EFFECT OF ARCH WIDTH AND TOOTH CHARACTERISTICS ON PERCEPTION OF SMILE AESTHETICS

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ORTHODONTICS AND DENTOFACIAL ORTHOPAEDICS

By

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BABU BANARASI DAS COLLEGE OF DENTAL SCIENCES, LUCKNOW

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LIST OF ABBREVIATIONS

S.NO	ABBREVIATED FORM	FULL FORM
1.	OCR	Outer commissure right
2.	OCL	Outer commissure left
3.	ICR	inner commissure right
4.	ICL	Inner commissure left
5.	VPTL	Visible posterior tooth left
6.	VPTR	Visible posterior tooth left
7.	4R	Distal surface of 1s Premolar right side
8.	4L	Distal surface of 1s Premolar left side
9.	3R	Distal surface of canine right side
10.	3L	Distal surface of canine left side
11.	CCR	Canine cusp tip right
12.	CCL	Canine cusp tip left
13.	SULP	Superior border of upper lip
14.	IULP	inferior border of upper lip
15.	SLPP	superior border of lower lip
16.	ILPP	Inferior border of lower lip
17.	Sn	Sub nasale
18.	NA	Not applicable

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ABSTRACT

Aim: To evaluate the effect of arch width and tooth characteristics on perception of smile in subjects with gratifying and non-gratifying smile as rated by panel of judges.

Material method: Full face and lower third smiling photographs were evaluated by the panel of judges to divide them as gratifying and non-gratifying smile based on mean score (1-10) given by judges. Final sample consisted of (group I-gratifying (n 200), group II- non gratifying (n 200) further group was subdivided as group IA gratifying males (n-70), IIA non gratifying males (n-74), IB gratifying female (n-130), IIB non gratifying (n-126)) Smile analysis was carried out on lower third smiling photographs as quantitative, qualitative and arch width measurements. The data so obtained was tabulated and subjected to statistical analysis for intra and intergroup comparison.

Result:

1. The scores as obtained for full face photograph were significantly higher than scores obtained for lower third of face for both male and female of gratifying and non-gratifying groups, thereby suggestive of the fact that beside smile as seen in lower third of the face, other facial features also contribute to overall aesthetics.
2. **In males** Inter canine width had significant contribution to the smiles whereas inter premolar width had no contribution to smile aesthetic.
3. **In females** Inter canine width had significant contribution to the smiles whereas inter premolar width had no contribution to smile aesthetic.
4. Amongst qualitative parameters smile arc and axial inclination of anterior teeth was significantly different between males with gratifying or non-gratifying smiles.
5. Amongst qualitative parameters axial inclination of anterior teeth, visibility of central incisor and in quantitative parameters commissure width, visibility of central incisor, gingival height was significantly different between females with gratifying or non-gratifying smiles.

Conclusion: Smile arc, axial inclination and intercanine width played major role in smile aesthtetics hence should be considered as priority during fixed orthodontic treatment.

INTRODUCTION

"A smile is an inexpensive way to change your looks."

Now a day's patients are more aware of their aesthetics and wish to look more attractive with improvement in smile. Orthodontist plays an important role in smile design, considering entire attributes of patient's facial structure. A smile has an ability to trigger emotional changes in the body. The release of endorphin encourages the mind to let go of stress anxiety and grief.

In orthodontics, during clinical examination more attention is given to the display zone of smile, which is determined by lip thickness, intercommissural width, interlabial gap, smile index, and gingival architecture[1]. There are two types of smile: the posed smile-which is a voluntary smile, may not be linked with emotion and is reproducible and spontaneous smile-which in an involuntary smile, linked with emotion and include movements like squinting of the eyes, flaring of nostrils and maximal elevation of lips[2]. Smile is classified based on smile line and depends on amount of incisor show and gingival display.

Smile style is another soft-tissue determinant of the dynamic display zone. There are three styles: the cuspid smile, the complex smile, and the Mona Lisa smile. An individual's smile style depends on the direction of elevation and depression of the lips and the predominant muscle groups involved. The cuspid or commissure smile is characterized by the action of all the elevators of the upper lip, raising it like a window shade to expose the teeth and gingival scaffold. The complex or full-denture smile is characterized by the action of the elevators of the upper lip and the depressors of the lower lip acting simultaneously, raising the upper lip like a window shade and lowering the lower lip like a window. The Mona Lisa smile is

characterized by the action of the zygomaticus major muscles, drawing the outer commissures outward and upward, followed by a gradual elevation of the upper lip. Patients with complex smiles tend to display more teeth and gingiva than patients with Mona Lisa smiles[3].

The generation of smile is a two-stage process, In stage one- the levator muscles contract and raise the upper lip until resistance is met from the buccal fat present in nasolabial folds. In

stage two further lifting of the upper lip against the resistance of nasolabial folds in which various

muscle group are involved including levator labii , superioris muscle, zygomaticus major, superior fibers of buccinators muscle, orbicularis oris this also produce the characteristic squinting that accompanies a spontaneous smile[2].The assessment of smile arc whether consonant curved or reverse helps to understand the dynamics of smile which can be improved by alignment and levelling of anterior teeth with fixed orthodontic treatment.

Perception of smile varies from person to person. A study reported that laypersons preferred more natural profile drawings than did dental specialists. Recent studies also confirmed that there is a difference in esthetic perceptions between orthodontists, general dentists, and layperson[1]. Miller stated that the trained and observant eye easily detects asymmetry. For this reason, professional opinions regarding facial esthetics may not coincide with the perceptions and expectations of patients or laypeople. Hence it is decided by the panel of judges.

Aesthetics can be evaluated by three categories macro, mini and micro aesthetics. Macro aesthetics includes, facial proportion in all three plane of space including asymmetry, excessive or deficit facial height, maxillary mandibular deficiency or excess, it follows the principle that apply when grouping of individual teeth are considered. The relationship between those teeth and surrounding soft tissue and the patient's facial characteristics creates a dynamic and three dimensional canvas. Macro aesthetics also attempts to identify and analyse the relationships and ratios between anterior teeth and surrounding tissue landmarks. Macro aesthetics is dependent on facial midline, nasolabial angle, rickets E line, interpupillary line etc. Mini aesthetics, include dentition in relation to the face and display of the teeth at rest during speech and smiling which is assessed in two position the M position and E position. By saying 'M' repetitively allows patient's lips to part gently, the clinician can assess minimum tooth reveal. By saying 'E' in an uninhibited and exaggerated way, the clinician can ascertain the maximum extension of lip. Micro aesthetics, teeth in relation to each other's this include assessment of teeth proportion in height and width, gingival shape, contour embrasure, black triangle hole etc.

According to Sabri[5] there are 8 major components of balanced smile lip line, smile arc, upper lip curvature, lateral negative space, smile symmetry, occlusal frontal plane, dental components, gingival components. An optimal smile is characterized by an upper lip that

reaches the gingival margins, with an upward or straight curvature between the philtrum and commissures; an upper
incisal line coincident with the border of the commissural line and occlusal frontal plane parallel to the pupillary line; and harmoniously integrated dental and gingival components. These concepts of smile esthetics are overlooked in orthodontic treatment planning. The eight components of the smile should be considered not as rigid boundaries, but as artistic guidelines to help clinicians to treat individual patients who are highly aware of smile esthetics.

The upper lip curvature presents 3 different shapes during a smile: upward, straight, and downward, with the latter being qualified as the least esthetic and the upward shape as the most esthetic. Before decision making related to orthodontic treatment, analysis of the amount of gingival exposure during a smile, teeth proportions, upper lip coverage, and facial thirds proportions, and other related measurements, should be considered However, opinions differ about the amount of periodontal tissue that can be seen as aesthetically pleasing. Upward or straight upper lip curvature shapes were found to have a positive impact on the perception of smile esthetics. In contrast, downward upper lip curvature shapes have a negative effect on perception when evaluating different degrees of gingival smiles. This information is useful for designing treatment plans[6].

An essential smile feature in the transverse dimension of smile is buccal corridor. A broad arch is more likely to fill the buccal corridor than a narrow and constricted arch. This smile feature has thought of primarily in terms of maxillary arch width[7]. Since the arch width affects the buccal corridor which is essential components of smile aesthetics, hence this study will include the arch width. Various tooth characteristics like arrangement, colour, texture, shape and size also define the smile aesthetics. A symmetrical tooth arrangement and sense of proportionality maintains the aesthetic smile hence this will also be included in the study.

The purpose of this study is to evaluate the effect of arch width and tooth characteristics on perception of smile in subjects with gratifying and non-gratifying smile as rated by panel of judges.

Aim & Objectives of the study:

AIM

The aim of this study will be to evaluate the effect of arch width and tooth characteristics on perception of smile in subjects with gratifying and non-gratifying smile as rated by panel of judges.

OBJECTIVES

1. To rate the frontal photographs by a panel of judges to divide the group in gratifying and non-gratifying group.
2. To rate the lower third smiling photographs by a panel of judges to divide the group in gratifying and non- gratifying group
3. To evaluate micro and mini aesthetic characteristics in subjects with gratifying and non-gratifying subjects.
4. To compare various characteristics of smile aesthetics between the gratifying and non-gratifying subjects.
5. To compare various characteristics of smile aesthetics between the gratifying and non-gratifying male and female subjects.

REVIEW OF LITERATURE

1. **Christensen G et al (1984)[8]** did study to formulate the standard of normalcy in an esthetic smile relative to (1) smile type (high, average, low); (2) parallelism of the maxillary incisal curve with the lower lip; (3) position of the incisal curve relative to touching the lower lip; and (4) the number of teeth displayed in a smile. A comparative analysis of the characteristic dental and facial features of esthetic smiles was conducted with 454 full-face photographs of dental and dental hygiene students with open smiles (smiles displaying teeth). The subjects were 207 men and 247 women from 20 to 30 years of age. Each subject was compared, analyzed, and evaluated by careful visual judgment rather than by mathematical measurements. Differences between smile type and parallelism of maxillary incisal curve relative to touching the lower lip were determined statistically. Concluded that an average smile exhibits approximately the full length of the maxillary anterior teeth, the incisal curve of the teeth parallel to the inner curvature of the lower lip, has the incisal curve of the maxillary anterior teeth touching slightly or missing slightly the lower lip, and displays the six upper anterior teeth and premolars.
2. **Peck S et al (1992)[9]** analyzed quantitatively lip tooth jaw relativity in the vertical dimension. 88 North American whites subjects with a mean age of 15 years, of which 42 male and 46 female orthodontic patients were selected. A significant sexual dimorphism was found in the vertical lip tooth-jaw relationship: the upper lip of the female subjects was positioned on average 1.5 mm more superiorly at maximum smile than the upper lip of the male subjects. High smile lines appeared more in female , and low smile lines appeared more in male. There was a significant sex difference in upper lip length: the male subjects exhibited a longer upper lip than the female subjects. The mean difference was 2.2 mm. A similarly significant male -female difference was seen in the skeletal maxillary height measurement: the male sample showed a 2.2 mm mean vertical maxillary increase over the female sample. Furthermore, a significant difference was found between the clinical crown height of the maxillary central incisors in the male and female subjects of comparable ages: the male group had longer central incisor crowns.
3. **Kokich V et al (1999)[10]** to determine the perceptions of lay people and dental professionals with respect to minor variations in anterior tooth size and alignment and their relation to the surrounding soft tissues. Smiling photographs were intentionally altered with one of eight

common anterior esthetic discrepancies in varying degrees of deviation, including variations in crown length, crown width, incisor crown angulation, midline, open gingival embrasure, gingival margin, incisal plane, and gingiva-to-lip distance. Forty images were randomized in a questionnaire and rated according to attractiveness by three groups: orthodontists, general dentists, and lay people; 300 questionnaires were distributed. The response rate was 88.2% for orthodontists, 51.8% for general dentists, and 60.6% for lay people. The results demonstrated threshold levels of noticeable difference between the varying levels of discrepancy. A maxillary midline deviation of 4 mm was necessary before orthodontists rated it significantly less esthetic than the others. However, general dentists and lay people were unable to detect even a 4-mm midline deviation. All three groups were able to distinguish a 2-mm discrepancy in incisor crown angulation. An incisal plane cant of 1 mm as well as a 3-mm narrowing in maxillary lateral incisor crown width were required by orthodontists and general dentists to be rated significantly less esthetic. Lay people were unable to detect an incisal plane asymmetry until it was **3** mm, or a lateral incisor narrowing until it reached 4 mm. Threshold levels for open gingival embrasure and gingiva-to-lip distance were both at 2 mm for the orthodontic group. Open gingival embrasure became detectable by the general dentists and lay people at **3** mm, whereas gingiva-to-lip distance was classified by these groups as noticeably unattractive at 4 mm. they concluded that orthodontists, general dentists, and lay people detect specific dental esthetic discrepancies at varying levels of deviation, which may aid the dental professional in making specific treatment recommendations.

4. Johnston C D et al (1999)[11] investigated the perception of discrepancies between the dental and facial midlines by orthodontists and young laypeople. A smiling photograph of a young adult female was modified by moving the dental midline relative to the facial midline. 20 orthodontists (10 males and 10 females) and 20 young adult laypeople (10 males and 10 females) scored the attractiveness of the smile on the original image and each of the modified images using a 10-point scale. The results showed that the images were scored as less attractive both by the orthodontists and laypeople as the size of the dental to facial midline discrepancy increased. The scores were unrelated to the direction of the midline discrepancy (left or right) or to the gender of the judge. They concluded that the orthodontists were more sensitive than laypeople to small discrepancies between the dental and facial midline. It was

estimated that the probability of a layperson recording a less favorable attractiveness score when there was a 2 mm discrepancy between the dental and facial midlines was 56 per cent.

5. **Eunkoo Kim, et al (2003)[12]** compared arch widths changes in anterior posterior part of the arch as well as smile aesthetics in 30 extraction and 30 non-extraction patients to determine changes in arch width as a result of treatment. Pre and post treatment arch widths of the canines, premolars, and molars were measured and compared. Standardized frontal photographs of the face taken during smiling. Fifty laypersons judged the esthetics of the smiles. In Intercanine width there was no difference between the two groups. The interpremolar and intermolar distance in both arches decreased significantly, whereas the interpremolar and intermolar widths increased significantly in the non-extraction sample. The average arch width of both arches significantly wider in the extraction sample. The results indicate that arch width is not decreased at a constant arch depth because of extraction treatment, and smile esthetics is the same in both groups of patients.
6. **Thomas JL. et al (2003)[13]** addresses the effect of mediolateral axial dental midline inclination on the perceived attractiveness of the smile. One male and one female subject were selected with an average smile line, revealing 75–100% of the maxillary anterior teeth. Frontal facial photographs were taken of both subjects. The maxillary dental midlines were altered both to the left and to the right at 5^0, 10^0, 15^0, and 20^0 angle from the facial midline. Only the positions of the teeth were altered; the soft tissues remained untouched. 50 were orthodontists or orthodontic residents and 50 were laypeople, both males and females evaluated the photographs. They found that increasing the axial maxillary midline angulation consistently decreases the attractiveness of a smile. Discrepancies of 10^0 were unacceptable by 68% of orthodontists and 41% of laypeople. Axial midline angulations of 10^0 or greater are generally unacceptable and should be assessed for orthodontic treatment.
7. **Flores mir et al (2004)[14]** compared the aesthetic perception of different anterior visible occlusion in different facial and dental views by 91 randomly selected adult lay persons. Result came out to be the lay panel perceived that the aesthetic impact of the visible anterior occlusion was greater in a dental view compared to a full facial view. The anterior visible occlusion, photographed subject, view type are factors, which influence the aesthetic perception of smiles. In addition, gender and level of education had an influence.

8. **Geron S et al (2005)[15]** studied the Influence of Sex on the Perception of Oral and Smile Esthetics with Different Gingival Display and Incisal Plane Inclination. Composed photographs of smile and speech with varying amounts of gingival exposure of the upper and lower teeth and gingiva at smile and at speech and with varying degrees of incisal plane tilting were rated for attractiveness by two groups of lay people. The images were presented as male or female images. A total of 300 questionnaires, including 7500 images, were evaluated by 100 subjects. The results showed that images were scored as less attractive as the amount of upper and lower gingival display was increased during smile and speech. The amount of gingival exposure graded in the esthetic range was up to 1mm for the upper incisors and 0mm for the lower incisors. Incisal plane tilting was graded as unesthetic when above 2^0 of deviation from the horizontal was seen. Male and female evaluators scored images differently with upper gingival exposure. Female evaluators gave statistically significant higher scores than male evaluators to upper gingival exposure images at smile and speech of both males and females, suggesting that females are more tolerant of upper gingival exposure. Images were scored differently when presented as male or female images. Female images were scored lower by both male and female evaluators, suggesting that additional efforts should be taken in female patients to achieve an esthetic result.
9. **Moore T. et al (2005)[7]** determined the influence of buccal corridors on smile attractiveness when judged by lay persons. They alter the amount of visible dentition (and buccal corridor) in subjects' smiling images and to have these images judged for smile attractiveness by a panel of lay persons. Full-face color slides of 10 randomly selected smiling subjects (5 women, 5 men) were digitized. The maxillary posterior dentitions for all subjects were digitally altered to produce a range of smile fullness: narrow (28% buccal corridor), medium-narrow (22% buccal corridor), medium (15% buccal corridor), medium-broad (10% buccal corridor), and broad (2% buccal corridor). The 5 images of each subject were paired into 11 possible combinations, and the resulting 110 pairings were randomly projected to a panel of 30 adult lay persons who compared the 2 images in each pair for smile attractiveness. They concluded that when the only difference between altered images of a smiling subject was the broadness of the smile, the presence of broad smile fullness (minimal buccal corridors) was consistently judged by lay persons to be more attractive than narrower smile fullness (larger buccal corridors). No significant differences were found in judging smile attractiveness with

varying levels of smile fullness between either male and female subjects or between male and female judges. Having minimal buccal corridors is a preferred esthetic feature for both men and women, and large buccal corridors should be included in the problem list during orthodontic diagnosis and treatment planning.

10. **Hasanreisoglu U et al (2005)[16]** performed a study to analyze the clinical crown dimensions of the maxillary anterior teeth with respect to their width, height, and width-to-height ratio and to determine whether a golden proportion existed among these factors in a Turkish population. Full face and anterior tooth images of 100 Turkish dental students viewed from the front and engaged in maximum smiling were recorded with digital photography under standardized conditions. Gypsum casts of the maxillary arches of the subjects were also made. The dimensions of the anterior teeth, the occurrence of the golden ratio, the difference between the actual and perceived sizes, and the relationship between the anterior teeth and several facial measurements by gender were analyzed using the information obtained from both the computer images and the casts. To estimate the size of the anterior teeth, measurements were made on the casts. A sharp-tipped digital caliper read to the nearest 0.01 mm, was used to measure the teeth. The width dimension was obtained by measuring the maximum distance between the mesial and distal contact points of the tooth on a line perpendicular to the long axis. Height was recorded as the longest distance from the cervical gingival margin to the incisal edge of the tooth on a line parallel to the long axis. All of the measurements were made of the facial surface of the tooth and recorded in millimeters. The width-to-height ratios were computed for the central incisors, lateral incisors, and canines, and the results (expressed in percentages) were compared by gender. In addition, width-to-height ratios of central incisors were compared to the 80% ratio proposed as the most esthetically pleasing by some .They concluded that maxillary central incisor and canine dimensions of men were greater than those of women in the Turkish population studied, with the canines showing the greatest gender variation. Neither a golden proportion nor any other recurrent proportion for all anterior teeth was determined. Bizygomatic width and interalar width may serve as references for establishing the ideal width of the maxillary anterior teeth, particularly in women.

11. **Ritter D et al (2006)[17]** measured and verified the esthetic influence of the bilateral spaces between maxillary teeth and lip corners, called negative space (NS), during smile. The sample consisted of 60 smile photos from 60 people, 30 males and 30 female, between the ages of 18-25. Two laypeople and two orthodontists assessed these images in relation to aesthetics using a scale of visual analog scale. In each picture, the right and left NS were measured in millimeters and in proportion to the smile width (SW). Data were analyzed for statistical significance. No significant asymmetries were observed between the right and left sides. The NS was significantly larger in men than in women when measured in millimeters, but the NS proportion to the SW was similar. When the 12 individuals with the smallest NS in proportion to SW were compared with the 12 individuals with the largest NS in proportion to SW, there was no statistical difference regarding the esthetic evaluation. They concluded that there was symmetry of the NS between the right and left sides. The men showed a statistically larger NS than the women, yet the percentage difference was not significant. The NS did not influence the esthetic evaluations of the smile photographs. Orthodontists and lay people did not consider the NS as an important factor influencing their esthetic evaluations.
12. **Parekh. S et al(2006)[18]** evaluated, using digital manipulated images and an internet study, the effects of changes in smile arcs and buccal corridors and their interactions on the perceptions of smile attractiveness as judged by orthodontists and lay raters. Using a visual analog scale in a Web-based survey, orthodontists and laypersons rated the attractiveness of nine digitally altered smile arc and buccal corridor variations of male and female smiles. The variations were accomplished in a clinically relevant manner and based on standards set by experienced orthodontists in a pilot web-based survey. For Pilot surveys experienced orthodontists were selected to set the standards for the ideal smile arc, the maximum acceptable accentuated smile arc, the ideal buccal corridor (ie, the ideal amount of black space), and an excessive buccal corridor. They found out that the Excessive buccal corridors and flat smile arcs in both male and female smiles are rated as less attractive by both orthodontists and laypersons. Flat smile arcs overwhelmingly decrease attractiveness ratings regardless of the buccal corridor.
13. **Maulik C, Nanda R (2007)[19]** established the averages for various components of the smile also compared the smiles of patients with and without rapid maxillary expansion (RME) were compared. Sample consisted of 230 subjects and was divided into 3 groups: non-

orthodontically treated (n _73), orthodontically treated with RME (n _ 70), and orthodontically treated without RME (n _ 87). A video clip was recorded and the smile with the widest commissure to commissure smile was captured on a screen through software then the frame was converted into JPEG image. Various component were measured, The anterior height of the smile, The posterior height of the smile, The parallelism of the smile arc in relation to the lower lip line, The most posterior maxillary tooth visible, The buccal corridor percentage, and Comparisons between the sex for all 5 variables were also made. They observed that, on smiling, most subjects displayed an average anterior smile height, a high posterior smile height, a flat smile arc, teeth visible to the maxillary second premolar, and 11% buccal corridor. Females displayed higher anterior and posterior smile heights, more parallel smile arc, and less buccal corridor than males. The orthodontically treated group demonstrated significantly more parallel smile arcs compared with the non-treated group. The RME group showed significantly less buccal corridor on smiling. The RME group had significantly fewer posterior maxillary teeth visible on smile compared to the non-expanded group.

