateral incisors. (Figure 17&18)

The values for Canines were in agreement with those suggested by Snow[6] who recommended a golden percentage value of 10% for canines. (Figure 17&18)

The values obtained for central incisor were slightly lower than those suggested by Snow[6] who recommended a golden percentage value of 25% for central incisors. (Figure 17&18)

Buccal corridor ratio: Buccal corridor ratio is found to have significant sexual dimorphism. Where medium narrow smile fullness is prevalent in males and medium broad smile fullness is prevalent in females. Out of total 150 female participants 53.3% showed medium, 66.1% medium broad and 25% medium narrow smile fullness. Out of total 150 male participants 46.7% showed medium, 33.9% medium broad and 75% medium narrow smile fullness. Chi square test was applied and p value was calculated. P value (0.00) showed statistically significant association among males and females, whereas no statistically significant was seen among different age groups. [Table4] (Figure 16)

Tooth shade: The most prevalent tooth shade among females is A1 and among males is A2. Chi square test was applied P value showed no statistically significant association among different age groups. [Table5] (Figure 19)

Discussion

Interest in dental esthetics has increased rapidly during the last few decades among both patients and dentists and the creation of a natural dental appearance has become an important task in all fields of dentistry especially in prosthodontics and restorative dentistry.

Actual tooth size and morphology are addressed in dental literature but inconsistent information is presented. Racial and gender differences in the average dimensions of the maxillary anterior teeth have been reported, but the results were valid only for specific isolated populations. In addition, some populations demonstrated no correlation between dental morphology and gender. These findings indicate the need for evaluation of anterior dentition for comparisons among different populations or racial groups. Knowledge of racial norms may help specify certain esthetic and functional modifications to treatment plans to accommodate the multiple racial groups within modern societies.[8]

The present cross sectional and photographic study was undertaken to study the influence of gender and age on seven parameters of white esthetics and to establish static norms in the local population of South Karnataka (Bengaluru).

In this study for evaluation of smile parameters photographs of posed and uposed smile were taken, Ackerman et al. classified smile into two basic types: The social smile/posed smile which is reproducible, voluntary. The lips part due to moderate muscular contraction of the lip elevator muscles and the teeth and sometimes the gingival scaffold are displayed. The enjoyment smile/unposed smile/Duchenne smile, is an involuntary smile and is elicited by laughter or great pleasure and results from maximal contraction of the elevator and depressor muscles causing full expansion of the lips, gingival show, and maximum anterior tooth display. Many studies refer to the posed smile as it is reproducible and can be used as a reference position. However in this study unposed smile also was considered because of maximum anterior tooth display.[4]

Smile evaluation is basically performed by clinical means such as photographs and filming. In the present study static photographs of posed and uposed smile were taken in frontal view with NHP, whereas couple of studies recorded and evaluated dynamic smile in addition to static evaluation. Nevertheless, the validity of photographs has been recently questioned in comparison to filming used for registering one's smile. That occurs because the smile is a dynamic and complex movement comprising interaction of several facial muscles that together produce different positions of dentolabial architecture.[5]

In this study digital smile designing software(Planmeca Romexis®**)** was used to obtain measurements from

photographs because it is a multi-use conceptual dental treatment planning tool that is used in interdisciplinary esthetic dentistry to strengthen diagnostic vision, improve communication/education and enhance predictability throughout the course of the treatment and it allows for careful analysis of the patient's facial and dental characteristics along with any critical factors that may have been overlooked during clinical, photographic or diagnostic cast–based evaluation procedures. But however, in other studies Adobe Photoshop ruler software is used to obtain measurements.

A key component of an esthetic smile is a consonance between the arcs formed between the incisal edges of the maxillary teeth and the curvature of the lower lip. Consonance (parallel) and nonconsonance (flat) in the smile arc were evaluated since it is well known that the consonance in smile arc is more attractive of the two.[9] Hulsey[10] noted that the curvature of the incisal edges of the maxillary anterior teeth was flatter in those who have undergone orthodontic treatment. Ackerman et al. also reported the flattening of the smile arc in 37% of treated patients when compared to only 5% in the untreated group.[4] The results of this study demonstrated that parallel smile arc was most common in both males and females of different age groups. (Table 1, Figure 15). This result was in agreement with Tjan et al.[11] and Dong et al.[12] who found parallel smile arc to be more common in their subjects. But however, Krishnan et al.[13] found parallel smile arc to be more common in females than males. The relationship between the patient's arch form and the smile arc has been established. It has been suggested to maintain the patient's original arch form as widening of the dental arches may flatten the smile arc.