14. **Daljit S Gill et al (2007)[2]** had outlined some of the factors should be taken in to consideration when planning optimal smile aesthetics the components of the smile that will include the smile arc, incisor gingival display, smile width, gingival aesthetics, tooth proportionality, symmetry.
15. **Ker A et al (2008)[20]** quantified the ideal and maximum acceptable deviations for smile characteristics. Using a digital image editing program, the authors built a survey that allowed raters to alter intraoral photos that were included in the questionnaire. In photographs of a sex-neutral face that showed the nasal tip to the mentolabial fold, they changed the features of the smile. An electronic survey was distributed by the authors in Boston (78), in Columbus, Ohio (81), and in Seattle (84). Raters were able to determine the range of acceptability for the variables and select the ideal for each smile attribute displayed through an interactive interface. Survey location was not significant except that raters from the West accepted a broader smile than did those from the Midwest and the East. Raters identified ideals and thresholds for various smile characteristics. Generally, the values for ideal paralleled existing data, and new guidelines for some variables emerged. The ranges of acceptability were large. They found that laypeople are capable of accurately identifying the qualities of an ideal

smile. Smile characteristics have wide permissible deviation ranges, thus clinicians should refrain from overly sensitizing patients to minor discrepancies.

16. **Vinod Krishnan, et al (2008)[1]** evaluate and compare esthetic perceptions of frontal views of smiles by dental specialists and laypersons, compare smile arcs for consonance and non-consonance in men and women, evaluate and compare buccal corridor space (right vs left; male vs female) in the whole sample, and to calculate the modified smile index (MSI) value and check its correlation with the facial index and the mandibular width-facial height index. The 60 subjects (18-21 yrs) with equal number of men and women were included in the sudy. Frontal posed smile photographs were taken of all subjects and result came out to be that there is no perception difference between specialist and laypersonon overall smile evaluation. Women had more consonant smile arc than men, and there were high correlation between the right and left buccal corridor in men and women.
17. **Rodrigues C.D. et al (2009)[21]** evaluated the attractiveness of a smile according to variations from esthetic norms, photographic framing, and the order of the presentation of photographs. A photograph of an individual was selected and digitally manipulated to create the following smiles: an ideal control smile (I), a smile with diastema (D1), a smile with midline deviation (LM3), a smile with deviation from the long axes of the lateral incisors (10D), and a smile with an inverted smile arc (LSRV). The manipulated photographs were developed in framings of the face and of the mouth and evaluated by 20 laypeople. For half the evaluators, the presentation started with facial photographs and, for the other half, the presentation began with the mouth shots. Evaluators were asked to rank the photographs from the least to the most attractive; then, each photograph was awarded a mark (scale of 0.0 to 10.0). They concluded that in both presentations, the smiles I, LM3, 10D, and LSRV received favorable ratings, whereas the D1 smile got poor ratings. The photographic framings used (face vs mouth) and the order of presentation of the photographs did not influence the rankings. The absence of variations from beauty norms of a smile has a positive impact on its esthetic perception, but variations from the norms do not necessarily result in reduced attractiveness.
18. **Schabel B et al (2009)[22]** conducted a study to analyze the relationships between subjective evaluations of posttreatment smiles captured with clinical photography and rated by a panel of orthodontists and parents of orthodontic patients, and objective evaluations of the same smiles from the Smile Mesh program softwares. Photographs of 48 orthodontically treated

patients were rated by a panel of 25 experienced orthodontists and 20 parents of patients. Independent samples *t* tests were used to test whether objective measurements were significantly different between subjects with "attractive" and "unattractive" smiles, and those with the "most attractive" and "least attractive" smiles. They found no significant differences for any measurement. Subjects with the "most unattractive" smiles had a significantly greater distance between the incisal edge of the maxillary central incisors and the lower lip during smiling, and a significantly smaller smile index than did those with the "most attractive" smiles and No Smile Mesh measurement could predict an attractive or unattractive smile.

19. **Havens D et al (2010)[23]** described the role that the posed smile plays on overall facial esthetics, as determined by laypersons and orthodontists, to describe the role of orthodontics in improving the posed smile with regard to overall facial esthetics; and also to investigate the most influential characteristics involved in rating facial attractiveness. 48 white female subjects were selected. The six Q-sorts consisted of three different photographs for each of two time points (pre- and post treatment), as follows: (1) smile only, (2) face without the smile, and (3) face with the smile. The evaluators determined a split-line for attractive and unattractive images at the end of each Q-sort. The evaluators also ranked nine facial/dental characteristics at the completion of the six Q-sorts. Before orthodontic treatment, the presence of a malocclusion can have a negative impact on facial attractiveness. After orthodontic treatment, a corrected malocclusion will be more in harmony with overall facial attractiveness. Orthodontist and lay evaluators generally agree on the appraisal of attractive subjects. Orthodontist and lay evaluators agree on the importance of each facial characteristic, with overall facial features as the most relevant esthetic feature.
20. **Catherine Mc Leod, et al (2011)[24]** studied the Canadian laypersons' perceptions of smile esthetics and data were compared to US data in order to evaluate cultural differences. Using Adobe Photoshop 7, a digital image of a posed smile of a sexually ambiguous lower face was prepared so that hard and soft tissue could be manipulated to alter buccal corridor, gingival display, occlusal cant, maxillary midline to face discrepancy, and lateral central gingival discrepancy. Adult Canadian laypersons completed a survey of 29 randomized images to compare smile preferences for these variables. These data were compared with previously published data for US laypersons. It appears that cultural differences do exist related to smile characteristics. Clinically significant differences in the preference of smile characteristics

were found between Canadian and US layperson.ideal aesthetic value were significantly different only for buccal corridor.

21. **Springer N et al (2011)[25]** quantified the ideal and the range of acceptable values for smile variables judged by laypersons from a full-face perspective for comparison with lower-face. Mirrored and symmetric male and female full faces previously determined by peers to be of average attractiveness were used. 96 laypersons judged these smile variables: smile arc, buccal corridor fill, maxillary gingival display, maxillary midline to face, maxillary to mandibular midline discrepancy, overbite, central incisor gingival margin discrepancy, maxillary anterior gingival height discrepancy, incisal edge discrepancy, and cant. Using customizable picture technology, the judges were able to manipulate the variables so that they would morph and appear continuously on a computer monitor. Medians for each smile variable were compiled, and were calculated to measure reliability. Multiple randomization tests with adjusted P values were used to compare these data with those for lower face views. They concluded that the acceptable range is quite large for most smile characteristics. The perspective (full face vs lower face) made little difference in the ratings of esthetic variables for the smile. Reliability was fair to moderate for all measures except buccal corridor limits, which had poor reliability. The sex of the raters did not affect how well their smiles appeared. Achieving an esthetic smile is clinically feasible since several aesthetic factors work in harmony with one another.
22. **Tikku T, et al (2012)[26]** conducted a studied on smile esthetics to find correlation between the buccal corridor and underlying hard tissues. The sample for study consisted of posed smiling frontal photographs, digital posterior-anterior (PA) cephalograms, and study models of 25 males and 25 females in age range of 18-25 years were taken. Photographs were evaluated for smile esthetics by panel of judges and subjects were divided in three groups with least attractive, average and attractive smile, and buccal corridor width was measured. Digital PA cephalograms were transferred on Nemo-tech software for frontal facial analysis. Intercanine and intermolar widths were measured on upper study model with the help of a digital calliper. They concluded that the buccal corridor is not influenced by underlying skeletal hard tissues but have mild to moderate inverse correlation with the intercanine and intermolar width.
23. **Batwa W et al (2012)[27]** Determined whether alteration of the occlusal plane angle can affect perceived attractiveness of the smile also to determine the most and least attractive smiles and

their corresponding occlusal plane angles as assessed by patients and dentists. This study was carried out in three stages. In the first stage, a maxillary model mounted on an articulator was used in a laboratory setting to record changes in vertical tooth position at various occlusal plane angles. In the second step, a computerized prediction of the smile's appearance at various occlusal plane angles was created using photo alteration utilizing the data from the first stage. (0, 5, 10, 15, and 20 degrees). Finally, the five developed photographs were assessed by participants. They concluded that according to dentists and patients, changing the occlusal plane angle does affect smile attractiveness. Patients tended to rate the 10 degree smile better than 0 and 20 degree smiles, and dentists tended to rate the 15 degree smile better than 0 and 20 degree smiles. This suggests that patients and dentists did not tolerate extreme deviations in the occlusal plane angle. Patients showed higher tolerance to occlusal plane changes (accepting 5, 10, and 15 degree smiles) than did dentists (accepting 10 and 15 degree smiles). This study suggested that large changes in the occlusal plane angle would affect relative smile attractiveness, but small changes are unlikely to affect smile attractiveness.

24. **Santosh kumar, et al. (2012)[28]** compared the difference in perceptions of orthodontists, general dentists, and laypersons regarding smile esthetics after symmetrical and asymmetrical alterations in anterior teeth and their supporting tissues. Digital alterations were made in the crown length, crown width, midline diastema, and gingiva-to-lip relationship of the maxillary anterior teeth in the close-up photograph of a woman's smile. The attractiveness of the smile in the original image and in each of the modified images were assessed by orthodontists, dentists, and laypersons and scored using a visual analog scale. The mean VAS scores were calculated for each photograph. They concluded that the Laypersons were more accepting of minor variations in anterior tooth size and alignment than orthodontists.

25. **Rai. D et al (2013)[29]** compared the judgment of laypersons and orthodontists on overall attractiveness and its correlation with five selected parameters of posed smile. Images of the posed smile were captured with a digital camera from the 60 non-orthodontic treated young adults (30 males, 30 females) and were judged by panels of 10 laypersons and orthodontists each. Visual analog scale was used to measure the pleasantness of smile and Likert scale was used to observe the importance of inciso-gingival display, upper vertical lip thickness, lower vertical lip thickness, buccal corridor and smile arc in smile attractiveness. Pearson's correlation and chi square test was used to identify determinants of the "pleasing smile" from

the results of a Visual analog scale and Likert scale. The VAS score was then determined by measuring in millimetres from the left hand end of the line to the point marked by the evaluator. Unpleasant smiles were defined as those with "mean numerical scores of 0 to 50". Pleasant smiles were defined as those with "mean numerical scores of 51 to 100". Factors responsible for attractive smile were given mean numerical scores of 3 to 5 and the unattractive smiles factors were scored from 0 - 2.99. The five factors were given an individual coding for the ease of statistical analysis; Inciso-gingival display (F1), Upper vertical lip thickness (F2), Lower vertical lip thickness (F3), Buccal corridor (F4), Smile arc (F5). These factors were evaluated with the help of a 5 point Likert scale (from 1 being very unattractive to 5 being very attractive). Likert scale has been used in the evaluation of dentofacial and facial aesthetics, to reduce the variations in VAS scale and to deliberately lean the evaluator towards a point of decision. They observed a strong disagreement between the orthodontists and laypersons in smile evaluation. They also confirmed the hypothesis that increased incisor display correlated with more pleasing smile esthetics and vice versa and was rated as an important factor by orthodontists, in both the male and female groups. The vertical thickness of the upper lip was an esthetic determinant for both the orthodontists and the laypersons, whereas the vertical thickness of the lower lip was an important determinant for laypersons alone: fuller lips were associated with better smiles, in both male and female groups. The orthodontists correlated narrow buccal corridor width with a more pleasing smile, in both male and female groups, giving no importance to the esthetic value of the smile arc. In contrast laypersons showed a strong correlation of a consonant smile arc with smile esthetics.

26. **Liang L et al (2013)[30]** analyzed the dynamics of smile and upper lip curvature in young Chinese population. 188 candidates were selected (88 males and 100 females) ranged from 20 to 35 years of age. Comic videos were shown to induce spontaneous smiles, and a digital video camera was used to record the dynamics of the smile in real time. Based on the final photos and video editing software, the smiles of all subjects were classified into three categories: gummy, cuspid, and commissure smiles. The upper lip curvatures of the subjects were also measured and classified into three categories: downward, straight, and upward. Female subjects obtained significantly higher percentage of commissure smile and lower percentage of cuspid smile than male subjects. In upper lip measurements, female subjects

expressed statistically significant higher percentage in upward curvature and lower percentage in downward curvature during dynamic smile than males. They concluded that in upper lip curvature and smile classifications, differences clearly exist based on race, when comparing Chinese subjects with those of Caucasian descent, and gender.

27. **R. Meshramkar, et al (2013)[31]** studied the prevalence of 'Golden proportion and 70% recurring aesthetic dental proportion' in individuals with attractive smiles. 214 smile photographs of students of SDM Dental College of age 18-25 years with natural dentition were analysed for their attractiveness based on 6 criteria. Further, smiles were digitally analysed to evaluate the prevalence of Golden Proportion and Recurring Aesthetic dental proportion (RED). Data was statistically analysed. RED proportion was present in 6.6% of population as opposed to golden proportion which was found in 0.6% of population. It was found that 70% RED was more prevalent than Golden Proportion in attractive as well as unattractive smiles.

28. **Sercan Akyalcin et al (2014)[32]** Investigated the common denominators of an esthetically pleasing smile in patients who were considered to be successfully treated upon the submission to American Board Orthodontics (ABO) clinical examination. Ninety subjects were included. Standardized digital smile photographs of the subjects were rated by 30 panel members, including orthodontists, general dentists, and parents of orthodontic patients, using a numeric version of the visual analog scale. Three groups were formed using the mean esthetic score viz. unattractive, average, and attractive smiles. Eleven smile characteristics were digitally measured on the photographs and compared between the groups. They found that harmonious smile arc relationship and less gingival display during a smile are significantly associated with smile attractiveness in patients considered successfully treated according to ABO standards.

29. **Kim J et al (2015)[33]** studied the influence of lip form on incisal display with lips in repose on the esthetic preferences of dentists and lay people. Computer-generated male and female models were created using 3 different lip forms each, straight, moderate, and high. Respondents manipulated the incisal display of all 3 images in unison by using a slider bar, with the resulting incisal display measured in millimeters serving as the primary dependent measures. Based on the findings of this online survey, they concluded that Lip form plays an important part in the esthetic perception of incisal display with lips in repose. Significant

differences were identified for the 3 different lip forms for both sexes. As the lip form increased from straight to high, there was a preference for increased incisal display. Incisal display preferences for male and female models were the same for all respondents except for the high lip form, in which a longer incisal display was preferred for the female high lip form. The occupation of the respondent had only a modestly significant effect, but dental professionals should be sensitive to these differences in their treatment plans. The respondent's ethnicity was shown to be statistically significant, with African Americans generally preferring shorter incisal displays.

30. **Prasad V et al (2015)[34]** compared the smile aesthetics in orthodontically treated subjects and subjects with aesthetically pleasing smile. Frontal smiling photographs of 80 subjects in the age group of 18-25 years were taken and divided into Group I (having an esthetically pleasing profile and normal occlusion) and Group II (orthodontically treated). Each Group had 40 subjects, who were further divided into male and female subgroups. Eight transverse and three vertical linear measurements were taken on the frontal photographs and eight ratios were derived. Esthetic scores and other variables were also obtained. They observed that females had a more interpremolar/smile width ratio, a greater positive upper lip curvature was found in Group I males and females and was rated higher for esthetic score and the visible maxillary first molar was more in Group II males and females and rated lower for esthetic score. They also found that esthetic scores rated by lay persons were higher for all the subjects.

31. **Sadrhaghighi H et al (2016)[35]** assessed the esthetic perception and level of acceptability of variations in smile components, including dental midline, buccal corridor, vertical lip thickness, and the golden ratio, byorthodontists, general dentists, dental students, artists, and laypersons. An attractive female smile was digitally manipulated with regard to four smile components: dental midline, buccal corridor, vertical lip thickness, and the golden ratio. (a) maxillary dental midline was deviated by 1 mm toward the right or the left side, relative to the facial midline (labial vermilion) ; (b) size of buccal corridor was altered by changing the arch width posterior to canine teeth in order to make the transverse arch narrower or wider by 10% ; (c) changing the vertical lip thickness at the vermilion by 1 mm (Fig. 3); (d) changing the golden ratio in the maxillary lateral incisors by decreasing or increasing the teeth width symmetrically by 1 mm The manipulated photographs (n=27) were randomly arranged in a

photo album and scored by five groups of raters (n=50 in each group) from zero to 100 using a horizontal visual analog scale. The acceptability threshold of each component by the five groups was calculated using the Spearman and Wilcoxon tests. They concluded that Orthodontists and laypersons had the same perception of midline deviations, with an acceptability threshold lower than that of artists and general dentists. Only orthodontists perceived variations of buccal corridor (by 20%). Changes in vertical lip thickness were not perceived by any group. Orthodontists, general dentists, and laypersons had similar perceptions of variations in the golden ratio. Dental students and artists did not perceive variations in this component.

32. **Dindaroğlu M et al (2016)[36]** did a study to evaluate the parameters that might affect the esthetic perception of localized and full-face views of social and spontaneous smiles. Video records of 40 individuals were used. Further, 200 images of each individual were captured for social and spontaneous smiles with and without calibration glasses. Full-face images of social smile (SSF) and spontaneous smile (smile of joy) (JSF) were obtained. Furthermore, the mouth-area images of the same social (SSM) and spontaneous (JSM) smiles from each subject were acquired. Here 160 images were evaluated by orthodontists and laypersons using the Q-sort method. The data were analyzed with logistic regression and independent samples t-test. From the orthodontic perspective, upper lip thickness (p=0.004), lip curtain over incisors (p=0.016), maxillary incisor display (p=0.01), and buccal corridor ratio (p=0.006) were significant to determine attractive and unattractive images when viewing localized social smiles. Laypersons identified no particular parameter to explain the variation in preferences for all the image groups (p>0.05).They concluded that Upper lip thickness and maxillary incisor display during smiling were found to be effective for distinguishing images as attractive and unattractive by orthodontists. No objective evaluations for the attractiveness were made by laypersons.
33. **Gaikwad S et al (2017)[37]** evaluated the conjugated effect of the smile arc and buccal corridors on attractiveness of face, as evaluated by orthodontists, general dentist and laypersons. The sample consisted of a male and a female subject who satisfied the eligibility criteria. Those subjects with range of 18 to 25 years, with ideally aligned teeth and no history of orthodontic treatment and with ideal smile arc and minimal buccal corridors were selected. Smile view photographs of these subjects were taken. Two photographs were modified to

create combination of three smile arc variance (flat, ideal, excessive) and three buccal corridor variations (none, ideal, excessive) respectively, thus, producing nine male & nine female images. These 18 images of the modified smiles were made and shown to 25 orthodontists, 25 general dentists & 25 laypersons in separate sessions. Evaluators were provided with a rating sheet and asked to score the attractiveness of each image on a numerical scale of 1 to 10, with 1 being the least attractive and 10 the most attractive. They concluded that all the three groups tended to agree that, as the smile arc and buccal corridor increased, the facial attractiveness decreased. Orthodontists were more precise in discerning the smile arc and buccal corridor compared to dentists and laymen. Thus, it can be concluded that everyone has got different perceptions and it varies from professional to individual. Hence, a detailed clinical examination of smile parameters should be included in the orthodontic protocol before planning any orthodontic treatment.

34. **Vasiliki P. Koidou, et al(2017)[38]** quantified the facial and smile esthetics to determine whether individuals identified as having superior smiles display differences in alignment discrepancies (angulation between interpupillary and commissure line); width-to-length ratios of maxillary anterior teeth; application of the golden proportion; and number of teeth revealed in an animated smile when compared with an average population. Internet search for "best smile" and "celebrity" identified 108 celebrities. Photographs showing smiles within 10 degrees of a frontal view were collected, while photographs of dental students were used for the control group. Alignment discrepancies, widths, lengths of the anterior teeth, and number of teeth in an animated smile were measured with photo editing software, and ratios were calculated. The groups were compared. Celebrities identified as having a best smile had smaller mean alignment discrepancies and revealed a greater number of teeth in an animated smile than dental students.

35. **Meshramkar R et al (2019) [39]** evaluated the influence of macro-, micro-, and miniesthetics in an attractive smile. A total of 214 dental students were taken of age group 18–25 years with natural dentition. Frontal photographs were taken of the subjects. The study was carried out in two stages: stage 1- the photographs were analyzed for beautiful smiles. Those photographs which had a mean score of 60 and above were selected. Out of 214 photographs, 33 photographs were selected for attractive smiles. In Stage 2 the different parameters of macro-, micro-, and miniesthetics that influence attractive smile were evaluated. They

concluded that Facial form contributes more in an attractive smile compared with the remaining factors for macroesthetics. In factors influencing microesthetics ideally tooth shade plays major role compared with other factors. Crowding ideally plays significant role compared with the remaining factors for miniesthetics

36. Sukhpal kaur, et al (2020) [40] compared the perceptions of dental specialists and laypeople regarding smile esthetics; to compare male and female smile parameters; and to find influence of smile parameters on esthetics of smile. Frontal posed photographs of 60 subjects were taken using a digital camera and rated on a visual analog scale by 10 dental specialists and 10 laypersons. Measurements made on photographs were used to analyse various parameters of smile, like buccal corridor space, smile arc, modified smile index, anterior height of smile, most posterior maxillary tooth visible, and midline relationship of central incisors to philtrum. Visual analog scale values showed that 6 photographs were rated as very good, 29 as good, 21 as average, and 4 photographs were rated as bad. There was no significant difference in perception of dental specialists and laypersons regarding esthetics of smile. Smile arc and anterior height of smile influenced the esthetics of smile. No significant difference in perception of dental specialist and layperson regarding esthetics of smile. Smile arc and anterior height of smile influenced the esthetic of smile. No significant difference was found between male and female smile parameters except modified smile index.

37. Melo M et al (2020) [41] performed a study to determine whether there are gender differences in a number of smile aesthetic parameters, with the purpose of facilitating the planning of multidisciplinary treatment. Parameters selected were coincidence of the maxillary interincisal midline with the facial midline, the arc of the smile, curve of the upper lip, line and width of the smile, and the shape of the upper central incisors. Photographs were obtained under resting and forced smiling conditions in 140 individuals (70 males and 70 females) with a mean age of 20.1 ± 4.3 years. All the parameters were recorded, The data were processed using the SPSS version 15.0 statistical package, with application of the chi-squared test and a confidence level of 95%. The statistical power was 80%, and the level of significance 5% ($\alpha = 0.05$).they concluded that none of the parameters showed significant differences in terms of gender. The kappa coefficient for interrater reliability was 0.81. Maxillary interincisal midline versus facial midline In the great majority of the subjects (94.3%; n = 132), the maxillary dental midline coincided with the facial midline, while 5.7%

(n = 8) showed deviation. Arc of the smile of the 140 individuals evaluated, 80% (n = 112) presented a consonant arc of the smile, while the remaining 20% (n = 28) showed a non-consonant arc. There were no statistically significant differences between males and females (p = 1). Curve of the upper lip: a total of 47.1% of the patients (n = 66) had an upward lip curve, 41.4% (n = 58) had a straight curve, and 11.4% (n = 16) presented a downward upper lip curve (p = 0.315).Smile line: Most of the patients (84.3%; n = 118) presented a medium smile line, 8.6% (n = 12) a low smile line, and 7.1% (n = 10) a high smile line. According to gender, females more often presented a high smile line compared with males (11.4% versus 2.9%, respectively). In contrast, males showed a higher frequency of low smile lines (11.4% versus 5.7%) (p = 0.135). Width of the smile of the 140 patients evaluated, 61.4% (n = 86) showed tooth exposure to the second premolar, 20% (n = 28) to the first molar, and 18.6% (n = 26) to the first premolar (p = 0.951).Shape of the teeth A total of 62.9% of the subjects (n = 88) presented an oval tooth shape, 22.9% (n = 32) a square shape, and 14.3% (n = 20) a triangular tooth shape (p = 0.379). No significant gender differences were observed in relation to the parameters studied, with the exception of the smile line, which was found to be higher in females than in males. The population studied has a maxillary interincisal midline centered with the facial midline, a consonant arc of the smile, an upward lip curve, a medium smile line, with exposure to the second premolar, and an oval tooth shape.

38. **Ngoc V et al (2020)[42]** evaluated the effects of altered displays in incisors, gingival margin, and other smile-related-factors on dentists' vs. non-professionals'. They altered the features like the width of maxillary lateral incisors, the length of maxillary central incisors, gingival margin of maxillary lateral incisors, gingival exposure, maxillary midline diastema, maxillary midline shift, and tilted occlusal plane of 42 digital smile photographs. Then, these altered photographs were presented to 51 dentists and 51 non-professionals, and each picture was rated by each participant with a visual analog scale ranging from 0 (very ugly) to 100 (very beautiful). They found out that the threshold of ugly smile perception with the factors of reducing the crown length of maxillary central incisors: dentists (2.0 mm), non-professionals (2.0 mm); gingival disclosure level: dentists (3 mm), non-professionals (4 mm); maxillary midline diastema: dentists (1.5 mm), non-professionals (1.0 mm); tilted occlusal plane: dentists (4^0), non-professionals (5^0). By either decreasing the crown width of the maxillary lateral incisors or shifting midline, at maximum deviation in this study (2.5 and 5 mm), both

studied groups did not perceive the smiles as ugly. Therefore they concluded that when assessing some effects on the smile aesthetics of Vietnamese people, dentists tend to feel more refined than non-professionals. They had different perceptions of smile aesthetics when the gingival exposure level was changed. Therefore, it is in need of consideration during orthodontic and prosthodontic treatment to achieve optimum aesthetic results.

39. **Hernan et al (2021)[6]** studied the influence of upper lip curvature on smile attractiveness in patients with different degrees of gingival smiles on the perception of smile attractiveness which was assessed by Peruvian orthodontists, dentists, and laypersons. frontal photograph was digitally altered to generate 3 types of upper lip curvature shapes (upward, straight, and downward) with 5 different levels of gingival smile exposure (0 mm, 2 mm, 3 mm, 4 mm, and 5 mm). Fifteen images were generated. Three groups of evaluators (50 dentists, 50 orthodontists, and 50 laypersons) assessed the images using a visual analog scale. They found out that Upward or straight upper lip curvature shapes were found to have a positive impact on the perception of smile esthetics. In contrary, downward upper lip curvature shapes have a negative effect on perception when evaluating different degrees of gingival smiles.

MATERIALS AND METHOD

The present study was conducted in the Department of Orthodontics BBDCODS, with an aim to evaluate the effect of arch width and tooth characteristics on perception of smile in subjects with gratifying and non-gratifying smile as rated by panel of judges. 500 students were selected from different colleges of Babu Banarasi Das University, Lucknow, in age range of 18-30 years (mean age 24) who fulfilled the sample selection criteria. The standardized frontal smiling photographs of subjects were taken. Also from the same image the lower third of face was cropped, Thus two photographs of each subject (frontal smiling photograph and lower third smiling photograph) were saved as JPEG (Joint Photographic Experts Group) format. Based on the rating by panel of judges for both the photograph of each patient on visual analogue scale from 0-10 (with 0 being least gratifying to 10 being most gratifying subjects) final sample was obtained. The final sample included 400 subjects equally divided in two groups, Group-I including 200 subjects with gratifying smile and Group- II including 200 subjects with non-gratifying smile. Both the groups were further subdivided into groups as per gender.

The approval was taken from Ethical Committee of Babu Banarasi Das College of Dental Science, BBDU, Lucknow before conducting the study. An informed consent was taken from all the participants of the study.

Eligibility Criteria

Inclusion criteria:

1. Subjects willing to participate in the study.
2. Subjects with age range of 18-30 years.
3. Subjects with complete permanent dentition except for third molar.

Exclusion criteria

1. Any lip surgery and other facial aesthetics enhancement procedures.
2. Facial asymmetry, congenital facial and dental defects.
3. Subjects who had undergone orthodontic or endodontic treatment or alteration of teeth by any dental procedure.

4. Subjects with active periodontal disease or had undergone periodontal treatment except routine scaling.
5. Subjects with missing and extracted teeth
6. Subjects who had history of trauma to orofacial structure

Sample

The final sample were selected from initial sample of 500 subjects whose full face and lower third frontal smiling photograph were rated by the panel of judges on visual analogue scale of 1-10.Distribution of sample is shown in table1

	GROUPS	SUB GROUPS
Full face	GROUP I Gratifying smile	Sub Group I_gA(MALE)
		Sub group I_gB(FEMALE)
	GROUP II Non Gratifying Smile	Sub Group I_{ng}A(MALE)
		Sub group II_{ng}B(FEMALE)
Lower third	GROUP I Gratifying Smile	Sub Group IIA(MALE)
		Sub group IIB(FEMALE)
	GROUP II Non Gratifying Smile	Sub Group IA(MALE)
		Sub group IIB(FEMALE)

TABLE 1: DISTRIBUTION OF SAMPLE

Materials and Equipment:

Material used for taking Facial photograph (Figure 1)

1) Camera-Canon (LENS:18-55) 14 megapixel Digital single lens reflex (DLSR)

2) Tripod stand

3) Ruler for calibration of photograph

4) White board

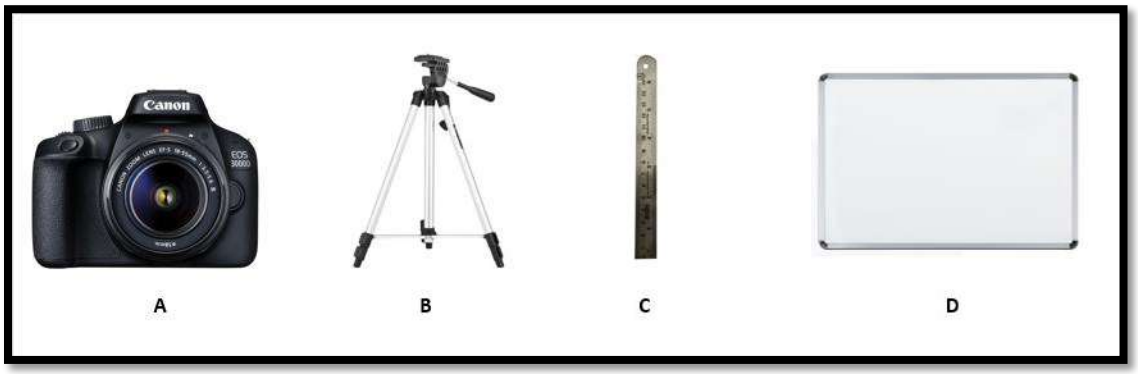


Figure 1: Armamentarium used for taking facial photographs and measurements

A) Camera- B) Tripod stand C) Ruler D) White board

D. Material used for assessment of facial smiling photographs

1) Computer system with loaded software

a) Adobe photoshop (Version 13.0.1X64) **Figure. (2a)**

b) Microsoft Paint (version 11.2304) for marking landmarks and reference planes on photographs **Figure. (2b)**

c) IC Measure software version 2.0.0.286 **Figure. (2c)**

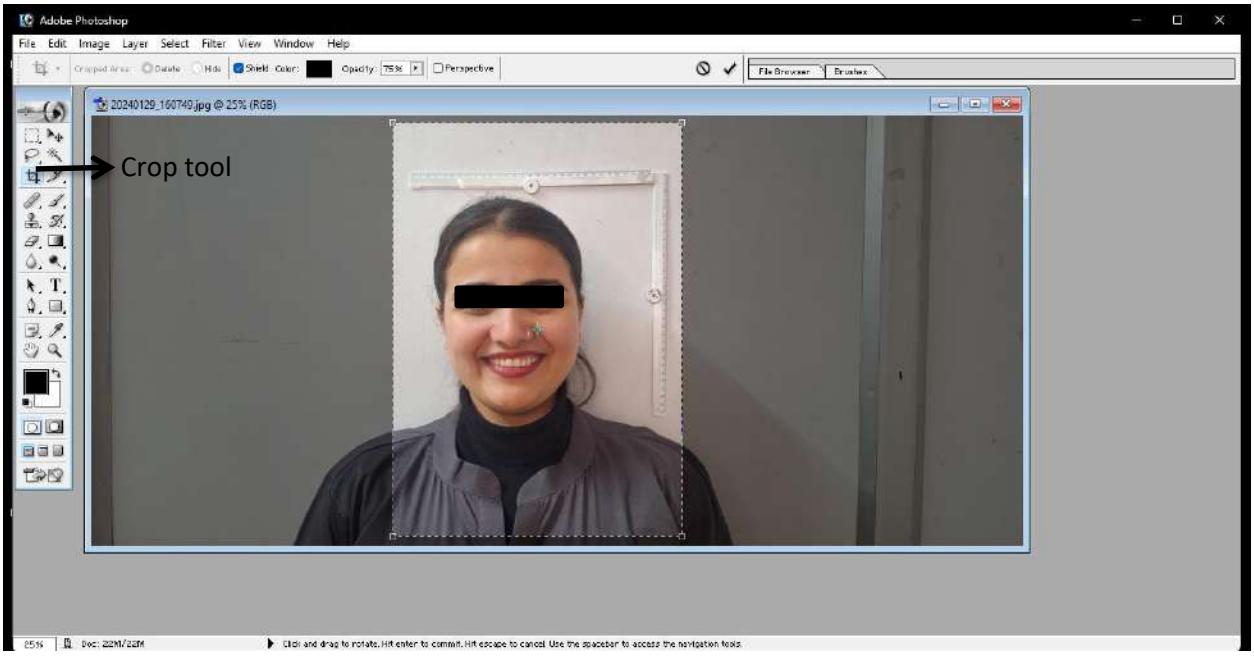


Figure 2a: Adobe Photoshop for cropping of photographs

Figure 2b: Microsoft Paint for marking landmarks and reference planes on photographs

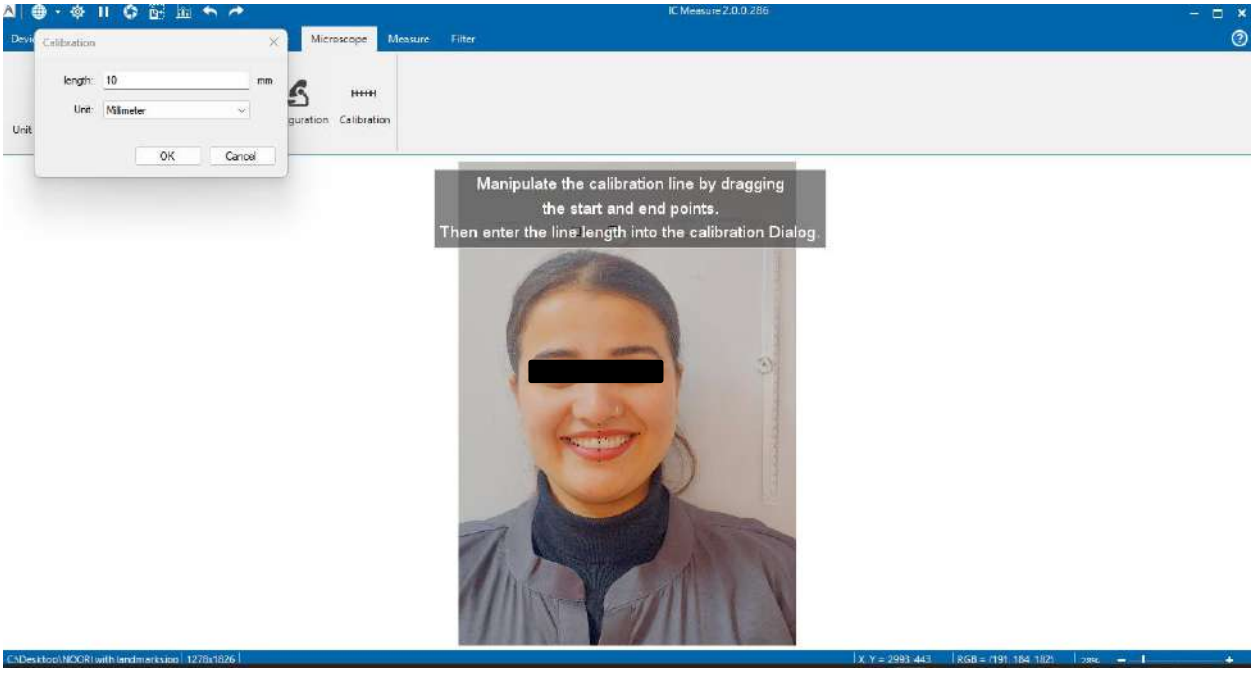


Figure 2c): IC Measure software for measurements.

METHODOLOGY

(A) METHOD FOR TAKING FULL FACIAL SMILING PHOTOGRAPHS.

i. All the subjects were made to stand in an upright position against the white board with vertical and horizontal rulers attached to the background for calibration of the photograph.

ii. Digital single lens reflector (DSLR) was placed on a tripod stand at a standard distance of approximately 4 feet from the subjects.

iii. The height of camera was adjusted for each subject. Pictures were taken in same environment with same lightning conditions.

iv. Before taking the photographs, each subject was asked to rehearse the following word “cheese” and smile, showing his/her teeth.

v. For each subject, three frontal smiling facial photograph of full face were taken. Amongst these the image that best represented the patient's natural unstrained social smile was selected.

(B) METHOD FOR STORING AND EDITING OF PHOTOGRAPHS.

All digital photographs (JPEG format) were imported into a commercially available photograph editing software (Adobe Photoshop, Windows 10, Adobe system) for editing. For full face smiling photographs, the photographs were cropped vertically 5mm above the head and 25 mm below the soft tissue chin and horizontally 10 mm lateral to both ears to a size of 5 X 3.5 inch. **(Figure 3a)**

Also facial photograph of only lower third of face was obtained from full face smiling photograph. Further image was cropped with vertical limits at nose tip and soft tissue pogonion and transverse limits at perpendicular dropped down from the zygomatic prominence. Thus eliminated most of nose, cheeks, and chin and minimize the influence of background on facial attractiveness. The images were adjusted to a standardized image size (3 × 5 inch) and saved as JPEG files format**. (Figure 3b)**

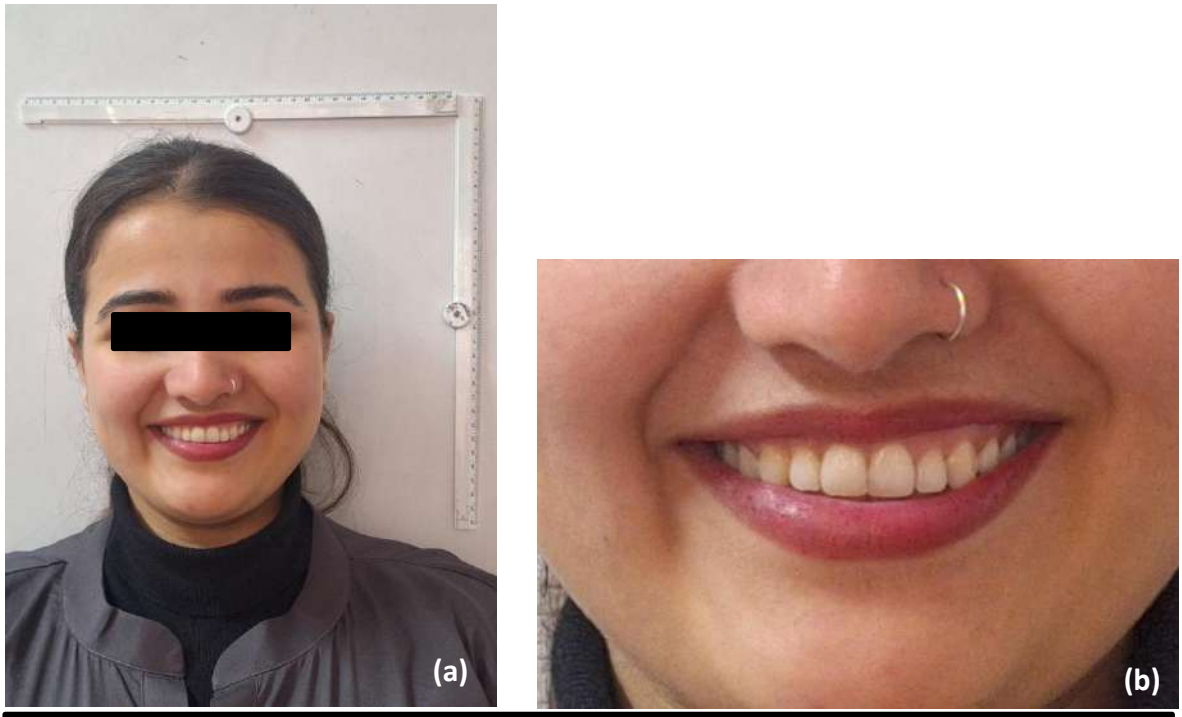


Figure 3(a- b)

a: cropped frontal smiling photograph

b: cropped lower third frontal smiling photograph

(C) METHOD OF RATING BY PANEL OF JUDGES.

Two photographic albums were made **(Figure 4)**

(i) First album had 500 full facial smiling photographs

(ii) Second album had 500 lower third smiling photographs

The photographs were arranged randomly in both the albums. Each album was rated by panel of judges including 1 General Dentist, 1 Orthodontist, 1 Plastic Surgeon, 1 Beautician and 1 Layperson using visual analogue scale from 1-10.The panel of judges were asked to assess the attractiveness of entire smile on overall full facial smiling photograph and of lower third of face to assess how the teeth would appear within the lips. The panel of judges were requested for following considerations during rating

(a) Disregard facial blemishes, any variation in teeth shade, or picture quality.

(b) To calibrate yourself for evaluation process, album can be flipped before rating.

(c) Do not flip back to compare any of the photographs or score to one another.

Each panel member made its evaluation separately without any knowledge of the subject's identity and the ratings given by the other panel members. The judges were requested to evaluate the smiles for the esthetic value of the teeth and lip appearance and overall facial balance. The smiles were graded using the scales from 1 being least gratifying to 10 being most gratifying. The scores were entered onto an Excel spread sheet (Windows 7, Microsoft Office 2007).(Table 2) for each judge and for each set of photograph visual analogue scale grading sheet as shown in **(Figure 5)** was given to each judge.

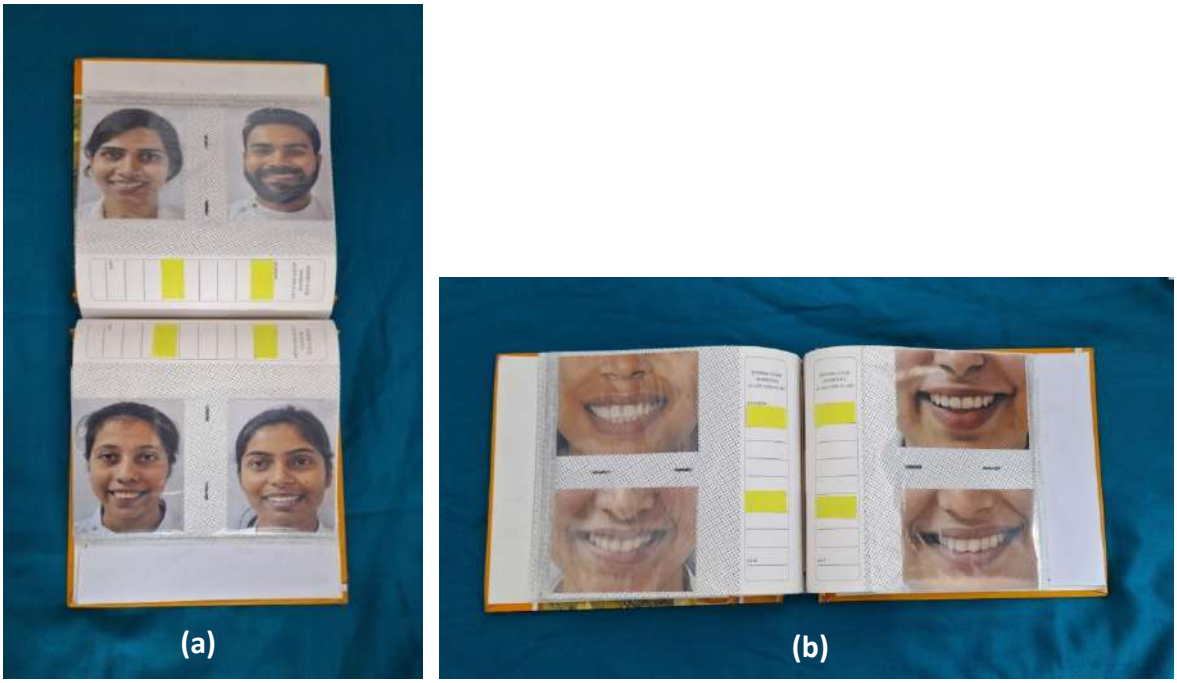


Figure 4: photographic albums

(a) full face smiling photograph (b) lower third smiling photograph

Photograph number	Visual analogue scale grading sheet									
	1	2	3	4	5	6	7	8	9	10
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

Figure 5: Visual analogue scale grading sheet

(D) METHOD FOR SELECTION OF FINAL SAMPLE.