The average smile that reveals 75-100% of maxillary incisor length is most frequent type of smile. Geron and Atalia[14] have concluded that 1 mm of upper-gingival exposure at smile and speech is within the esthetic range. However, smiles with excessive upper and lower gingival display are considered less attractive. Since 90% of the participants in the present study have 75-100% exposure of maxillary incisor length it indicates that average smile is most common irrespective of gender and age. But however, Tjan et al.[11] found a sexual dimorphism where low-smile line was predominantly a male characteristic (2.5:1;M:F) and high-smile line was predominantly a female characteristic (2:1; F:M). Since the present study is statistically insignificant ($p>0.005$) (Table 2) only female characteristic was in agreement with that of Tjan et al.[11]

Ackerman developed a ratio called the smile index to visualize and quantify the frontal smile. The ratio is used for comparing smiles among patients. The lower the smile index, the less youthful the smile appears. The mean value for SI was 4.70mm for males and 4.91 mm for females. No statistical significance ($p>0.005$) (Table 2) was found between gender and SI of all three groups. Ackerman et al.[15] reported a mean SI of 6.04 mm for males and 6.29 mm for females. Balani et al noted a mean value of 8.26mm for boys and 7.91mm for girls in central India. They also found no statistical significance between gender and SI. Schabel et al.[16] noted a mean value of 5.3 mm for SI in their study.

The central incisor W/L ratio is another consideration for aesthetic treatment. In an evaluation of maxillary central incisor tooth W/L ratios in Caucasians, Sterrett et al., in 1999, [17] identified a male ratio of 0.85 and a female ratio of 0.86. Also, W/L ratio ranged from 65% to 85% in a study by Peixoto, [18] which is similar to that found in our study. In the present study the mean value of maxillary incisor ratio in males was 85.82% and 86.30% (extra oral photograph), 86.37% and 86.62% (cast) for RMI and LMI respectively. And in females was 84.98% and 85.92% (extra oral photograph), 85.17% and 86.16% (cast) for

RMI and LMI respectively. The right MIR (P=0.047) for male participants (cast) showed a statistically significant association among the three groups. Post hoc Bonferroni test showed a significant difference between group 1 and group 2 (p=0.041) (Table 2). According to Hasanresioglu et al., the highest W/H ratio is found in squarer teeth due to shorter height and/or greater width than those of other population which came in agreement with the result of this study.[8] in this study, the oldest age group was observed to have a higher W/L ratio than the other groups did. This may be attributed to attrition of teeth associated with prolonged use.

Proportion between Antero -Superior teeth is widely considered in Dentistry and it is based on the golden ratio initially proposed by Levin in 1978.[19] It is important to determine a mathematical or geometrical relationship between teeth, in order to achieve an esthetic restorative result. The results of present study showed that the average golden percentage for males was RC 10.17%, RLI 15.91%, RCI 23.83%, LCI 24.02%, LLI 15.38%, and LC 10.41%. Whereas for females it was RC 10.54%, RLI 15.99%, RCI 23.33%, LCI 23.67%, LLI 15.56%, LC 10.41%(Table 4, Figure 17&18).

The values for Canines are in agreement with those suggested by Snow[6], who recommended a golden percentage value of 10 for canines. The values for lateral incisor are in agreement with those suggested by Snow, who recommended a value of 15 as the golden percentage for lateral incisor. But the figures obtained for central incisor are slightly lower than those suggested by Snow, who estimated 25% for central incisors. The p value (0.003) for RCI and p value (0.0037) for LCI showed statistical significance among males and females of all three groups. The golden percentage for CI in males was more than females. But the overall results showed that the golden proportion did not seem to exist. This was in accordance with the studies conducted by Minoo Mahshid et al in 2004, Fayyad MA et al in 2006. Preston in 1993, Gillen et al. in 1994, Mahshid et al. in 2004, Hasanresioglu et al. in 2005, Fayyad et al. in 2006, Murthi and Ramani in 2008 and Petricevic et al. in 2008.

The buccal corridor is the space created between the buccal surface of the posterior teeth and the lip corners when the patient smiles. It is referred as “negative" spaces. This negative space is affected by the smile, the maxillary arch width, the facial muscles, the position of the buccal surfaces of the posterior maxillary teeth.[7] A minimal buccal corridor is preferred esthetically in both males and females, and large buccal corridors should be considered as undesirable trait. However, several perception studies have reported lay person’s reaction to buccal corridors and a strong relationship could not be established between these trait and smile esthetics. Hulsey[10] and Frush and Fisher[7] described two different methods to measure buccal corridor ratio. In this study the method described by Frush and Fisher[7] and used later by Moore et al. was used.[20] They defined buccal corridors of 28% as narrow, 22% as medium-narrow, 15% as medium, 10% as medium-broad, and 2% as broad smile fullness. In the present study 66.1% of females showed medium broad, 53.3% medium and 25% medium narrow. Whereas in males 75% showed medium narrow, 46.7% medium and 33.9% medium broad. A statistically significant correlation was seen between males and females in all three age groups (Table 3 Figure 16). Post hoc Bonferroni test showed no significant association among 3 age groups for females but whereas for males a statistically significant association was observed between group 1 v/s group 3 (p=0.004) and group 2 v/s group 3 (p=0.00) . Hence in this study medium broad was more common among females and medium narrow in males, which was in agreement with the study conducted by Diana et al.