The mean score were calculated for each subject as rated by different members of the panel. The subject with the score between 6-10 were considered as having gratifying smile and subjects with a mean score of 1-5 were considered as having non gratifying smiles.

Out of 500 subjects some of the samples were excluded as their premolars are not visible during smile. Thus the total of 400 subjects were selected for further assessment of arch width and smile characteristics and equally divided in two groups Group-I including 200 subjects with gratifying smile and Group- II including 200 subjects with non-gratifying smile. Both the groups were further subdivided into groups as per gender.

(E) METHOD OF LOCATING REFRENCE POINTS AND PLANE

The selected and cropped frontal photographs were transferred to Paint (Microsoft Paint version 11.2304) for marking landmarks and reference planes on photographs.

Following landmarks and reference plane were identified **(Figure 6):**

1. **Outer commissure right (OCR)** - Outer junction of upper and lower lips lateral to the angle of the mouth on right side.
2. **Outer commissure left (OCL)** - Outer junction of upper and lower lips lateral to the angle of the mouth on left side.
3. **Inner commissure right (ICR)** - Inner junction of the upper and lower lips mesial to the angle of the mouth on right side.
4. **Inner commissure left (ICL)** - Inner junction of the upper and lower lips mesial to the angle of the mouth on left side.
5. **Visible posterior tooth right** (**VPTR)** - Distal surface of last visible posterior tooth at its contact point with the tooth distal to it on right side
6. **Visible posterior tooth left (VPTL)** - Distal surface of last visible posterior tooth at its contact point with the tooth distal to it on left side.
7. **4R** - Distal surface of 1s Premolar at its contact point with 2nd premolar on right side.
8. **4L**- Distal surface of 1st Premolar at its contact point with 2nd premolar on left side
9. **3R** - Distal surface of canine at its contact point with first premolar on right side.
10. **3L**-Distal surface of canine at its contact point with first premolar on left side.
11. **Canine cusp tip right (CCR)**- Tip of maxillary canine was marked as CCR for right side.
12. **Canine cusp tip left (CCL)**- Tip of maxillary canine was marked as CCL for left side.
13. **LFCI**- Inferior most point on labial frenum between the central incisors (if visible) was marked as LFCI.
14. **Inferior border of upper lip (IULP)**- Inferior most point in midline on the inferior border of the tubercle of upper lip
15. **Superior border of upper lip (SULP)**- Inferior most point in midline on the superior border of upper lip.
16. **Superior border of lower lip (SLPP)**- Deepest midline point of the superior margin of lower lip.

17. **Inferior border of lower lip (ILPP)**- Most inferior point in midline on the inferior border of lower lip
18. **Zenith of marginal gingiva(MG)-** in relation to upper central incisors
19. **Sub nasale (Sn)-** located at the junction of the columella and the upper lip.

Reference plane used in study (figure 7)

1. **Facial midline**-Line in midsagittal plane joining the points Gabella, subnasale and menton. **(figure 7a)**
2. **Dental midline**- Line in midsagittal plane joining the points SULP, IULP, LFCI, ILPP and SLPP**.(figure 7b)**

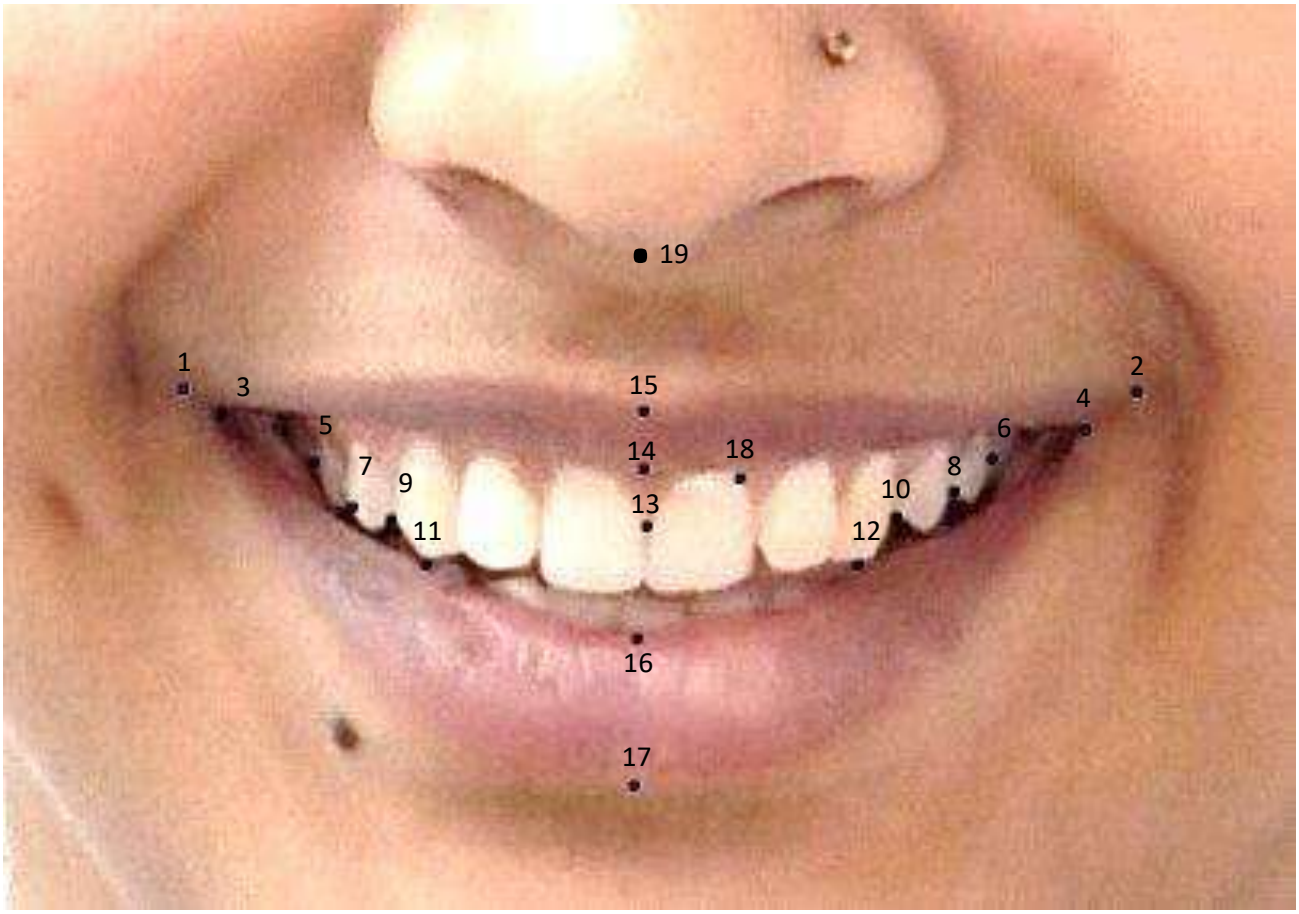


Figure 6 : Reference Point used in the study:-

1-Outer Commissure Width Right (OCR)	2- Outer Commissure Width Left (OCL)
3-Inner Commissure Right (ICR)	4- Inner Commissure Left (ICL)
5- Visible Posterior Teeth Right (VPTR)	6- Visible Posterior Teeth Left (VPTL)
7-4R	8-4L
9-3R	10-3L
11- Canine Cusp Tip Right (CCR)	12- Canine Cusp Tip Left (CCL)
13- Inferior Point on Labial Frenum (LFCI)	14- Inferior Border of Upper Lip (IULP)
15 – Superior Border of Upper Lip (SULP)	16- Superior Border of Lower Lip (SLPP)
17- Inferior Border of Lower Lip (ILPP)	18- Zenith of Marginal Gingiva
19- Sub nasale.	

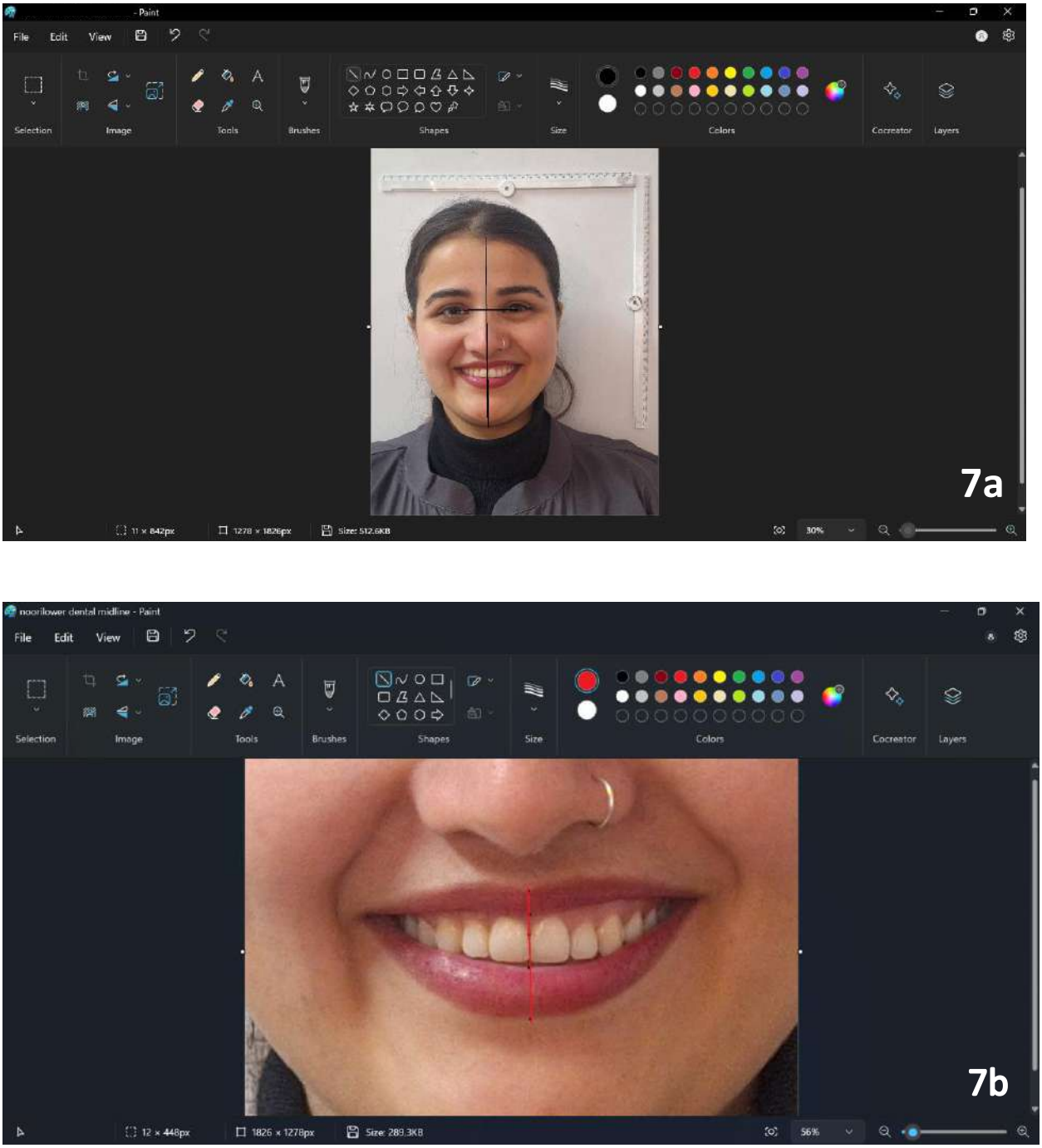


Figure 7: Reference plane used in study (A) facial midline, (B) Dental midline.

METHOD OF ANALYZING PHOTOGRAPHS

Photographs were analyzed by two measurements

1. **Qualitative measurements including:** Facial Midline, Smile Arc, Dental Midline, Smile Symmetry, Lip Line, Axial Inclination, Gingival Shape, Gingival Contour, Zenith
2. **Quantitative measurements including:** Commissure Width, Philtrum Height, Visibility Of Central Incisor, Buccal Corridor, Gingival Height, Inter Premolar Width Inter Molar Width.

(A) Macro aesthetics

1. **Facial midline**: check if facial midline coincides with dental midline or not.

(B) Mini aesthetics (figure 8)

1. **Commissure width (OCR-OCL):** Horizontal distance from outer commissure of right side to left side.(Figure.8a)
2. **Philtrum height (Sn-SULP):** Vertical distance from subnasale to superior border of upper lip (Figure.8b)
3. **Visibility of maxillary central incisor**: It was taken as vertical measurement of visible portion of central incisor. (Figure.8b)
4. **Smile arc**: The smile arc was considered as "consonant"—if the curvature of the maxillary incisal edges coincides with or parallels the border of the lower lip in smiling. In non-consonant" smile arc, the maxillary incisal edges are either flat or reversed relative to the curvature of the lower lip. (Figure.8c)
5. **Smile symmetry**: The vertical distance was measured between perpendiculars drawn from OCL and OCR to facial midline. The smile is said to be symmetrical if the vertical distance is zero. (Figure 8d)
6. **Buccal corridor (VPTR-ICR and VPTL-ICL):** Horizontal distance from most lateral aspect of the most posterior visible tooth to the inner commissure on both sides. (Figure.8e)
7. **Lip line**: The level of lower border of upper lip (IULP) with respect to vertical teeth exposure during smile. It could be high or low lip line.

a) A high lip line exposes all of the clinical crowns plus a contiguous band of gingival tissue.

b) A low lip line displays less than 75% of the maxillary anterior teeth.

(C) Micro aesthetics (Figure 9)

Dental component

1. **Axial inclination**: long axis of maxillary anterior teeth should follow progression from the midline distally. (Figure 9)

Gingival component

1. **Shape**: was noted as pyramidal/ inflamed.
2. **Contour**: was noted as knife edge or rolled out margin.
3. **Zenith**: it was marked at the most apical point of the gingival marginal scallop on maxillary central incisor and was recorded as normal if the zenith lies distal to the long axis of central incisor. (Figure 9b)
4. **Gingival display:** The amount of gingival show superior to maxillary incisor if seen was measured as distance between IULP and superior margin of margin gingiva of maxillary central incisors.

(D) Parameters for measuring arch width (figure 10)

1. **Inter canine width (3R-3L):** horizontal measurement of outer most lateral border of canine from one side to other.
2. **Inter premolar width (4R-4L):** horizontal measurement of outer most lateral border of first premolar from one side to other.

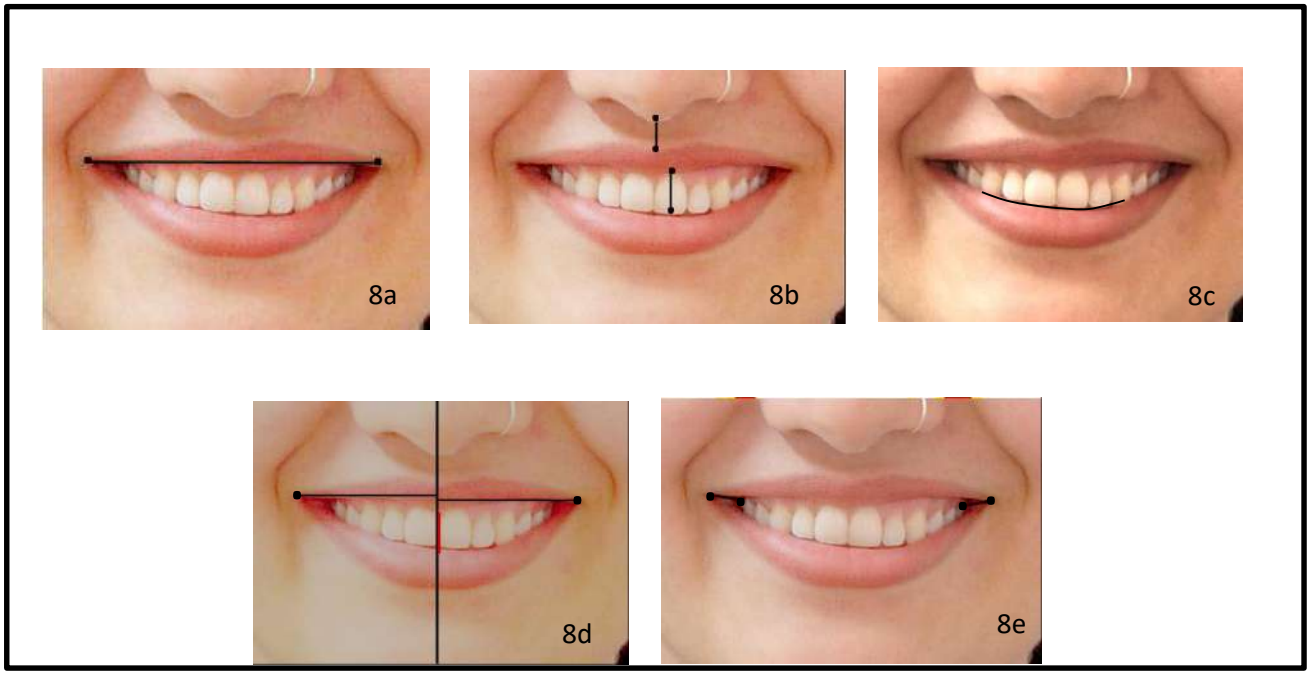


Figure 8: Mini aesthetics parameters.
(a)Commissure width (b) Philtrum height, Visibility of maxillary central incisor,
(c) Smile arc, (d) Smile symmetry, (e) Buccal corridor.

Figure 9: Micro aesthetics parameters. (a) Axial Inclination, Zenith

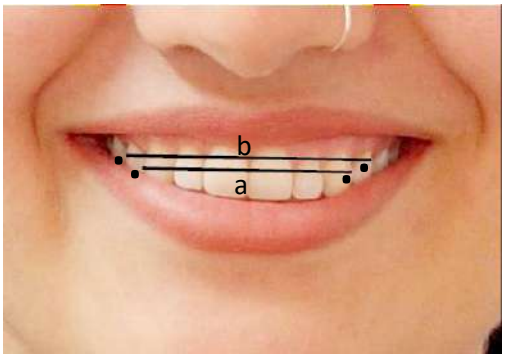


Figure 10: Measurement of arch width.
(a) Inter canine width, (b) Inter premolar width

The data so obtained was tabulated and was subjected to statistical analysis.

Data analysis

Data was entered into Microsoft Excel spreadsheet and was checked for any discrepancies. Summarized data was presented using Tables and Graphs. The data was analysed by SPSS (21.0 version). Shapiro Wilk test was used to check which all variables were following normal distribution. Data was normally distributed therefore, inferential statistics were performed using parametric test i,e Paired t test for intragroup comparison and one way Anova followed by Tukeys test for post hoc pairwise comparison. For assessing the relationship between categorical variables, chi square test was used. Level of statistical significance was set at p-value less than 0.05

TOOLS FOR STATISTICAL ANALYSIS

Formula used for the analysis

A. The Arithmetic Mean

The most widely used measure of central tendency is arithmetic mean, usually referred to simply as the mean, calculated as

$$\bar{X} = \frac{\sum_{i=1}^{n} X_i}{n}$$

B. The Standard Deviation

The standard deviation (SD) is the positive square root of the variance, and calculated as

$$SD = \sqrt{\frac{\sum X_i^2 - \frac{(\sum X_i)^2}{n}}{n-1}}$$

where, n= no. of observations

and also denoted by subtracting minimum value from maximum value as below

C. Tests of significance

Test of significance are used to estimate the probability that the relationship observed in the data occurred purely by chance was there a relationship between the variables. They are used to test the hypothesis proposed at the start of the study.

In this study Parametric tests were used

a) **The data was normally distributed**
b) **The data was obtained from the sample which is randomly selected**
c) **The data was quantitative data**

I. T TEST.

T tests are based on the t distribution which is a symmetrical, bell-shaped curve like the normal distribution, but having different area and probability properties.

T distribution is a family of curves which are differentiated by their degrees of freedom.

With increasing sample sizes, the t distribution assumes the shape of the normal distribution. 2 A sample size of 100 is often chosen as the cut-off point for deciding when to apply For t or z.

TYPES OF T TESTS INDICATIONS.

a) Paired T Test

The paired t test is used to decide whether the differences between variables measured on the same or similarly matched individual are on average zero. As the data are matched there must be an equal number of observations in each sample.

Assumption. The paired t-test assumes that the differences in scores between pairs are approximately normally distributed, although the two sets of data under scrutiny do not need to be normally distributed.

b) Unpaired or two-sample t test (equal variance assumed)

The unpaired t test is used for comparing two independent groups of observations when no suitable pairing of the observations is possible.The samples do not need to be of equal sizes.

Assumptions. The test requires the populations to be normally distributed with equal variance, though the test is relatively robust to deviations from these assumptions. Unpaired t test or two-sample t test (unequal variance)

When the variances of the two groups differ and transformation does not produce equal variance, the calculation of the t test becomes more complex. Instead of using the pooled variance, estimates of the individual population variances are used

Formula:

$$t = \frac{M_x - M_y}{\sqrt{\frac{S_x^2}{n_x} + \frac{S_y^2}{n_y}}}$$

M =mean

n = number of scores per group

$$S^2 = \frac{\sum (x - M)^2}{n - 1}$$

x = individual scores

M = mean

n= number of scores in group

- Define the problem
- State null hypthesis(H_0) & alternate hypothesis(H_1)
- Find t value, Find (X_1 - X_2)
- Calculate SE of difference between two means

$SE = \sigma\sqrt{1/n_1+1/n_2}$ or

$t = (X_1 - X_2) / SE$

- Calculate degree of freedom = $n_1 + n_2 - 2$
- Fix the level of significance (0.05)
- Compare calculated value with table value at corresponding degrees of freedom and significance level

- If observed t value is greater than theoritical t value, t is significant, reject null hypothesis and accept alternate hypothesis

II. ANALYSIS OF VARIANCE

Analysis of variance (ANOVA) is used when we compare more than two groups simultaneously. The purpose of one-way ANOVA is to find out whether data from several groups have a common mean. That is, to determine whether the groups are actually different in the measured characteristic. One way ANOVA is a simple special case of the linear model. For more than two independent groups, simple parametric ANOVA is used when variables under consideration follows Continuous exercise group distribution and groups variances are homogeneous otherwise non parametric alternative Kruskal-Wallis (H) ANOVA by ranks is used. The one way ANOVA form of the model is

$Y_{ij} = \alpha_{.j} + \varepsilon_{ij}$

where:

- Y_{ij} is a matrix of observations in which each column represents a different group.
- $\alpha_{.j}$ is a matrix whose columns are the group means (the "dot j" notation means that α applies to all rows of the j^{th} column i.e. the value α_{ij} is the same for all i).
- ε_{ij} is a matrix of random disturbances.

The model posits that the columns of Y are a constant plus a random disturbance. We want to know if the constants are all the same.

Assumptions are:

a) Response variable must be normally distributed (or approximately normally distributed).
b) Samples are independent.
c) •Variances of populations are equal.
d) The sample is a simple random sample (SRS).

Two-way anova is used when we have one measurement variable and two nominal variables, and each value of one nominal variable is found in combination with each value of the other

nominal variable. It tests three null hypotheses: that the means of the measurement variable are equal for different values of the first nominal variable; that the means are equal for different values of the second nominal variable; and that there is no interaction (the effects of one nominal variable don't depend on the value of the other nominal variable). When we have a quantitative continuous outcome and two categorical explanatory variables, we may consider two kinds of relationship between two categorical variables, In this relationship we can distinguish effect of one factor from that of the other factor. This type of model is called a **main effect model** or **no interaction** model.

Tukey Multiple Comparison Test

After performing ANOVA, Tukey HSD (honestly significant difference) post hoc test is generally used to calculate differences between group means as

where,

$$q = \frac{\bar{X}_1 - \bar{X}_2}{SE}$$

$$SE = \sqrt{\frac{S^2}{2}\left(\frac{1}{n_1} + \frac{1}{n_2}\right)}$$

S^2 is the error mean square from the analysis of variance and n_1 and n_2 are number of data in group 1 and 2 respectively.

I.CHI-SQUARED TEST

- It is to determine if there is any association between categorical data from two or more groups.
- Categorical data are data that can be separated into distinct groups that do not have a numerical relationship or order between them.

Methodology.

(a) Make a contingency table. Data are organized into a contingency table comprising row, and columns. The categories for one variable define the rows, and the categories for the other variable defines column.

(b) Test the difference between observed and expected values.

1. Test compares the size of the discrepancy between the numbers observed in the rows and columns against the number that would be expected if the null hypothesis (that there are no differences between the groups) was true.
2. If the observed and expected values are close then it would be reasonable to anticipate that the null hypothesis is true. 2

3. Chi square distribution is a family of probability density curves that are defined by the number of degrees of freedom.
4. The test statistic CHI square is a squared value it will, always be positive and greater than zero irrespective of the direction of the difference between samples (i.e. greater than or less than).
5. Right hand tail of the CHI square distribution therefore represents the two-tailed probability that the samples were derived from the same population. 2 CHI square tests are therefore always regarded as two sided.

Assumptions.
1. Sample is randomly selected from the population.
2. Actual frequencies (not percentages or proportions) are entered into the contingency table.
3. Observations should be independent (not paired) if data are paired, McNemar's test should be used.
4. All values must be greater than 1. 5. 80% of the expected values must be >5.

$$\chi_c^2 = \sum \frac{(O_i - E_i)^2}{E_i}$$

O : OBSERVED FREQUENCY
E : EXPECTED FREQUENCY

Statistical significance

Level of significance "p" is level of significance signifies as below:

$p > 0.05$	Not significant (ns)
$p < 0.05$	significant (*)

Measurement of Reliability-

Reliability of measurements was done by repeating the measurement of 10 subjects selected from sample at 1 week interval from the first set of evaluation to the second set of evaluation by the same observer. The comparison was done between the first and second set of measurements by student t test. Statistically no significant difference was noted between them.(table 2)

parameters		**Mean ± Std. Deviation**	**Mean Std. Error**	**P value**	**Level of significance**
Commissure width	First reading	67.425 ±.899	.449	0.058	NS
	Second reading	65.67±.432	.216		
Philtrum height	First reading	13.140±2.932	1.311	0.381	NS
	Second reading	14.800±4.518	2.020		
Visibility of CI	First reading	13.220±3.761	1.682	0.268	NS
	Second reading	15.360±2.674	1.196		
Gingival height	First reading	.880±1.967	.880	0.978	NS
	Second reading	.840±1.878	.840		
3-3 width	First reading	63.960±6.559	2.933	0.926	NS
	Second reading	63.480±6.440	2.880		
4-4 width	First reading	73.360±7.578	3.389	0.947	NS
	Second reading	73.760±7.66	3.427		
Buccal corridor right	First reading	2.720±.130	.058	0.100	NS
	Second reading	2.360±.328	.147		
Buccal corridor left	First reading	2.380±1.231	.550	0.152	NS
	Second reading	1.380±1.179	.527		

Table 2: Measurement of reliability

Observation and Result

The present study was conducted in the Department of Orthodontics BBDCODS, with an aim to evaluate the effect of arch width and tooth characteristics on perception of smile in subjects with gratifying and non-gratifying smile as rated by panel of judges. 500 students were selected from different colleges of Babu Banarasi Das University, Lucknow, in age range of 18-30 years (mean age) who fulfilled the sample selection criteria. The standardized frontal smiling photographs of subjects were taken. Also from the same image the lower third of face was cropped, Thus two photographs of each subject (frontal smiling photograph and lower third smiling photograph) were saved as JPEG (Joint Photographic Experts Group) format.

Based on the rating by panel of judges including 1 General Dentist, 1 Orthodontist, 1 Plastic Surgeon, 1 Beautician and 1 Layperson both the photograph of each patient on visual analogue scale from 0-10 (with 0 being least gratifying to 10 being most gratifying subjects) final sample was obtained. The final sample included 400 subjects equally divided in two groups, Group-I including 200 subjects with gratifying smile and Group- II including 200 subjects with non-gratifying smile. Both the groups were further subdivided into groups as per gender.

Various Qualitative and Quantitative measurements were made on the lower third smiling photographs of the subjects in all the groups. The result of the study are tabulated as follows:

	GROUPS	**Mean score ± Std. Deviation**	**Std. Error Mean**	**P value**
Full face	Group I_g	5.837±0.6519	.0461	0.001^{***}
	Group II_{ng}	4.436±0.4419	.0312	
Lower third	Group I	5.609±0.4763	.0337	0.001^{***}
	Group II	4.253±0.5651	.0400	

*** highly significant p<0.001

Table 3: Mean score and standard deviation of group I and group II

Table 3 shows the mean score given by the panel of judges. Based on the mean scores given by panel of judges for full face, the Group I_g (n-200) = 5.837±0.6519 is on the higher side and Group II_{ng} (n-200) = 4.436±0.4419 on the lower side, there is a highly significant difference (P value<0.001) between these two groups. The mean scores given by panel of judges for lower third smiling face, the Group I (n-200) 5.609±0.4763is on the higher side and Group II (n-200)

4.253±0.5651on the lower side, a highly significant difference (P value<0.001) is seen between these two groups.

		Mean± Std. Deviation	**Std. Error Mean**	**P value**
Full face	Gratifying male (I_gA)	5.902±0.6661	.0839	0.001***
	Non gratifying male ($II_{ng}A$)	4.457±0.4607	.0512	
Lower third	Gratifying male (IA)	5.600±0.497	.0839	0.001***
	Non gratifying male (IIA)	4.458±0.4565	.0514	

*** highly significant p<0.001

Table 4: Mean and standard deviation of group IA and IIA (gratifying and non-gratifying male (n-144))

Table 4 shows the mean score given by the panel of judges to males. Based on the mean score given by the panel of judges for males subjects on full face the subjects were divided into two groups. Group I_nA (n-63) 5.902±0.6661 is on the higher side and Group $II_{ng}A$ (n-81) 4.457±0.4607 on the lower side, there is a highly significant difference (P value<0.001) between these two groups. Similarly in the lower third smiling photographs highly significant difference (P < 0.001) is seen between the two groups with mean value of group IA (n-70) 5.60±0.497and group IIA (n-74) 4.458±0.4565.

		Mean	Std. Error Mean	P value
Full face	Gratifying (I_gB)	5.910±0.6640	.0576	0.001***
	Non gratifying ($II_{ng}B$)	4.437±0.4555	.0411	
Lower third	Gratifying (IB)	5.633±0.4943	.0429	0.001***
	Non gratifying (IIB)	4.374±0.5771	.0520	

*** highly significant p<0.001

Table 5: Mean and standard deviation of group IB and IIB (gratifying and non-gratifying female (n-256))

Table 5 shows the mean score given by the panel of judges to females. Based on the mean score given by the panel of judges for females subjects on full face the subjects were divided into two groups. Group I_nB (n-133) 5.910±.6640 is on the higher side and Group $II_{ng}B$ (n-123) 4.437±.4555 on the lower side, there is a highly significant difference (P value<0.001) between these two groups. Similarly in the lower third smiling photographs highly significant difference (P < 0.001) is seen between the two groups with mean value of group IB (n-130) 5.633±.4943 and group IIB (n-126) 4.374±0.5771.

Overall qualitative measurement

S.No	Parameters		Gratifying (Group I)		Non-gratifying(GroupII)		P value
			N	%	N	%	
1	Facial midline	Coincident	145	72.5%	131	65.5%	0.080
		Deviated	55	27.5%	69	34.5%	
2	Smile arc	Consonant	41	20.5%	48	24%	0.235
		Non consonant	48	79.5%	152	76%	
3	Dental midline	Coincident	63	31.5%	60	30%	0.414
		Deviated	60	68.5%	140	70%	
4	Smile symmetry	Symmetric	55	27.5%	59	29.5%	0.370
		Asymmetric	145	72.5%	141	70.5%	
5	Lip line	High	37	18.5%	46	23%	0.207
		Optimal	135	67.5%	136	68%	
		Low	28	14%	18	9%	
6	Axial inclination	Parallel	95	47.5%	78	39%	0.053
		Non parallel	105	52.5%	122	61%	
7	Gingival shape	Pyramidal	200	100%	200	100%	NA
		Non pyramidal	0	0%	0	0%	
8	Gingival contour	Knife edge	200	100%	200	100%	NA
		Rolled out	0	0%	0	0%	
9	Zenith	Normal	200	100%	200	100%	NA
		Receded	0	0%	0	0%	

P<.05 NS, p <.05 * just significant, p <.01** significant, p <.001*** Highly significant , NA –not applicable

Table 6: Descriptive statistics of various qualitative parameters in group I and group II.

According to the qualitative assessment of the lower third smiling photographs, table 6 shows the descriptive statistics of various qualitative parameters in group I and group II. Facial midline is 72.5% coincident and 27.5% deviated in group I whereas in group II facial midline is 65.5% coincident and 34.5% deviated as compared to group I. Non-significant difference (P>0.05) is seen between group I and group II with P value of 0.08.

Smile arc was 20.5% consonant and 79.5% non-consonant in group I whereas in group II 24% consonant and 76 % non-consonant as compared to group I. Non-significant difference (P>0.05) is seen between group I and group II with P value of 0.23.

Dental midline is 31.5% coincident and 68.5% deviated in group I whereas in group II dental midline is 30% coincident and 70% deviated as compared to group I. Non-significant difference (P>0.05) is seen between group I and group II with P value of 0.41.

Smile symmetry is 27.5 symmetrical and 72.5% % asymmetrical in group I whereas in group II Smile symmetry is 70.5% coincident and 29.5% deviated as compared to group I. Non-significant difference(P>0.05) is seen between group I and group II with P value of 0.37.

Lip line is 18.5% high, 14% low and 67.5% optimal in group I whereas in group II lip line is

23% high 9% low and 68% optimal. Non-significant difference (P>0.05) is seen between group I and group II with P value of 0.20.

Axial inclination is 47.5% parallel and 52.5% non-parallel in group I whereas in group II inclination is 39% parallel and 61% non-parallel. Just significant difference (P<0.05) is seen between group I and group II with P value of 0.0

In the present study group 100% of the sample had pyramidal shaped gingiva, knife edge gingival contour and normal zenith, hence no further statistical analysis is required.

S.no.	Parameters		Gratifying (group IA) (N-70)		Non-gratifying (group IIA) (N-74)		P value
			N	%	N	62.2%	
1	Facial midline	Coincident	52	74.3%	46	37.8%	0.083
		Deviated	18	25.7%	28	25.7%	
2	Smile arc	Consonant	9	12.9%	19	74.3%	0.041*
		Non consonant	61	87.1%	55	25.7%	
3	Dental midline	Coincident	21	30%	24	67.6%	0.447
		Deviated	49	70%	50	32.4%	
4	Smile symmetry	Symmetric	24	34.3%	21	28.4%	0.279
		Asymmetric	46	65.7%	53	71.6%	
5	Lip line	High	12	17.1%	15	20.3%	0.857
		Optimal	46	65.7%	48	64.9%	
		Low	12	17.1%	11	14.9%	
6	Axial inclination	Parallel	18	25.7%	34	45.9%	0.009**
		Non parallel	52	74.3%	40	54.1%	
7	Gingival shape	Pyramidal	70	100%	74	100%	NA
		Non pyramidal	0	0%	0	0%	
8	Gingival contour	Knife edge	70	100%	74	100%	NA
		Rolled out	0	0%	0	0%	
9	Zenith	Normal	70	100%	74	100%	NA
		Receded	0	0%	0	0%	

P<.05 NS, p <.05 * just significant, p <.01** significant, p <.001*** Highly significant , NA –not applicable

Table 7: Descriptive statistics of various qualitative parameters in group IA and group IIA.

Table 7 shows Descriptive statistics of various qualitative parameters in group IA and group IIA Facial midline is 74.3% coincident and 25.7% deviated in group IA whereas in group IIA facial midline is 62.2% coincident and 37.8% deviated as compared to group IA. Non-significant difference (P>0.05) is seen between group IA and group IIA with P value of 0.083.

Smile arc is 12.9% consonant and 87.1% non-consonant in group IA whereas in group IIA 25.7% consonant and 74.3 % non-consonant as compared to group I. Just-significant difference ($P<0.05$) is seen between group IA and group IIA with P value of 0.041.

Dental midline is 30% coincident and 70% deviated in group IA whereas in group IIA dental midline is 32.4% coincident and 67.6% deviated as compared to group IA. Non-significant difference ($P>0.05$) is seen between group IA and group IIA with P value of 0.447.

Smile symmetry is 34.3% symmetrical and 65.7% asymmetrical in group IA whereas in group IIA Smile symmetry is 28.4% coincident and 71.6% deviated as compared to group IA. Non-significant difference ($P>0.05$) is seen between group IA and group II A with P value of 0.279.

Lip line is 17.1% high, 17.1% low and 65.7% optimal in group IA whereas in group IIA lip line is 20.3% high 14.9% low and 64.9% optimal. Non-significant difference ($P>0.05$) is seen between group IA and group IIA with P value of 0.857.

Axial inclination is25.7% parallel and 74.3% non-parallel in group IA whereas in group IIA inclination is 45.9% parallel and 54.1% non-parallel. Significant difference ($P<0.01$) is seen between group IA and group IIA with P value of 0.009.

In the present study group 100% of the sample had pyramidal shaped gingiva, knife edge gingival contour and normal zenith, in all the male subjects hence no further statistical analysis is required.

S.no.	Parameters		Gratifying (group IB) (N-130)		Non-gratifying (group IIB) (N-126)		P value
			N	%	N	%	
1	Facial midline	Coincident	93	71.5%	85	67.5%	0.293
		Deviated	37	28.5%	41	32.5%	
2	Smile arc	Consonant	32	24.6%	29	23%	0.439
		Non consonant	98	75.4%	97	77%	
3	Dental midline	Coincident	42	32.3%	36	28.6%	0.304
		Deviated	88	67.77%	90	71.4%	
4	Smile symmetry	Symmetric	31	23.8%	38	30.2%	0.159
		Asymmetric	99	76.2%	88	69.8%	
5	Lip line	High	25	19.2%	31	24.6%	0.128
		Optimal	89	68.5%	88	69.8%	
		Low	16	12.3%	7	5.6%	
6	Axial inclination	Parallel	77	59.2%	44	34.9%	0.001***
		Non parallel	53	40.8%	82	65.1%	
7	Gingival shape	Pyramidal	130	100%	126	100%	NA
		Non pyramidal	0	0%	0	0%	
8	Gingival contour	Knife edge	130	100%	126	100%	NA
		Rolled out	0	0%	0	0%	
9	Zenith	Normal	130	100%	126	100%	NA
		Receded	0	0%	0	0%	

P<.05 NS, p <.05 * just significant, p <.01** significant, p <.001*** Highly significant , NA –not applicable

Table 8: Descriptive statistics of various qualitative parameters in group IB and group IIB

Facial midline is 71.5% coincident and 28.5% deviated in group IB whereas in group IIB facial midline is 67.5% coincident and 32.5% deviated as compared to group I. Non-significant difference (P>0.05) is seen between group IB and group IIB with P value of 0293.

Smile arc is 24.6% consonant and 75.4% non-consonant in group IB whereas in group IIB 23% consonant and 77 % non-consonant as compared to group IB. Non-significant difference (P>0.05) is seen between group IB and group IIB with P value of 0.43.

Dental midline is 32.3% coincident and 67.7% deviated in group IB whereas in group IIB dental midline is 28.6% coincident and 71.4% deviated as compared to group IB. Non-significant difference (P>0.05) is seen between group IB and group IIB with P value of 0.304.

Smile symmetry is 23.8% symmetrical and 76.2% asymmetrical in group IB whereas in group IIB Smile symmetry is 30.2% coincident and 69.8% deviated as compared to group IB.

Non-significant difference (P>0.05) is seen between group IB and group IIB with P value of 0.159. Lip line is 19.5% high, 12.3% low and 68.5% optimal in group IB whereas in group IIB lip line is 24.6% high 5.6% low and 69.8% optimal. Non-significant difference (P>0.05) is seen between group IB and group IIB with P value of 0.128.

Axial inclination is 59.2% parallel and 40.8% non-parallel in group IB whereas in group IIB inclination is 34.9% parallel and 65.1% non-parallel. Highly significant difference (P<0.001) is seen between group IB and group IIB with P value of 0.001.

In the present study group 100% of the sample had pyramidal shaped gingiva, knife edge gingival contour and normal zenith in all the female sample, hence no further statistical analysis is required.

Quantitative measurement

Parameters		Mean ±Std. deviation	Mean std. error	P value
Commissure width	Group I	65.217±3.034	.214	0.001
	Group II	64.137±3.239	.229	
Philtrum height	Group I	14.622±4.463	.315	0.914
	Group II	14.670±4.384	.310	
Visibility of central incisor	Group I	11.364± 2.987	.211	0.025*
	Group II	12.015±2.799	.197	
Gingival height	Group I	0.464±1.205	.085	0.236
	Group II	0.613±1.302	.092	
Buccal corridor	Group I	1.938±2.182	.15	0.975
	Group II	1.931±2.142	.15	

P<.05 NS, p <.05 * just significant, p <.01** significant, p <.001*** Highly significant

Table 9: Descriptive statistics of various quantitative parameters in group I and group II

Various quantitative parameters were assessed on lower third smiling photograph of both the groups following which the mean was calculated of all the subjects.

Commissure width of the Group I (n-200) is 65.217±3.034 is on the lower side and Group II (n-200) is 64.137±3.239 on the higher side, there is a just significant difference (P value<0.001) between these two groups with p value of 0.001 .

Philtrum height of the Group I (n-200) is 14.622±4.463 is on the lower side and Group II (n-200) is 14.670±4.384 on the higher side, there is a just significant difference (P value<0.05) between these two groups with p value of 0.914.

Visibility of central incisor of the Group I (n-200) is 11.364± 2.987 is on the lower side and Group II (n-200) is 12.015±2.799 on the higher side, there is a just significant difference (P value<0.05) between the two groups with p value of 0.025

Gingival height of the Group I (n-200)is 0.464±1.205 is on the lower side and Group II (n-200) is 0.613±1.302 on the higher side, there is a non-significant difference (P value>0.05) between the two groups with p value of 0.236

Buccal corridor of the Group I (n-200) is 1.938±2.182 is on the lower side and Group II (n-200) is 1.931±2.142on the higher side, there is a non-significant difference (P value>0.05) between the two groups with p value of 0.975.

Parameters		Mean ± Std. Deviation	Mean Std. Error	P value
Commissure width	Group I A	65.002±2.936	.350	0.079
	Group II A	64.113±3.089	.359	
Philtrum height	Group I A	15.695±4.668	.558	0.073
	Group II A	14.316±4.483	.521	
Visibility of central incisor	Group I A	11.522±3.074	.367	0.831
	Group II A	11.415±2.941	.341	
Gingival height	Group I A	0.611±1.470	.175	0.623
	Group II A	0.503±1.169	.135	
Buccal corridor	Group I A	1.857±2.154	.257	0.636
	Group II A	1.687±2.159	.251	

P<.05 NS, p <.05 * just significant, p <.01** significant, p <.001*** Highly significant

Table 10: Descriptive statistics of various quantitative parameters in group IA and group II A.

Commissure width of the Group IA (n-70) is 65.002±2.936 is on the higher side and Group IIA (n-74) is 64.113±3.089 on the lower side, there is a non-significant difference (P value>0.05) between the two groups with p value of 0.079

Philtrum height of the Group IA (n-70) is 15.695±4.668 is on the higher side and Group IIA (n-74) is 14.316±4.483 on the lower side, there is a non-significant difference (P value>0.05) between the two groups with p value of 0.073

Visibility of central incisor of the Group IA (n-70) is 11.522±3.074 is on the higher side and Group A (n-74) is 11.415±2.941 on the lower side, there is a non-significant difference (P value>0.05) between the two groups with p value of 0.831

Gingival height of the Group I A(n-70) is 0.611±1.470 is on the higher side and Group IIA (n-74) is 0.503±1.169 on the lower side, there is a non-significant difference (P value>0.05) between the two groups with p value of 0.623

Buccal corridor of the Group I A(n-70)is 1.857±2.154 is on the higher side and Group II A(n-74) is1.687±2.159 on the lower side, there is a non-significant difference (P value>0.05) between the two groups with p value of 0.636

Parameters		Mean ± Std. Deviation	Mean Std. Error	P value
Commissure width	Group IB	65.332±3.039	.271	0.004**
	Group IIB	64.150±3.339	.297	
Philtrum height	Group IB	14.09 ± 4.351	.381	0.173
	Group IIB	14.83 ± 4.239	.377	
Visibility of central incisor	Group IB	11.32 ±2.912	.255	0.003**
	Group IIB	12.35 ±2.666	.237	
Gingival height	Group IB	0.38 ± 1.032	.090	0.011**
	Group IIB	0.67 ± 1.375	.122	
Buccal corridor	Group IB	2.00 ±2.19	.192	0.879
	Group IIB	2.04 ±2.138	.190	

P<.05 NS, p <.05 * just significant, p <.01** significant, p <.001*** Highly significant

Table 11 : Descriptive statistics of various quantitative parameters in group IB and group IIB

Commissure width of the Group IB (n-130) is 65.332±3.039 is on the lower side and Group IIB(n-126) is 64.150±3.339 on the higher side, there is a significant difference (P value<0.01) between these two groups with p value of 0.004.