Tooth colour is one of the important factors affecting aesthetics. Colour is complex, encompasses both subjective and objective phenomenon. Shade selection is an important procedure to provide patients with an aesthetic restoration that harmoniously blends to the patient's existing dentition. Natural teeth are known to possess different shades in their surfaces. Moreover, it has been found that the colour of natural teeth is influenced by many factors. Age is the commonest of these. Light is perhaps one of the most important factors and unfortunately also the most commonly overlooked one. Also, colour imparted by different skin complexions is another factor that may influence the shades of natural teeth.[21] There are different techniques for shade selection like using shade guide system and technology based shade selection. Advancements in technology in the area of computers, the Internet, and communication systems have greatly affected and shaped modern society and have led to technology based shade selection. RGB devices, Digital camera, Colorimeter, and Software's fall under this. In the present study photographs taken from digital camera and smile designing software PLANMECA ROMEXIS® was used to select the shade. A1 shade was most prevalent among females and A2 among males of all 3 age groups. Whereas least prevalent was C1. (Table 5 Figure 19)

The main limitation of the present study was that, static photographs were taken instead of video to evaluate dynamic smile. The focal length of camera, distance between camera and subjects and magnification errors of the photographs can also be additional limiting factors. Minor variations in the values obtained in this study, as compared to previous studies, may be attributed to the ethnic difference of the subjects that were chosen in the present study.

Within the limitations of this study it can be concluded that Smile analysis is an important aspect of patient-driven diagnosis and treatment planning. The information obtained regarding tooth norms in south Karnataka (Bengaluru) may prove useful to clinicians when restoring anterior teeth and also can be used to design templates for smile designing software exclusively for the local population.

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Legends Figure

Figure 1: Armamentarium used in the

Figure 2: Camera set up and capturing of extra_oral photographs

Figure 3: Posed smile

Figure 4: Unposed smile

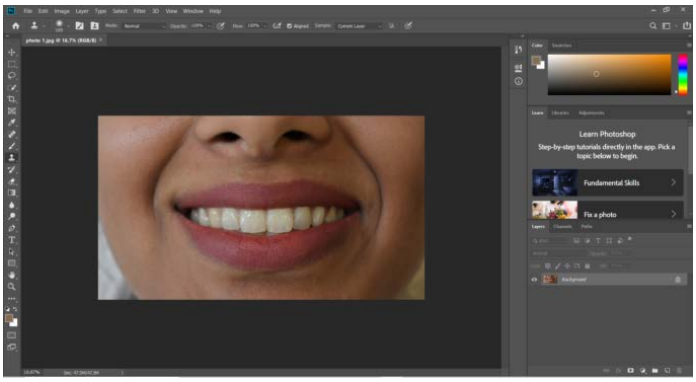

Figure 5: Adobe Photoshop 7.0.1

Figure 6: Smile designing software (Planmeca Romexis®)

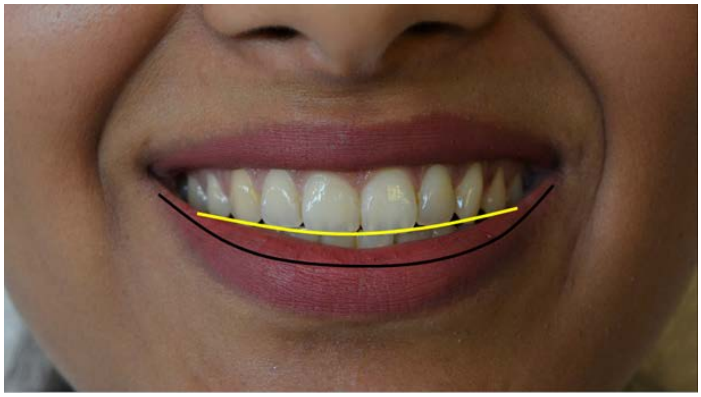

Figure 7: Determination of smile arc

Figure 8: Determination of maxillary incisor exposure on smiling

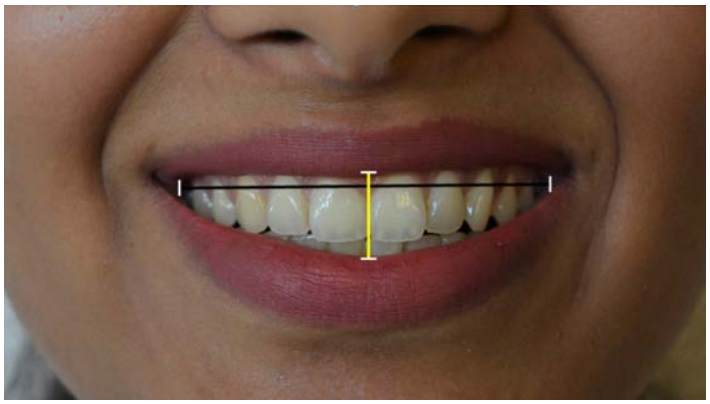

Figure 9: Determination of smile index

Figure 10: Determination of maxillary central incisor ratio

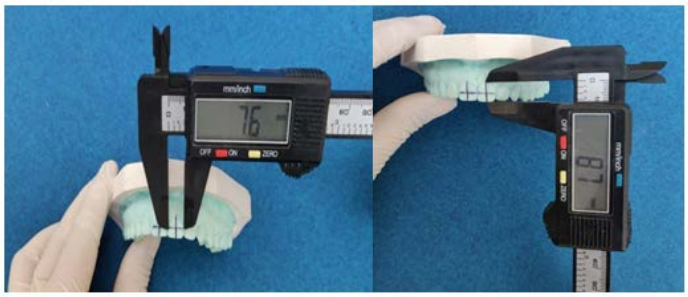

Figure 11 & 12 : Determination of width and height of Maxillary central incisor on the study model

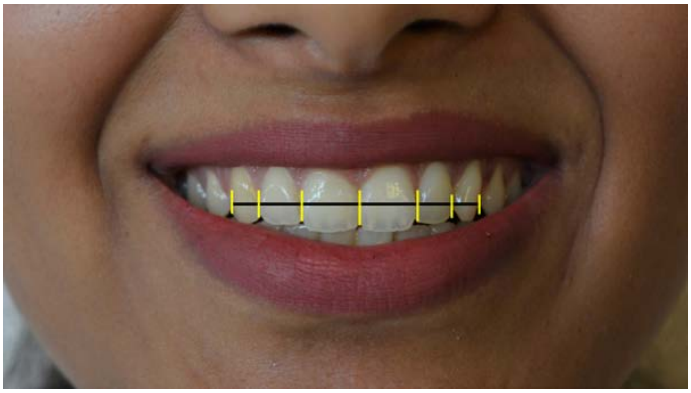

Figure 13 : Determination of anterior superior teeth ratio

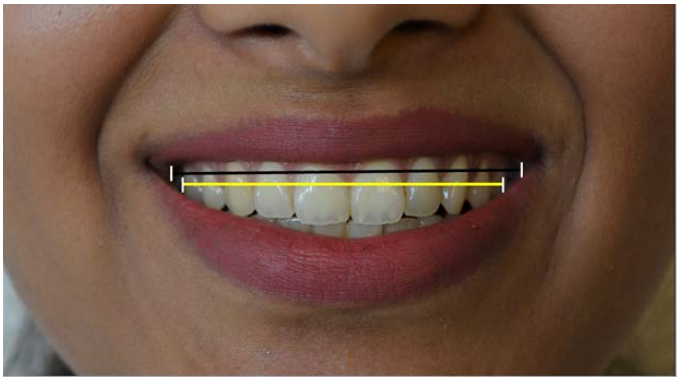

Figure 14 : Determination of buccal corridor ratio

Table 1: Distribution of Smile Arc among the Groups (Females and Males)

		Group 1		Group 2		Group 3		Chi-square	P value
		Frequency	Percent	Frequency	Percent	Frequency	Percent		
Females	Parallel	45	90.0	44	88.0	35	70.0	0.766	0.10
	Raverse	0	0	0	0	4	8.0		
	Straight	5	10.0	6	12.0	11	22.0		
	Total	50	100.0	50	100.0	50	100.0		
Males	Parallel	37	74.0	40	80.0	35	70.0	0.85	0.93
	Raverse	0	0	0	0	1	2.0		
	Straight	13	26.0	10	20.0	14	28.0		
	Total	50	100.0	50	100.0	50	100.0		