Philtrum height of the Group I B(n-130) is 14.09 ± 4.351 is on the lower side and Group II B(n-126) is 14.83 ± 4.239 on the higher side, there is a non-significant difference (P value>0.05) between these two groups with p value of 0.173.

Visibility of central incisor of the Group I B(n-130) is 11.32 ±2.912 is on the lower side and Group IIB (n-126) is 12.35 ±2.666 on the higher side, there is a significant difference (P value<0.01) between the two groups with p value of 0.003

Gingival height of the Group I B(n-130) is 0.38 ± 1.032 is on the lower side and Group IIB (n-126) is 0.67 ± 1.375 on the higher side, there is a significant difference (P value<0.01) between these two groups with p value of 0.011

Buccal corridor of the Group I B (n-130) is 2.00 ±2.19 is on the lower side and Group IIB(n-126) is 2.04 ±2.138 on the higher side, there is a non-significant difference (P value>0.05) between the two groups with p value of 0.879.

Arch width

Parameters		Mean ± std deviation	Mean std error	P value
3-3 width	Group I	56.574±5.432	0.384	0.495
	Group II	56.966±6.046	0.427	
4-4 width	Group I	65.363±6.329	0.447	0.486
	Group II	65.821±6.776	0.479	

ns-non significant p>0.05

Table 12: mean and standard deviation of arch width in group I and group II

Table 12 show the mean of inter canine and inter premolar distance of all the subjects in lower third smiling photograph that was measured as the horizontal measurement of outer most lateral border of canine from one side to other and the horizontal measurement of outer most lateral border of 1st premolar from one side to other respectively.

The mean intercanine width in group I (n-200) is 65.363±6.329 that is on the higher side whereas in group II (n-200) it is 56.966±6.046 on lower side. There is a non-significant difference (P value>0.05) between the two groups with P value of 0.495

The mean interpremolar width in group I (n-200) is 56.574±5.432 that is on the lower side whereas in group II (n-200) it is 65.821±6.776 on higher side. There is a non-significant difference (P value>0.05) between the two groups with P value of 0.486.

Parameters		Mean ± std deviation	Mean std error	P value
3-3 width	Group I A	57.924±5.411	0.646	0.041*
	Group II A	55.927±6.142	0.714	
4-4 width	Group I A	66.627±6.635	0.793	0.138
	Group II A	64.945±6.871	0.798	

*just significant <0.05, ns-non significant>0.05

Table 13: mean and standard deviation of arch width in group IA and group IIA

The mean intercanine width in group IA (n-70) is 57.924±5.411 that is on the higher side whereas in group IIA (n-74) it is 55.927±6.142 on lower side. There is a just significant difference (P value<0.05) between the two groups with P value of 0.041

The mean interpremolar width in group I A(n-70) is 66.627±6.635 that is on the higher side whereas in group IIA (n-74) it is 64.945±6.871on lower side. There is a non-significant difference (P value>0.05) between the two groups with P value of 0.138.

Parameters		Mean ± std deviation	Mean std error	P value
3-3 width	Group IB	55.83±5.309	0.465	0.035*
	Group IIB	57.62±5.911	0.526	
4-4 width	Group IB	64.689±6.069	0.532	0.138
	Group IIB	66.376±6.685	0.595	

*just significant <0.05, ns-non significant>0.05

Table 14: mean and standard deviation of arch width in group IB and group IIB

The mean inter-canine width in group IB (n-130) is 55.83±5.309 that is on the lower side whereas in group IIB (n-126) it is 57.62±5.911 on higher side. There is a just significant difference (P value<0.05) between the two groups with P value of 0.035

The mean inter-premolar width in group I B (n-130) is 64.689±6.069 that is on the lower side whereas in group IIB (n-126) it is 66.376±6.685 on higher side. There is a non-significant difference (P value>0.05) between the two groups with P value of 0.138.

DISCUSSION

In orthodontics, during clinical examination more attention is given to the display zone of smile, which is determined by lip thickness, inter commissural width, interlabial gap, smile index, and gingival architecture[1]. There are two types of smile: the posed smile-which is a voluntary smile, may not be linked with emotion and is reproducible and spontaneous smile- which in an involuntary smile, linked with emotion and include movements like squinting of the eyes, flaring of nostrils and maximal elevation of lips[2]. Smile is classified based on smile line and depends on amount of incisor show and gingival display.

Perception of smile varies from person to person. A study reported that laypersons preferred more natural profile drawings than did dental specialists. Recent studies also confirmed that there is a difference in esthetic perceptions between orthodontists, general dentists, and layperson[1]. Miller stated that the trained and observant eye easily detects asymmetry. For this reason, professional opinions regarding facial esthetics may not coincide with the perceptions and expectations of patients or laypeople. Hence it is decided by the panel of judges.

Aesthetics can be evaluated by three categories macro, mini and micro aesthetics. Macro aesthetics includes, facial proportion in all three plane of space including asymmetry, excessive or deficit facial height, maxillary mandibular deficiency or excess, it follows the principle that apply when grouping of individual teeth are considered. The relationship between those teeth and surrounding soft tissue and the patient's facial characteristics creates a dynamic and three dimensional canvas.

An essential smile feature in the transverse dimension of smile is buccal corridor. A broad arch is more likely to fill the buccal corridor than a narrow and constricted arch. This smile feature has thought of primarily in terms of maxillary arch width[7]. Since the arch width affects the buccal corridor which is essential components of smile aesthetics, hence this study will include the arch width. Various tooth characteristics like arrangement, colour, texture, shape and size also define the smile aesthetics. A symmetrical tooth arrangement and sense of proportionality maintains the aesthetic smile hence this will also be included in the study[7]. Considering this the aim of the present study was to evaluate the effect of arch width and tooth characteristics on perception of smile in subjects with gratifying and non-gratifying smile as rated by panel of judges.

500 students were selected from different colleges of Babu Banarasi Das University, Lucknow, in age range of 18-30 years (mean age) who fulfilled the selection criteria. The standardized frontal smiling photographs of subjects were taken. Also from the same image the lower third of face was cropped, Thus two photographs of each subject (frontal smiling photograph and lower third smiling photograph) were saved as JPEG (Joint Photographic Experts Group) format.

All the subjects were made to stand in an upright position against the white board with vertical and horizontal rulers attached to the background for calibration of the photograph. Digital single lens reflector (DSLR) was placed on a tripod stand at a standard distance of approximately 4 feet from the subjects. The height of camera was adjusted for each subject. Pictures were taken in same environment with same lightning conditions. Before taking the photographs, each subject was asked to rehearse the following word "cheese" and smile, showing his/her teeth. For each subject, three frontal smiling facial photograph of full face were taken. Amongst these the image that best represented the patient's natural unstrained social smile was selected.

Two photographic albums were made, First album had 500 full facial smiling photographs, and Second album had 500 lower third smiling photographs. The photographs were arranged randomly in both the albums. Each album was rated by panel of judges including 1 General Dentist, 1 Orthodontist, 1 Plastic Surgeon, 1 Beautician and 1 Layperson using visual analogue scale from 1-10 from 1 being least gratifying to 10 being most gratifying.The panel of judges were asked to assess the attractiveness of entire smile on overall full facial smiling photograph and of lower third of face to assess how the teeth would appear within the lips. For each judge and for each set of photograph visual analogue scale grading sheet was given.

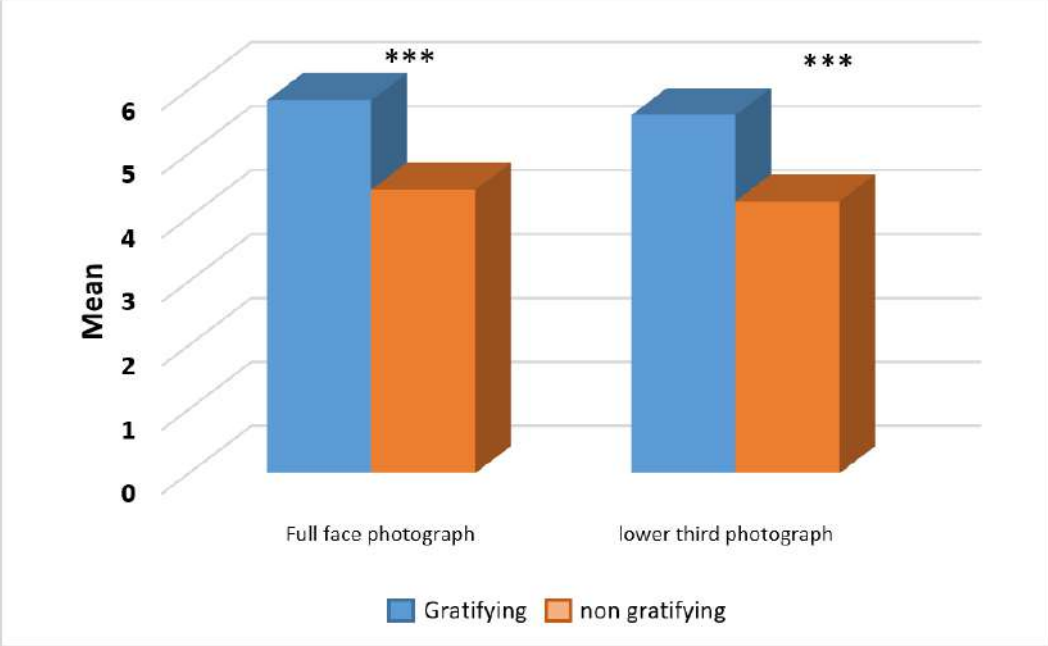
The mean score were calculated for each subject as rated by different members of the panel. The subject with the score between 1-5 were considered as having non gratifying smiles and more than 5 were considered as having gratifying smile.

Out of 500 subjects some of the samples were excluded as their premolars are not visible during smile. Thus the total of 400 subjects were selected for further assessment of arch width and smile characteristics and equally divided in two groups Group-I including 200 subjects with gratifying smile and Group- II including 200 subjects with non-gratifying smile. Both the groups were further subdivided into groups as per gender.

Photographs were analyzed for Qualitative measurements, Quantitative measurements and arch width.The data obtained for these parameters were recorded on microsoft excel sheet and subjected to statistical analysis.

When comparison of mean score obtained in full face photograph for gratifying and non gratifying subjects was done. Higher score was obtained for gratifying subjects (5.837±0.6519) in comparison to non gratifying subject (4.436±0.4419) and the difference was statistically significant ($p<0.001$).

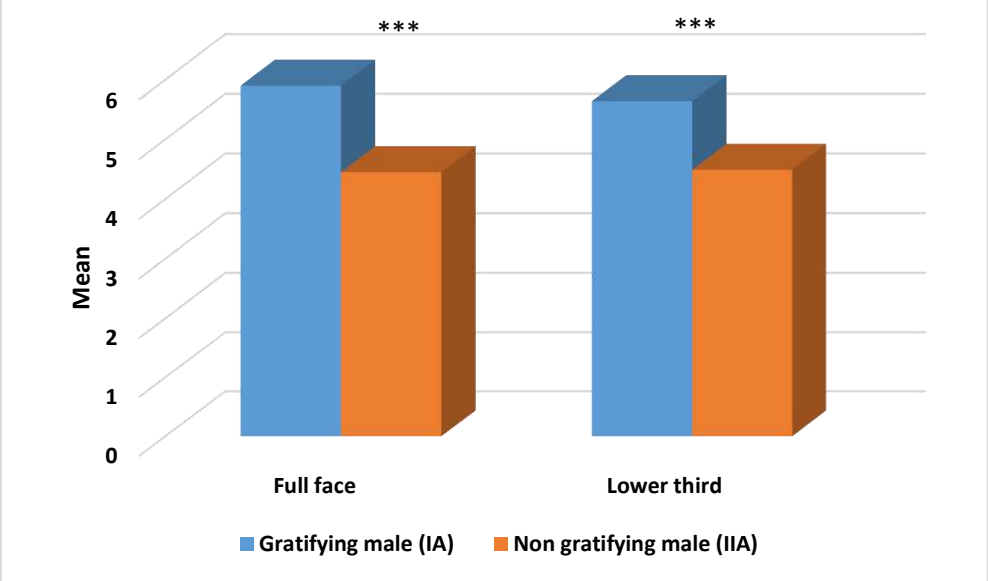
Similar finding were observed for lower third smiling photograph. Gratifying subjects had greater mean score (5.837±0.6519) than non gratifying subjects (4.436±0.4419) and the difference was statistically significant ($p<0.001$) (graph1).



Graph 1: showing comparison of mean score of gratifying and non-gratifying subjects in both full face and lower third photograph.

When comparison of mean score obtained in full face photograph for gratifying and non gratifying male subjects was done higher score was obtained for gratifying subjects (5.902±0.6661) in comparison to non gratifying subject (4.457±0.4607) and the difference was statistically significant ($p<0.001$).

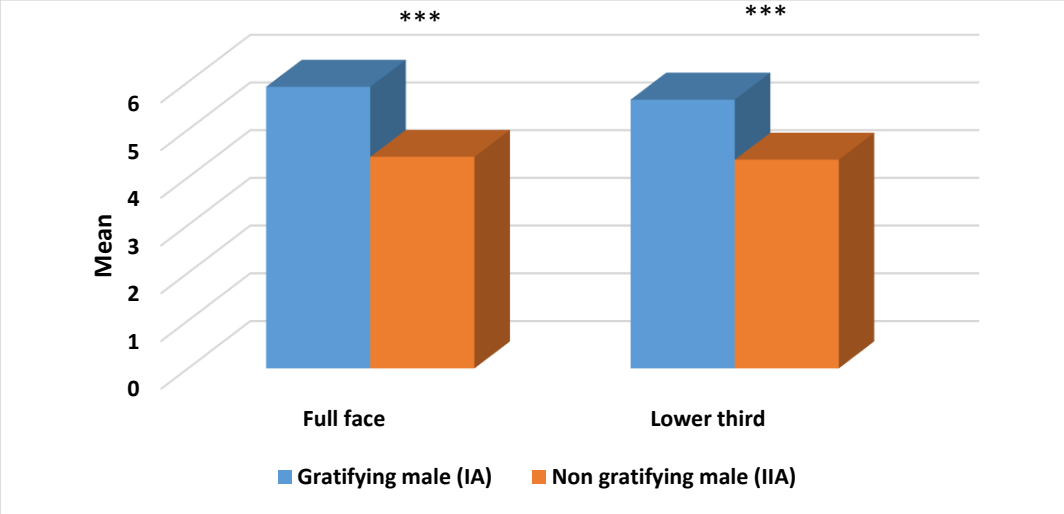
Similar finding were observed for lower third smiling photograph. Gratifying subjects had greater mean score (5.60±0.497) than non gratifying subjects (4.458±0.4565) and the difference was statistically significant (p<0.001). (graph 2)



Graph 2: showing comparison of mean score of gratifying and non-gratifying male subjects in both full face and lower third photograph.

When comparison of mean score obtained in full face photograph for gratifying and non gratifying female subjects was done higher score was obtained for gratifying subjects (5.910±0.6640) in comparison to non gratifying subject (4.437±0.4555) and the difference was statistically significant (p<0.001).

Similar finding were observed for lower third smiling photograph. Gratifying subjects had greater mean score (5.633±0.4943) than non gratifying subjects (4.374±0.5771) and the difference was statistically significant (p<0.001). (graph 3)



Graph 3: showing comparison of mean score of gratifying and non-gratifying female subjects in both full face and lower third photograph.

Study comprises of 144 male subjects and 256 female subjects.

Full face photographs of gratifying male subject was 68 and non-gratifying male subject was 76 and in lower third smiling photograph of gratifying male subject was 70 and non-gratifying male subject was 74. Full face photographs of gratifying female subject was 154 and non-gratifying female subject was 100 and lower third smiling photograph of gratifying female subject was 130 and non-gratifying female subject was 126.

Results of the present study showed that the mean score for full face smiling photographs of Group I_g was 5.837±0.651 and Group II_{ng} was 4.436±0.441, there was a highly significant difference ($P<0.001$) between these two groups. (graph 1)

The mean score for lower third smiling photographs of Group I was 5.609±0.476 and Group II was 4.253±0.565, there was a highly significant difference ($P<0.001$) between these two groups. (graph 1)

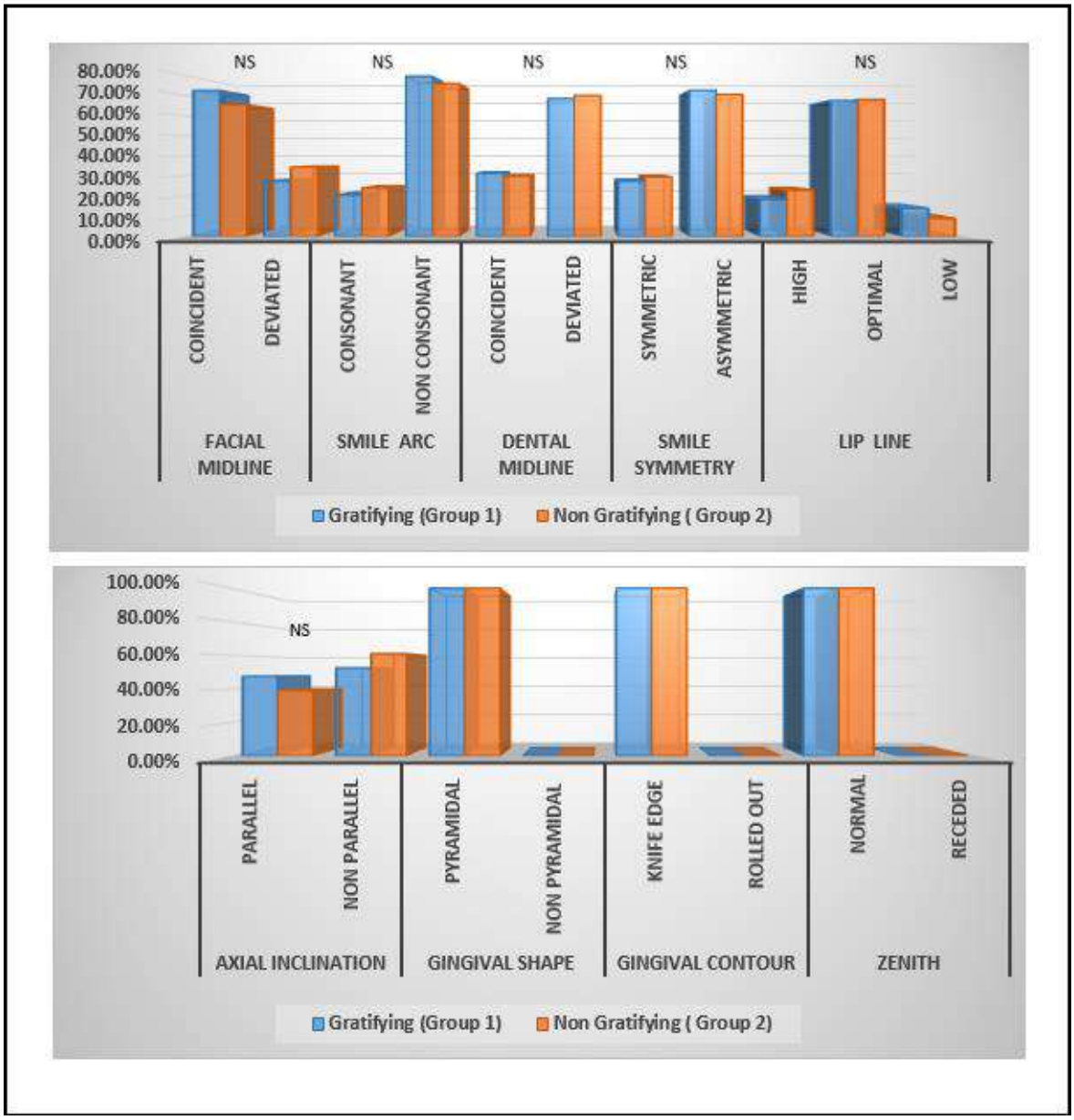
Similar result was found in the study done by Flores Mir et al[14] on laypersons perception of smile aesthetics on photograph in three views, the frontal view (FV) included the smiling face and neck of the subject, the lower facial third (LV) view included the tip of the nose and the soft tissue menton, the dental view (DV) included the anterior teeth and surrounding gingival tissues. They rated the aesthetic appeal of each view on a scale from 0 (least attractive imaginable) to 100 (most attractive imaginable) using a visual analogue scale. Mean and standard deviation for the ratings from each view types was 52.12±16.14,

43.18±15.28, and 30.53±15.01 respectively. The best mean rating was for the FV and the worst for the DV.

All the lower third smiling photographs were assessed for certain Qualitative measurements, quantitative measurement and arch width.

Qualitative midline include Facial Midline, Smile Arc, Dental Midline, Smile Symmetry, Lip Line, Axial Inclination, Gingival Shape, Gingival Contour, Zenith

In overall sample there was non-significant difference of facial midline, smile arc, dental midline, smile symmetry, lip line, axial inclination. Gingival shape was pyramidal, gingival contour was knife edge and normal zenith was present in 100% of the samples in present study.



Graph 4: Qualitative measurements of gratifying subjects (group I) and non gratifying subjects (group II) as assessed on lower third smiling photograph.