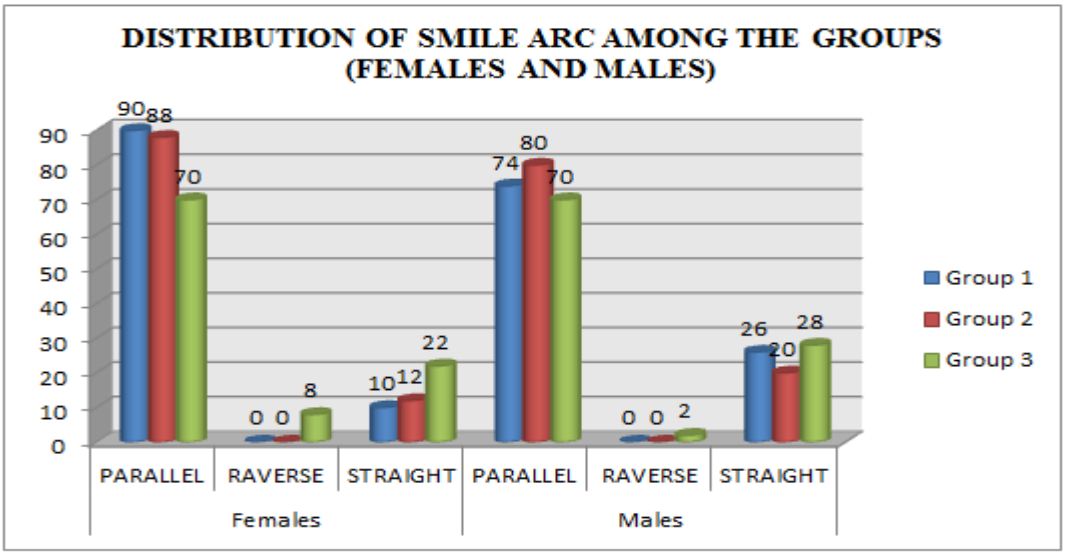

Figure 15

Table 2: Comparison of The Parameters Among Females And Males 0f All The Groups Using Anova

			F VALUE	P value
MIE	Right	Females	1.29	0.27
		Males	0.79	0.45
	Left	Females	0.73	0.47
		Males	1.55	0.21
MIR(%)-R	S	Females	1.21	0.30
		Males	1.14	0.32
	C	Females	3.02	0.051
		Males	3.11	0.047*
MIR(%)-L	S	Females	0.66	0.51
		Males	2.70	0.07
	C	Females	1.15	0.31
		Males	1.22	0.29
Smile index		Females	2.56	0.08
		Males	0.27	0.75

Table 3: Gender-Wise Distribution of Buccal Corridor Ratio among the Groups

		BCR-classified			Total
		Medium	Medium broad	Medium narrow	
Females	Count	57	72	21	150
	Percent	53.3%	66.1%	25.0%	50.0%
Males	Count	50	37	63	150
	Percent	46.7%	33.9%	75.0%	50.0%
Total	Count	107	109	84	300
	Percent	100.0%	100.0%	100.0%	100.0%
Chi-square value- 32.69					
P value- 0.00*					