Facial midline

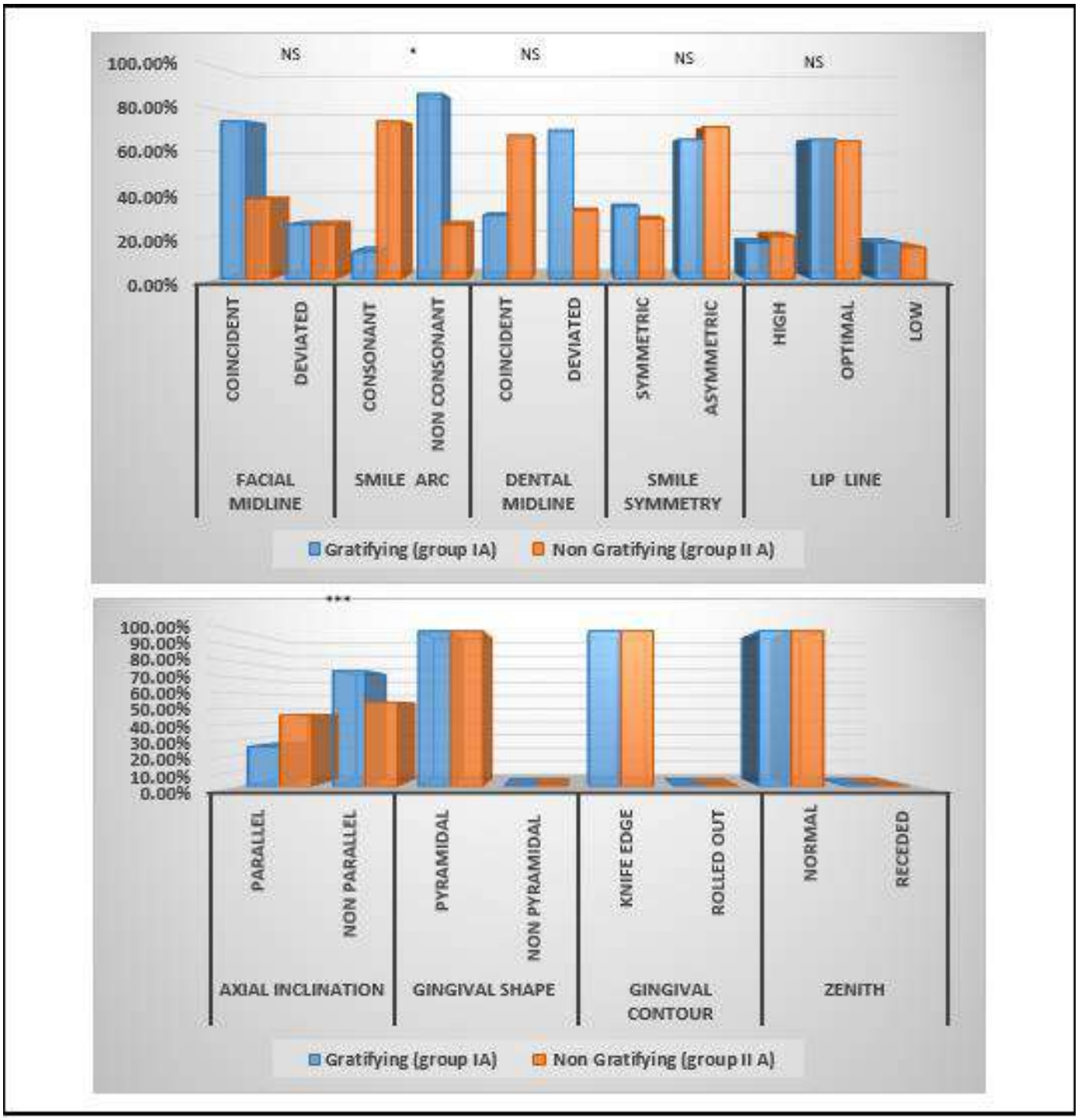
Facial midline was assessed as coincident/deviated. Group I had more number of coincident smile (72.5%) as compared to group II (65.5%). Non-significant difference (P>0.05) was seen between group I and group II with P value of 0.08. Johnston et al[11] in study stated that discrepancies of 2mm or more between the facial and dental midline will have a negative effect on dentofacial aesthetic.

Springer et al[25] found the limit of acceptability for the maxillary midline deviation from the facial midline was found to be 3.2 mm. Kokich et al[10] found even more leeway at 4 mm using 1-mm increments. A significant difference in the midline can exist before it starts to look unappealing.

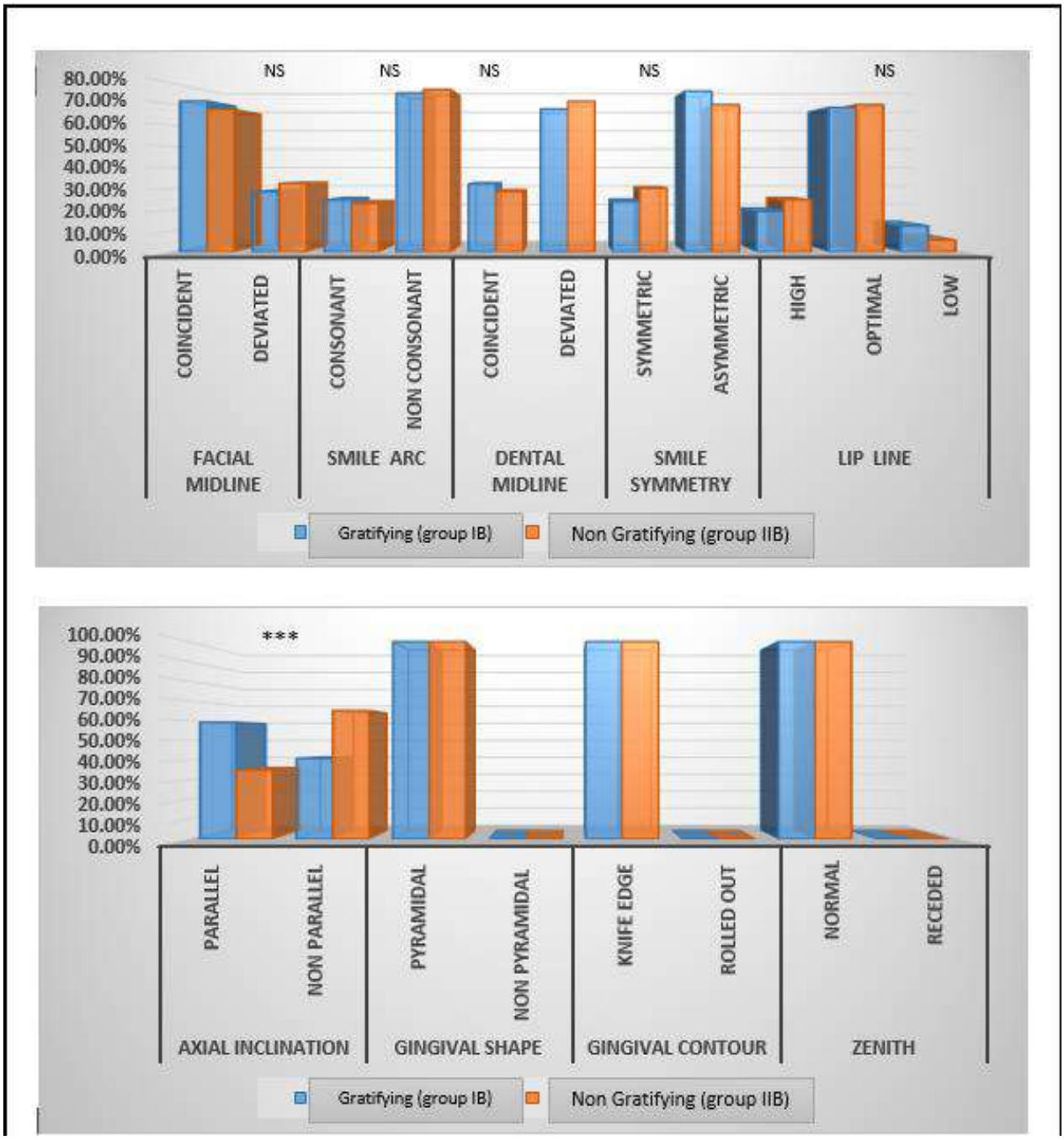
In present study the comparison of facial midline in group IA (72.5% coincident and 27.5 % deviated) and in group IIA (65.5% coincident and 34.5% deviated) there was no significant difference (p value 0.080).In between male and female samples group IA (74.3%) has more numbers of coincident facial midline as compared to group IB (71.5%).(graph 5,6)

Similarly Kaur et al[40] in his study found non-significant difference (p value 0.795) between male (53.3% coincident and 46.7% deviated) and female (56.7% coincident and 43.3% deviated) subjects.

The midline between the central incisors should be parallel to the facial midline. The greater the discrepancy, more asymmetric smile is visible, and this proves evident even for a laypersons. An incorrect inclination of the maxillary interincisal midline can be immediately recognized by any observer, being less attractive than a lateral deviation of the maxillary interincisal midline with respect to the facial midline. (Graph 5,6)



Graph 5: Qualitative measurements of gratifying and non gratifying male subject as assessed on lower third smiling photograph (group IA group IIA)



Graph 6: Qualitative measurements of gratifying and non gratifying female subject as assessed on lower third smiling photograph (Group IB Group IIB).

Smile arc

The present study done on 400 subjects the consonant smile arc in group I was 20.5% and non-consonant smile was 79.5% and in group II there was 24% consonant and 76% non-consonant, and the difference was statistically non-significant (graph 4). Kaur et al[40] conducted a study and compared the perception of dental specialist and layperson regarding smile esthetic the perception of smile arc between dental specialist and lay person was found statistically significant which was contradictory to our study, probably may be due to the lesser sample size of 60 subjects used by them. Akyalcin et al[32] in his study used a different criteria of patient selection as compared to the present study he used a sample of Orthodontically treated patients according to ABO standards, and observed 81.8% consonant smile arch which is much larger from our study. The reason for this could be considered as in the present study patient included did not have history of previous orthodontic treatment.

Maulik and Nanda[19] evaluated dynamic smile analysis in treated (157) and non-treated patients (73). They found that approximately half (49%) of the total sample had flat smile arc, which was in approximation to the present study.

In the present study group IA (12.9%consonant and 87.1% non consonant) and IIA (74.3%consonant and 25.7% non consonant) was found to have just significant difference with p value of 0.041(graph 5) and in group IB (24.6%consonant and 75.4% non consonant) and IIB (23%consonant and 77% non consonant) non-significant difference was seen in smile arc (graph 6)

In between male and female samples group IB (24.6%consonant) has more numbers of consonant smile as compared to group IA (12.9% consonant).

According to Kaur et al[40] more female smiles (36.7%) showed consonant smile arc than male smiles (20%) which was similar to present study. Maulik and Nanda[19] also found similar result where females had a greater percentage displaying a parallel smile arc corresponding *P* values are 0.000 as compared to males. According to Krishnan et al[1] more women (67%) than men (40%) have consonant smiles.

Dental midline

Dental midline was assessed as coincident/deviated. Group I had more number of coincident smile (31.5%) as compared to group II (30%). Non-significant difference (P>0.05) was seen between group I and group II with P value of 0.41. Dental midline was coincident more in gratifying females (32.3%) compared to gratifying males (30%).

Springer et al[25] in his study mentioned the allowable discrepancy between the upper and lower midlines was found to be 3.2 mm. The lower midline can be off by approximately half of a mandibular incisor width with no esthetic ramifications.

Ker at al[20] in his study mentioned Maxillary and mandibular midlines are non-coincident in three-fourths of the population, and small deviations do not cause any detriment to smile esthetics. The contribution of the mandibular midline to esthetics may be diminished owing to the narrow width and uniform size of mandibular incisors. They found that mandibular midline deviation was acceptable until it exceeded 2.1 mm and one-third of the respondents accepted the maximal deviation of 2.9 mm. This demonstrates that many respondents found this deviation to be acceptable when more than one-half of the mandibular incisor deviated from the maxillary midline. This finding adequately accommodates patients who have a missing or extracted lower incisor.

Smile symmetry

Smile symmetry was assessed as symmetrical/ asymmetrical. Group I had less number. of smile symmetry (27.5%) as compared to group II (29.5%). Non-significant difference (P>0.05) was seen between group I and group II with P value of 0.37.There was more smile symmetry was found in male (34.3%) subjects as compared to the female (23.8%) (graph 4,5,6)

According to Ker at al[20] asymmetry during smiling could be considered clinically as a dental occlusal cant or maxillary skeletal asymmetry, and it is crucial to know the underlying cause through careful diagnostic evaluation, in order to define the treatment best suited to each individual case.

According to Sarver and Ackerman [43]smile asymmetry can be due to soft tissue considerations, such as asymmetric smile curtain. In asymmetric smile curtain there is a differential elevation of upper lip during smile, which gives the illusion of a transverse cant to the maxilla.

Group IA (34.3%) had more number of smile symmetry as compared to group IIA (28.4%). Non-significant difference (P>0.05) was seen between group IA and group IIA with P value of 0.279. Group IB (23.8%) had less number of smile symmetry as compared to group IIB (30.2%). Non-significant difference (P>0.05) was seen between group IB and group IIB with P value of 0.159.

Lip line

Lip line was assessed as high/optimal/low. Similar number of optimal smiles was present in both group I (67.5%) Group II (68%). Non-significant difference (P>0.05) was seen between group I and group II with P value of 0.20 (graph 4). According to the gender, female (19.2%) more often have high smile line compared with males (17.1%), in contrast the males (17.1%) show a higher frequency of low smile line as compared to females (12.3%) (graph 5,6) More number of optimal smiles was present in group IIB (68.5%) Group IB (69.8%). Non-significant difference (P>0.05) was seen between group IB and group IIB with P value of 0.128.

Similar results was found in study done by Melo et al[41] in which he determined whether there are gender differences in a number of smile aesthetic parameters. The smile line was 84.3% presented a medium smile line, 8.6% a low smile line, and 7.1% a high smile line which was non-significant. According to the gender female (11.4%) more often have high smile line compared with males (2.9%), in contrast the males (11.4%) show a higher frequency of low smile line as compared to females (5.7%).

The ideal smile line is that in which the maxillary interincisal midline is centered with respect to the facial midline, and the teeth are fully exposed along with about 1mm of gingival tissue.

Axial inclination

Axial inclination was assessed as parallel/ non parallel. Group I (47.5%) had more number of parallel axial inclination compared to group II (39%).Non significant difference (P>0.05) was seen between group I and group II with P value of 0.053**.** Ritter at al[17] commented on axial inclination of the anterior teeth are slightly progressive as the teeth are positioned posteriorly, with the gingival portion of the crowns more distal than the incisal portion.

Similar to this statement in the present study the axial inclination shows just significant difference in group I and group II in overall sample, whereas in females there was highly significant difference and in males moderately significant difference was present. None of the evaluator have evaluated this parameter.(graph 4,5,6)

Group IA (25.7%) had less number of parallel axial inclination compared to group IIA (45.9%).moderately significant difference (P<0.01) was seen between group IA and group IIA with P value of 0.009.

Gingival shape

Gingival contour

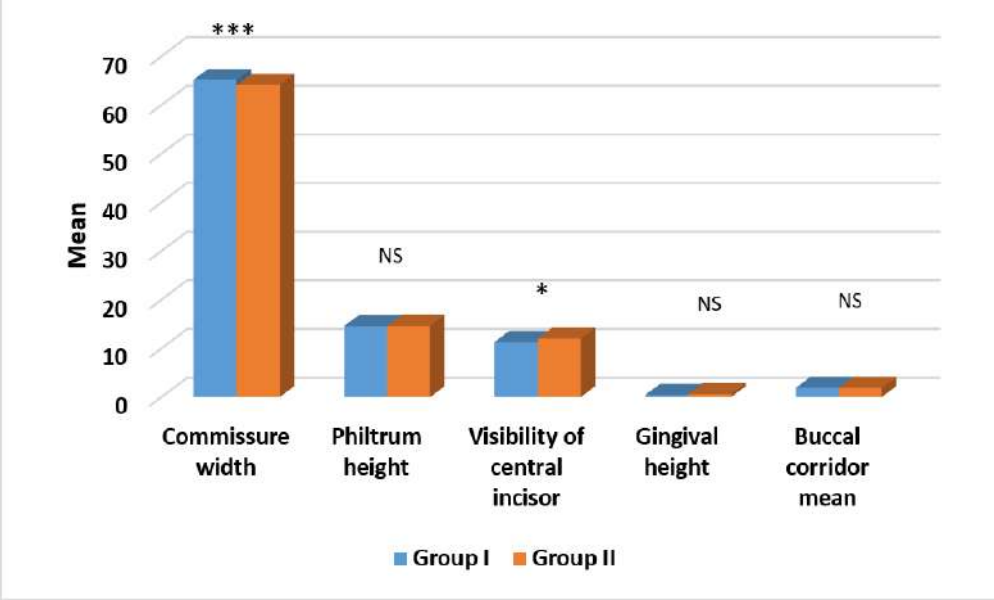
Zenith

In the present study group 100% of the sample had pyramidal shaped gingiva, knife edge gingival contour and normal zenith.

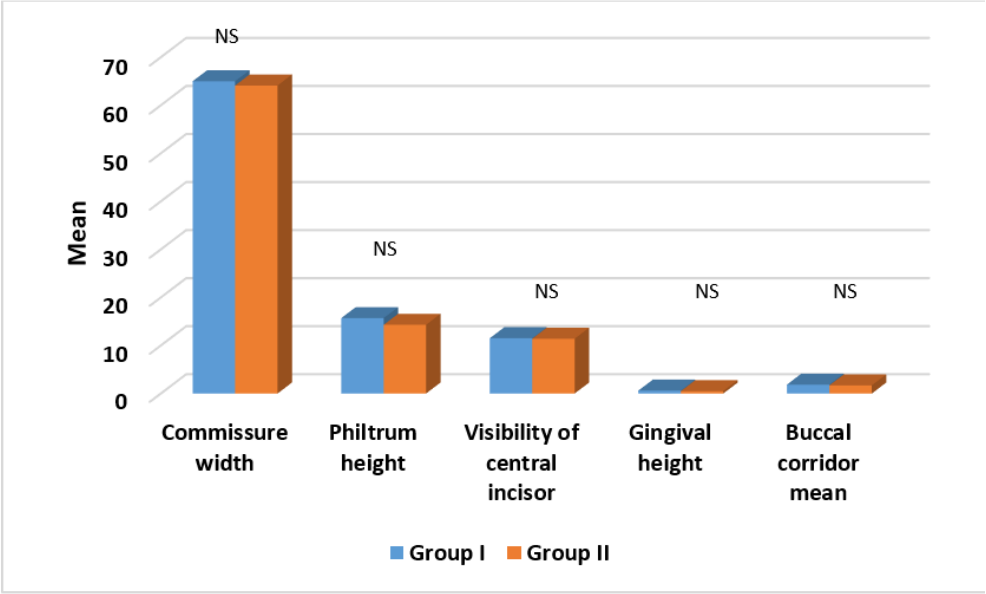
Gingival shape refers to the curvature of the gingiva at the margin of the tooth. For best appearance, the gingiva shape of maxillary lateral incisor should be symmetric half oval or half circle. The maxillary central and canine should exhibit a gingival shape that is more elliptical and oriented distally to the long axis of the tooth. The gingival zenith should be located distal to the longitudinal axis of the maxillary central and canine; the gingival zenith of maxillary lateral should coincide with their longitudinal axis. Pawar B et al[44] in his study on Gingival zenith and its role in redefining esthetics. The angle formed between the gingival line and maxillary midline (GLA) and the distance between the gingival zenith of the lateral incisor and the gingival line were measured (LID) on 35 young adults. They found that The gingival zenith of the canine is apical to the gingival zenith of the incisors (GLA <90°) and the gingival zenith of the lateral incisor is below or on (17%) the gingival line when head is oriented on the axis orbital plane. A directional asymmetry was shown with the right side higher than the left side.

All the lower third smiling photographs were assessed for Quantitative measurements including commissure, Philtrum Height, Visibility Of Central Incisor, Buccal Corridor, Gingival Height.

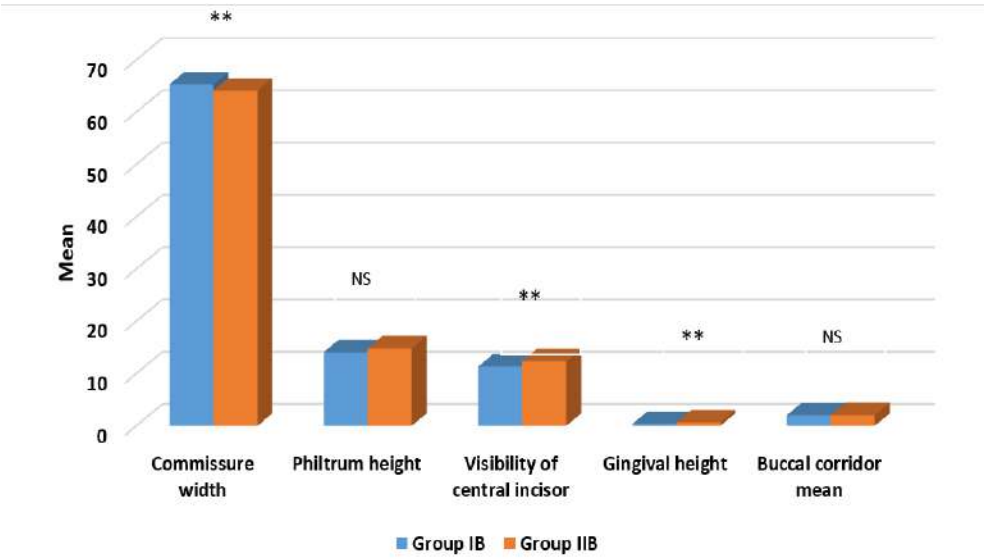
Measurements showed variable results for all the parameters in terms of statistical significance. (graph 7)



Graph 7: Quantitative measurements of gratifying and non gratifying subject Group I Group II



Graph 8: Quantitative measurements of gratifying and non gratifying male subject Group IA Group IIA



Graph 9: Quantitative measurements of gratifying and non gratifying male subject Group IB Group IIB

Commissure width

In present study the mean value of commissure width in group I was more (65.217±3.034) as compared to group II (64.137±3.239) and highly significant difference was seen between.

Whereas in males there was no significant difference between both the groups while in female moderately significant difference was seen. (graph 8,9)

Schabel et al[22] compared the measurements of clinical photographs and digital videographs captured of 48 orthodontically treated patients and found higher correlation between these two methods for maximum incisor exposure, interlabial gap, smile width, smile index etc. They found a Smile width of 59.0±5.0 in smiles captured by clinical photographs and 59.1±5.3 in photographic smiles obtained from digital video clips. These values are lower than the present study .The difference could be attributed to the age range of their sample that was from 12- 20 years when the soft tissue growth might not have completed in some of the subjects, also can be due to method of capturing the samples.

Prasad V et al[34] compared smile esthetic in extraction and non extraction cases in which he considered 80 orthodontically treated subjects in which 40 were treated with extraction (group I) and rest 40 without extraction (group II). The smiling photographs of each individual was captured and was rated by panel of judges. Non-significant difference for smile esthetics was seen in both the groups which was contrary to

the finding of the present study. The difference can be due to the sample in present study were non orthodontically treated patients was evaluated.

Maganzini et al[45] conducted a study on smile esthetics following orthodontic treatment he comparedthe still photographs of two groups divided on the basis of the discrepancy index of the initial malocclusion using Smile Mesh Analysis software. The smile width increased and buccal corridor space decreased in post treatment smiles. This is suggestive of the fact that a broader smile is preferred in esthetic finishing of the case.