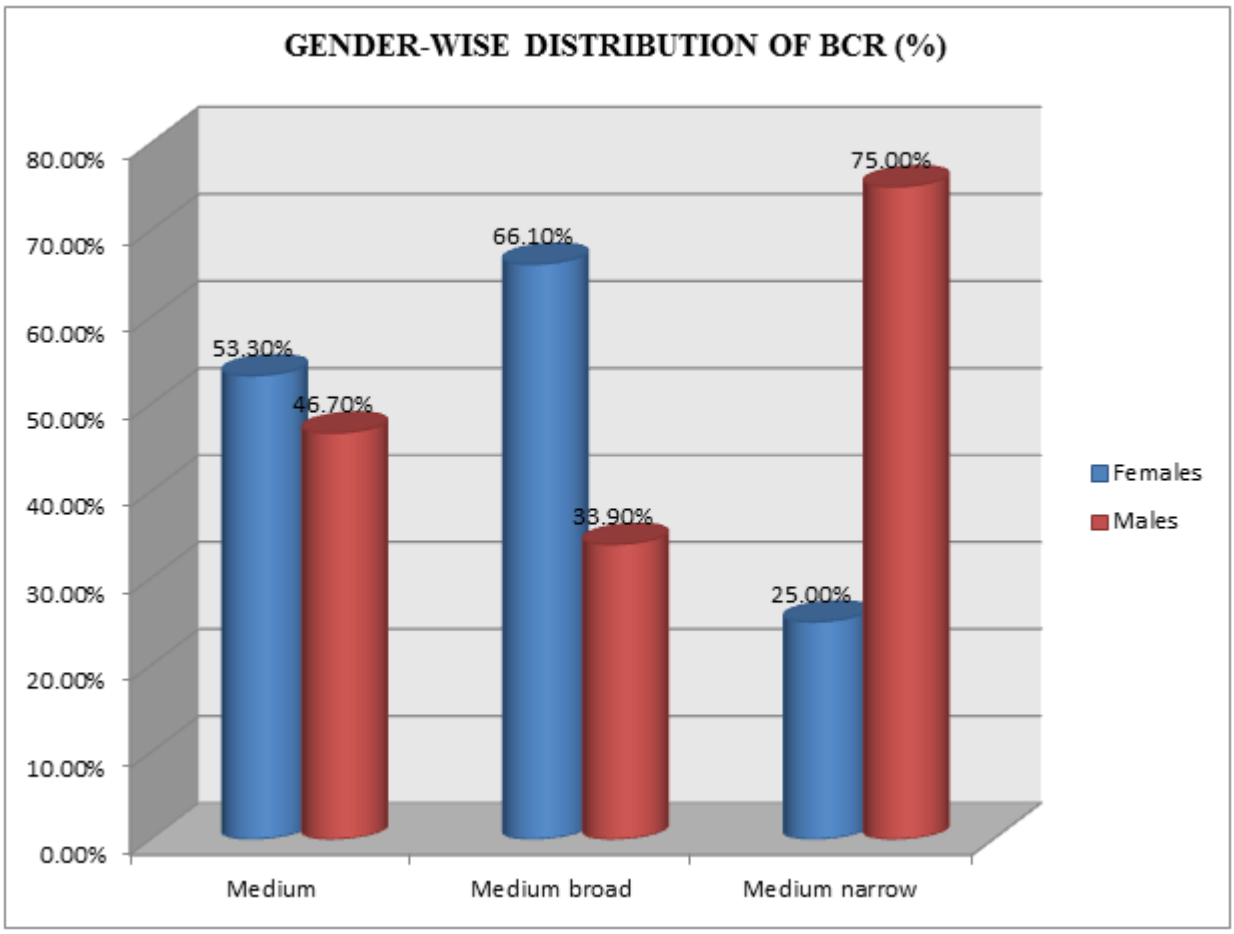

Figure 16

Table 4: Comparison of Antero - Superior Teeth Ratio between Females and Males Using Independent Sample T Test (Overall)

		Minimum	Maximum	Mean	S.D	Mean diff	P value
Right canine	Females	5.00	16.00	10.54	1.86	0.36	0.061
	Males	7.00	13.00	10.17	1.51		
Right LI	Females	12.00	19.00	15.99	1.47	0.08	0.68
	Males	10.00	27.00	15.91	2.18		
Right CI	Females	13.00	27.00	23.33	1.51	-0.49	0.003*
	Males	20.00	27.00	23.83	1.30		
Left CI	Females	20.00	26.10	23.67	1.23	-0.35	0.037*
	Males	20.00	37.00	24.02	1.66		
Left LI	Females	9.00	26.00	15.56	1.73	0.181	0.33
	Males	11.00	21.00	15.38	1.54		
Left canine	Females	6.00	16.00	10.43	1.88	0.016	0.93
	Males	7.00	15.00	10.41	1.61		

*significant

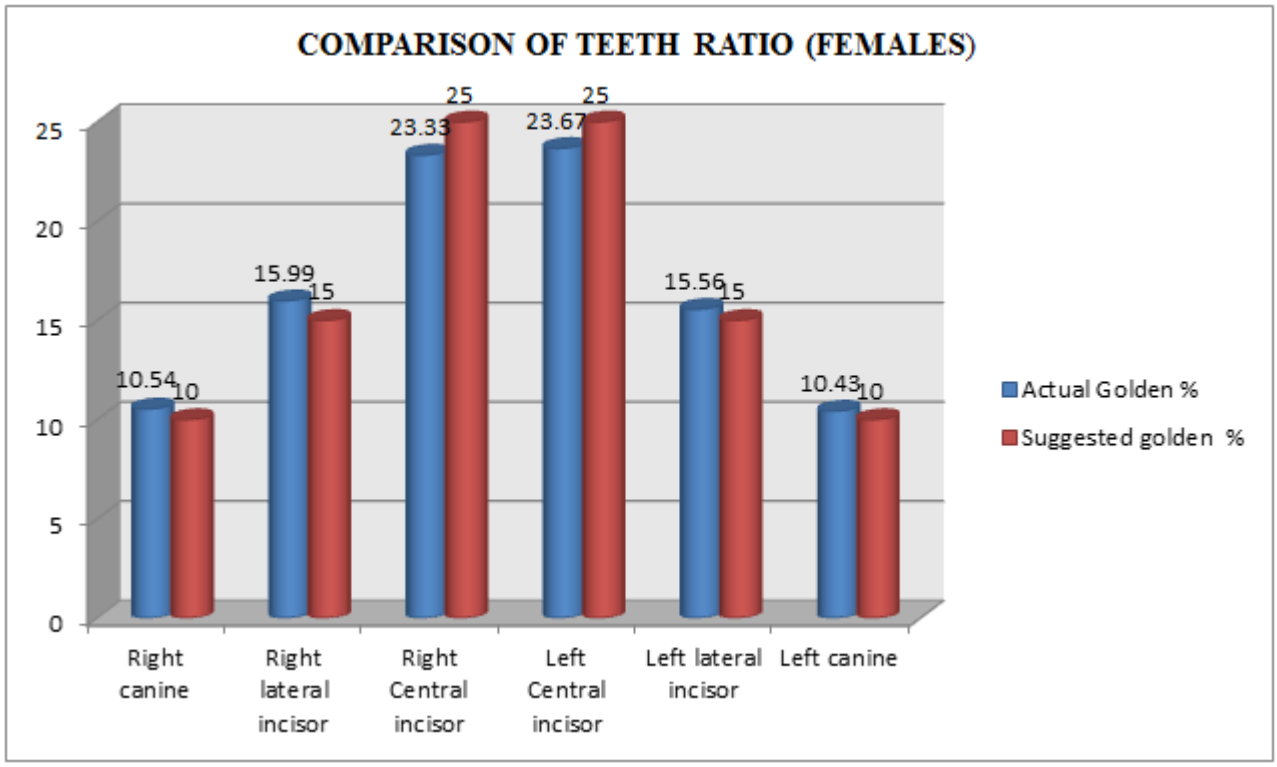

Figure 17

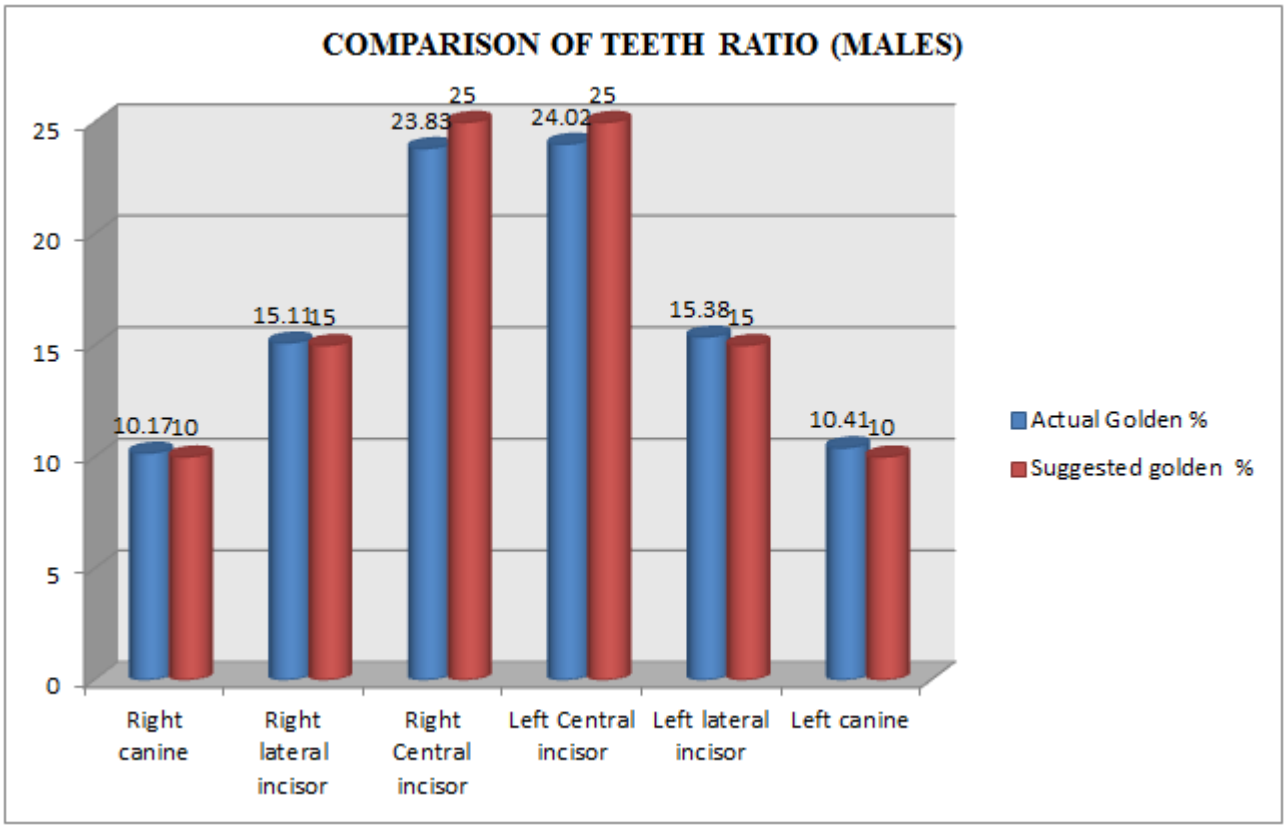

Figure 18

Table 5: Cross-Tabulation of Gender and Shades among the Groups (Females and Males)

		Group 1		Group 2		Group 3		Chi-square value	P value
		Frequency	Percent	Frequency	Percent	Frequency	Percent		
Females	A1	13	26.0	28	56.0	19	38.0	23.02	0.0106*
	A2	11	22.0	10	20.0	21	42.0		
	A3	0	0	0	0	3	6.0		
	B1	24	48.0	12	24.0	6	12.0		
	B2	1	2.0	0	0	1	2.0		
	C1	1	2.0	0	0	0	0		
	Total	50	100.0	50	100.0	50	100.0		
Males	A	0	0	1	2.0	0	0	10.78	0.54
	A1	23	46.0	14	28.0	9	18.0		
	A2	20	40.0	24	48.0	30	60.0		
	A3	2	4.0	1	2.0	4	8.0		
	B1	3	6.0	8	16.0	4	8.0		
	B2	2	4.0	2	4.0	2	4.0		
	B3	0	0	0	0	1	2.0		
	Total	50	100.0	50	100.0	50	100.0		

*significant

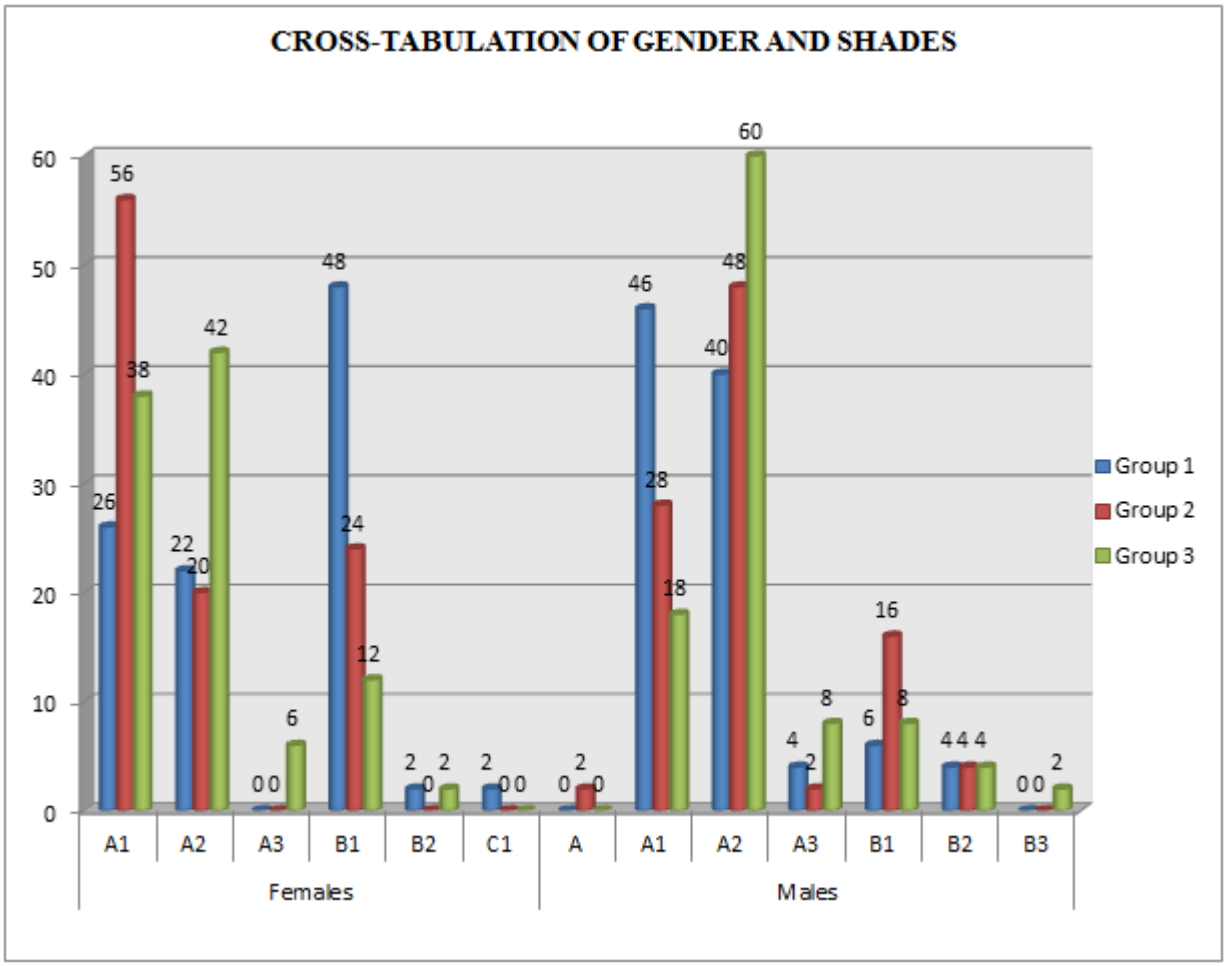

Figure 19