Chetan et al[46] evaluated the smile obtained from digital videographs in different age groups (15-20 years, 21-30 years, 31-40 years and 41-50 years). They measured the parameters smile width in two frames, the first at rest or relaxed lip position and second frame was of unstrained posed smile. The intercommissure width increased from rest to smile and decreased with age in both males and females. The smile width during smiling for different age groups ranged from 64.32+4.70 mm to 66.76+4.70 mm in males and from 65.68±3.35 to 66.04±3.71 mm in females and the values were quite comparable to our studies.

Buccal corridor

In present study the mean value of buccal corridor in group I (1.938±2.18) and in group II (1.931±2.14) non significant difference was found between the groups.

When compared between male and female buccal corridor in male (1.857±2.15) was less as compared to females (2±2.19) in gratifying subjects. Non significant difference was seen in group I and group II of male and female subjects.

Janson et al[47] stated that large buccal corridors are considered less attractive. Similarly in a study by Tikku et al[26] it was found that the values of buccal corridor were lower in subjects with attractive smile 0.96±0.30mm) and highest in subjects with least attractive smile (2.00±0.59mm). This was supported by Parekh et al who found that a broader smile (minimal buccal corridor) as judged by laypeople and Orthodontists were more attractive than than a narrow smile with a large buccal corridor.

Ker et al[20] found that laypersons did not approve of narrower smiles in U.S. population Mcleod et al[24] found that Canadian laypeople preferred less buccal corridor dimension than U.S. laypersons. Hence it can be suggested that shadows in the corners of the mouth during smile considered as negative spaces that hamper the attractiveness of the smile.

Krishnan et al[1] in his study on Characterization of posed smile by using visual analog scale, smile arc, buccal corridor measures, and modified smile index. 60 untreated patients were include in the study. 20 judges evaluated the photographs of the subjects using VAS. Further analysis was done on the photographs. They found that there is a differences between buccal corridor spaces of the right and left sides in posed smiles, indicated no statistically significant difference between the right and left negative spaces in males and females.

There seems to be a difference of opinion among investigators about the esthetic value of buccal corridors. Some concluded that they have no esthetic value; others believe that visible buccal corridors are unpleasing.

The parameters like Philtrum height, Visibility of central incisor, Gingival height will be discussed together as variation in any one of them will result in variable maxillary incisor show with gingival display.

Philtrum height

In present study the Philtrum height of the Group I 14.622±4.463 was on the lower side and Group II was 14.670±4.384 on the higher side, there was a just significant difference between these two groups.

Philtrum height of the male 15.695±4.668 was more as compared to females14.09 ± 4.351.There was non significant difference between both male and female subjects.

This parameters were not analysed by many evaluators.

According to the study done by Meron et al male had more upper lip length (17.57) compared to female (15.1) .Chetan et al[46] found upper lip length increases with age that could be attributed to less of resting muscle tone, increased flaccidity and redundantly with age. Similar finding were reported by Desai et al[48].

Visibility of central incisor

Visibility of central incisor of the Group II was (12.015±2.799) was more as compared to Group I (11.364± 2.987), there was just significant difference between the two groups. Whereas in Group IIB (12.35 ±2.666) visibility of central incisor was more as compared to Group IB (11.32 ±2.912), there was a moderately significant difference. While in Group IA (11.522±3.074) was more and Group IIA (11.415±2.941), there was a non-significant difference. There was more of visibility of central incisor in gratifying male as compared to female.

Study done by schabel et al[22] found similar result in which they found non significant difference between attractive and non attractive smiles.

Ackerman et al[3] found overall mean value of maxillary incisor exposure as 6.47+1.51mm in posed smile and this reading was much more lesser than present study this can be due to the age group selected in their study was growing subjects.

According to Peck et al[9] maxillary central incisor crown proportion located from a line between the lip commissures. Youthful smiles reveal between 75% and 100% of these teeth above the commissure line. This proportion can become 40% or less, causing the smile to age. With age, there is a decrease in maxillary tooth exposure during a smile, and an increase in mandibular incisor exposure. This phenomenon occurs due to natural tooth wear and the loss of elasticity of the lips.

Gingival height of the Group I 0.464±1.205 was on the lower side and Group II was 0.613±1.302 on the higher side, there was a non-significant difference between the two groups. Group I A was 0.611±1.470 was on the higher side and Group IIA was 0.503±1.169 on the lower side, there was a non-significant difference Group I B was 0.38 ± 1.032 was on the lower side and Group IIB was 0.67 ± 1.375 on the h, there was a moderately significant difference

In the study by Mc Leod[24] Canadian population preferred more gingival display than US population and in a study by Ker et al[20] gingival display of 2.1mm was maximum tolerance limit of US population.

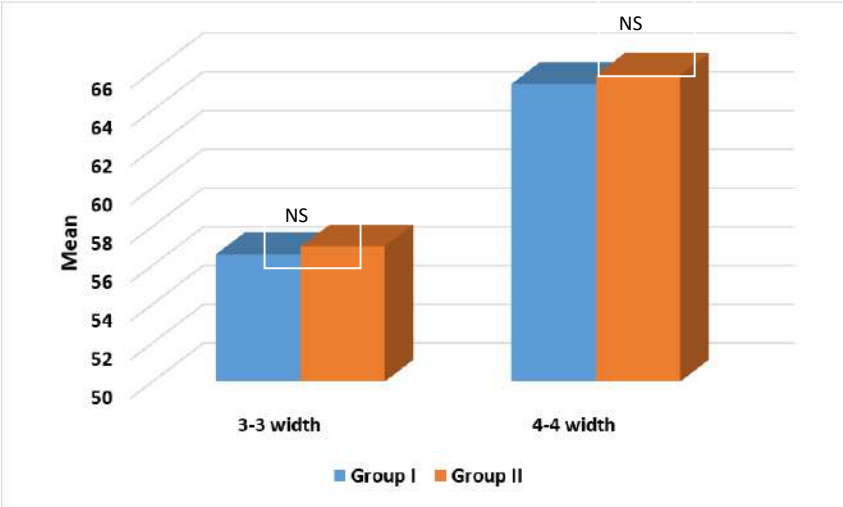
Peck and Peck[9] found that women show, on average, 0.7 mm of gingiva during a smile, while in males 0.8 mm of the clinical crown is covered by the upper lip, on average.

Arch width

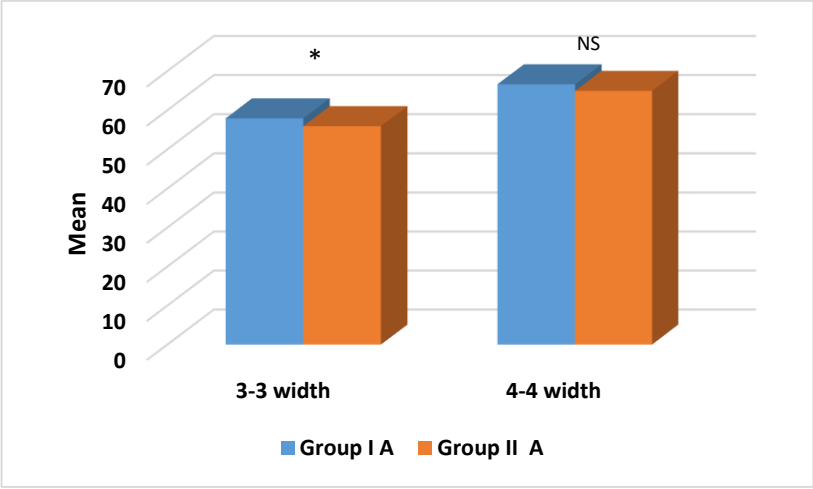
The mean **intercanine width** in group I was 65.363±6.329 that was more compared to group II 56.966±6.046 on. There was statistically non-significant difference. Gratifying male inter canine distance was more as compared to gratifying females (graph 10,11,12)

The mean **interpremolar width** in group I was 56.574±5.432 that was less compared to group II 65.821±6.776. There was a non-significant difference. Gratifying male inter premolar distance was more as compared to gratifying females.

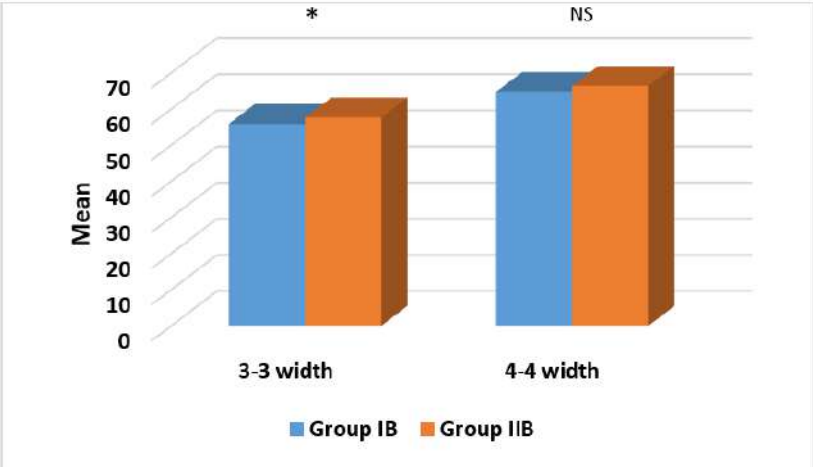
Just significant difference was found between gratifying and non-gratifying male also between gratifying and non-gratifying female.



Graph 10: comparison of Inter canine and Inter premolar distance of gratifying and non gratifying subjects of both the group (group I group II)



Graph 11: comparison of Inter canine and Inter premolar distance of gratifying and non gratifying male subjects of both the group (group IA group IIA).



Graph 12: comparison of Inter canine and Inter premolar distance gratifying and non gratifying in Female subject (group I, group II)

Prasad et al[34] in his study compared the subjects with normal occlusion to subjects treated with extraction of first premolar for orthodontic treatment. The inter canine distance of subjects with normal occlusion in male and female ranged from 56.36±3.20 and 61.44±4.02, which was similar to present study.

Study by Kim et al[12], studied the pre and post treatment records of 30 extraction cases. The pre treatment intercanine distance was 34.8±3.3 and inter premolar width 44.3±3.7.The difference could be due to difference in mesiodistal width of tooth with races or their readings were of overall sample that included both males and females.

As males have greater mesiodistal width of the teeth than females hence inter canine distance, inter premolar distance was significantly higher in males as compared to females in present study.

It can be concluded from the result of the present study that no single characteristics determines facial attractiveness hence these parameters should not be considered as rigid boundaries.

However smile designing involves a multifactorial decision making process that should always include the aesthetic desire of patient and limitation of orthodontist both within the anatomic and physiologic limitations of patients face. Also patients should be given a clear idea about realistic expectations for orthodontic treatment as achieving pleasing smile esthetics that involves multiple parameters; however, there is a limitation to which changes can be made with fixed orthodontic treatment for certain

parameters only. The concept of interdisciplinary approach for maximizing smile esthetics, outcomes must be followed routinely.

The major limitation of the present study was that static smile was considered whereas assessment of dynamic smile with videographic analysis may give better assessment of smile esthetics.

Future scope of present study includes assessment of dynamic smile for classifying them as subjects with gratifying or non-gratifying smile, conducting study on large sample size on subjects representative of particular population group, also male and female subjects could be divided based on facial divergence for comparison of smile esthetics between them.

CONCLUSION

The following conclusions may be drawn from the present study conducted to evaluate the effect of arch width and tooth characteristics on perception of smile in subjects with gratifying and non-gratifying smile as rated by panel of judges.

1. The scores as obtained for full face photograph were significantly higher than scores obtained for lower third of face for both male and female of gratifying and non-gratifying groups, thereby suggestive of the fact that beside smile as seen in lower third of the face, other facial features also contribute to overall aesthetics.
2. **In males** Inter canine width had significant contribution to the smiles whereas inter premolar width had no contribution to smile aesthetic.
3. **In females** Inter canine width had significant contribution to the smiles whereas inter premolar width had no contribution to smile aesthetic.
4. Amongst qualitative parameters smile arc and axial inclination of anterior teeth was significantly different between males with gratifying or non-gratifying smiles.
5. Amongst qualitative parameters axial inclination of anterior teeth, visibility of central incisor and in quantitative parameters commissure width, visibility of central incisor, gingival height was significantly different between females with gratifying or non-gratifying smiles.

It can be concluded from the result of the present study that no single characteristics determines facial attractiveness hence these parameters should not be considered as rigid boundaries.

Smile arc, axial inclination and intercanine width played major role in smile aesthtetics hence should be considered as priority during fixed orthodontic treatment.

SUMMARY

In orthodontics, during clinical examination more attention is given to the display zone of smile, which is determined by lip thickness, inter commissural width, interlabial gap, smile index, and gingival architecture[1]. There are two types of smile: the posed smile-which is a voluntary smile, may not be linked with emotion and is reproducible and spontaneous smile- which in an involuntary smile, linked with emotion and include movements like squinting of the eyes, flaring of nostrils and maximal elevation of lips[2]. Smile is classified based on smile line and depends on amount of incisor show and gingival display.

Aesthetics can be evaluated by three categories macro, mini and micro aesthetics. Macro aesthetics includes, facial proportion in all three plane of space including asymmetry, excessive or deficit facial height, maxillary mandibular deficiency or excess, it follows the principle that apply when grouping of individual teeth are considered[4]. The relationship between those teeth and surrounding soft tissue and the patient's facial characteristics creates a dynamic and three dimensional canvas. 500 students were selected from different colleges of Babu Banarasi Das University, Lucknow, in age range of 18-30 years (mean age) who fulfilled the selection criteria. The standardized frontal smiling photographs of subjects were taken. Also from the same image the lower third of face was cropped, Thus two photographs of each subject (frontal smiling photograph and lower third smiling photograph) were saved as JPEG (Joint Photographic Experts Group) format.

All the subjects were made to stand in an upright position against the white board with vertical and horizontal rulers attached to the background for calibration of the photograph. Digital single lens reflector (DSLR) was placed on a tripod stand at a standard distance of approximately 4 feet from the subjects. Two photographic albums were made, First album had 500 full facial smiling photographs, and Second album had 500 lower third smiling photographs. The photographs were arranged randomly in both the albums. Each album was rated by panel of judges using visual analogue scale from 1-10 from 1 being least gratifying to 10 being most gratifying. The mean score were calculated for each subject as rated by different members of the panel. The subject with the score between 1-5 were considered as having non gratifying smiles and more than 5 were considered as having gratifying smile.

Out of 500 subjects some of the samples were excluded as their premolars are not visible during smile. Thus the total of 400 subjects were selected for further assessment of arch width and smile characteristics and equally divided in two groups Group-I including 200 subjects with gratifying smile and Group- II including 200 subjects with non-gratifying smile. Both the groups were further subdivided into groups as per gender.Photographs were analyzed for Qualitative measurements, Quantitative measurements and arch width.

The data obtained for these parameters were recorded on microsoft excel sheet and subjected to statistical analysis.

The results are as follow:

1. The scores as obtained for full face photograph were significantly higher than scores obtained for lower third of face for both male and female of gratifying and non-gratifying groups, thereby suggestive of the fact that beside smile as seen in lower third of the face, other facial features also contribute to overall aesthetics.
2. **In males** Inter canine width had significant contribution to the smiles whereas inter premolar width had no contribution to smile aesthetic.
3. **In females** Inter canine width had significant contribution to the smiles whereas inter premolar width had no contribution to smile aesthetic.
4. Amongst qualitative parameters smile arc and axial inclination of anterior teeth was significantly different between males with gratifying or non-gratifying smiles.
5. Amongst qualitative parameters axial inclination of anterior teeth, visibility of central incisor and in quantitative parameters commissure width, visibility of central incisor, gingival height was significantly different between females with gratifying or non-gratifying smiles.

It can be concluded from the result of the present study that no single characteristics determines facial attractiveness hence these parameters should not be considered as rigid boundaries.

Smile arc, axial inclination and intercanine width played major role in smile aesthtetics hence should be considered as priority during fixed orthodontic treatment.

ANNEXURE-I

BABU BANARASI DAS UNIVERSITY

BBD COLLEGE OF DENTAL SCIENCES, LUCKNOW

INSTITUTIONAL RESEARCH COMMITTEE APPROVAL

The project titled **"Effect Of Arch Width And Tooth Characteristics On Perception Of Smile Aesthetics In Subject With Pleasing And Non-Pleasing Smile"** submitted by **Dr Aliya Rehman** Postgraduate student in the **Department of Orthodontics & Dentofacial Orthopaedics** for the Thesis Dissertation as part of MDS Curriculum for the academic year 2021-2024 with the accompanying proforma was reviewed by the Institutional Research Committee in its meeting held on **14th September, 2022** at BBDCODS.

The Committee has granted approval on the scientific content of the project. The proposal may now be reviewed by the Institutional Ethics Committee for granting ethical approval.

Prof. Dr. Puneet Ahuja
Chairperson

Dr. Mona Sharma
Co-Chairperson

ANNEXURE-II

BABU BANARASI DAS UNIVERSITY
BBD COLLEGE OF DENTAL SCIENCES, LUCKNOW

BBDCODS/IEC/09/2022 **Dated: 16th September, 2022**

Communication of the Decision of the Xth Institutional Ethics Sub-Committee Meeting

IEC Code: 17

Title of the Project: Effect Of Arch Width And Tooth Characteristics On Perception Of Smile Aesthetics In Subject With Pleasing And Non-Pleasing Smile.

Principal Investigator: Dr Aliya Rehman **Department:** Orthodontics & Dentofacial Orthopaedics

Name and Address of the Institution: BBD College of Dental Sciences Lucknow.

Type of Submission: New, MDS Project Protocol

Dear Dr Aliya Rehman,

The Institutional Ethics Sub-Committee meeting comprising following members was held on 15th September, 2022.

1.	Dr. Lakshmi Bala Member Secretary	Prof. and Head, Department of Biochemistry
2.	Dr. Praveen Singh Samant Member	Prof. & Head, Department of Conservative Dentistry & Endodontics
3.	Dr. Jiji George Member	Prof. & Head, Department of Oral Pathology & Microbilogy
4.	Dr. Amrit Tandan Member	Professor, Department of Prosthodontics and Crown & Bridge
5.	Dr. Rana Pratap Maurya Member	Reader, Department of Orthodontics & Dentofacial Orthopaedics

The committee reviewed and discussed your submitted documents of the current MDS Project Protocol in the meeting.
The comments were communicated to PI, thereafter it was revised.

Decisions: The committee approved the above protocol from ethics point of view.

Forwarded by:

Prof. Dr. Puneet Ahuja
Principal 16/9
BBD College of Dental Sciences
BBD University, Lucknow
PRINCIPAL
Babu Banarasi Das College of Dental Sciences
(Babu Banarasi Das University)
BBD City, Faizabad Road, Lucknow-226028

Lakshmi Bala 16/09/22
Dr. Lakshmi Bala
Member-Secretary
Institutional Ethics Sub-Committee (IEC)
BBD College of Dental Sciences
BBD University, Lucknow
Member-Secretary
Institutional Ethic Committee
BBD College of Dental Sciences
BBD University
Faizabad Road, Lucknow-226028

ANNEXURE -III

Babu Banarasi Das College of Dental Sciences

(Babu Banarasi Das University)

BBD City, Faizabad Road, Lucknow – 227105 (INDIA)

Guidelines for Devising a Participant / Legally Acceptable Representative InformationDocument (PID) in English

1. **Study Title**
   To evaluate the effect of arch width and tooth characteristics on perception of smile in subjects with gratifying and non-gratifying smile as rated by panel of judges.

2. **Invitation Paragraph**
   You are being invited to take part in a research study. Before you decide it is important for you to understand why the research/study is being done and what it will involve. Please take time to read the following information carefully and discuss it with friends, relatives and your treating physician/family doctor if you wish. Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

3. **What is the purpose of the study?**
   the purpose of the study is to to evaluate the effect of arch width and tooth characteristics on perception of smile in subjects with gratifying and non-gratifying smile as rated by panel of judges

4. **Why have I been chosen?**
   No patient is required as it is an in vitro study

5. **Do I have to take part?**
   Not applicable.

6. **What will happen to me if I take part?**
   Not applicable.

7. **What do I have to do?**
   Not applicable

8. **What is the procedure that is being tested?**
   The procedure will involve evaluation of the effect of arch width and tooth

characteristics on perception of smile in subjects with gratifying and non-gratifying smile as rated by panel of judges

9. What are the interventions for the study?

- To rate the frontal photographs by a panel of judges to divide the group in gratifying and non-gratifying group.
- To rate the lower third smiling photographs by a panel of judges to divide the group in gratifying and non- gratifying group
- To evaluate micro and mini aesthetic characteristics in subjects with gratifying and non-gratifying subjects.
- To compare various characteristics of smile aesthetics between the gratifying and non-gratifying subjects.
- To compare various characteristics of smile aesthetics between the gratifying and non-gratifying male and female subjects.

10. What are the side effects of taking part?

Not applicable

11. What are the possible disadvantages and risks of taking part?

Not applicable

12. What are the possible benefits of taking part?

Not applicable

13. What if new information becomes available?

Sometimes during the course of a research project, new information becomes available about the research being studied. If this happens, your researcher will tell you about it and discuss with you whether you want to continue in the study. If you decide to withdraw, your researcher/investigator will make arrangements for your withdrawal. If you decide to continue in the study, you may be asked to sign an updated consent form.

14. What happens when the research study stops?

If the study stops/finishes before the stipulated time, this will be explained to the patient/volunteer.

15. What if something goes wrong?

If any severe adverse event occurs, or something goes wrong during the study, the

complaints will be handled by reporting to the institution (s), and

Institutional ethical
community.

16. Will my taking part in this study be kept confidential?

yes.

17. What will happen to the results of the research study?

The results of the study will be used to be compare features of smile asthetics in gratifying and non-gratifying subjects.

18. Who is organizing the research?

This research study is organized by the academic institution (BBDCODS).

19. Will the results of the study be made available after study is over?

Yes

20. Who has reviewed the study?

The study has been reviewed and approved by the Head of the Dept, and the IEC/IRC of the institution.

21. Contact for further information

Dr. Aliya Rehman
Department of Orthodontics and Dentofacial Orthopaedics
Babu Banarasi College of Dental Sciences.
Lucknow-227105
Mob- 9971450902

Dr. Rohit Khanna (HOD)
Department of Orthodontics and Dentofacial Orthopaedics
Babu Banarasi College of Dental Sciences.
Lucknow-227105
Mob-9415037011

Signature of PI……

Name……..

Date……

ANNEXURE -IV

Babu Banarasi Das College of Dental Sciences

(Babu Banarasi Das University, Lucknow)

BBD City, Faizabad Road, Lucknow – 227105 (INDIA)
प्रतिभागी के लिए सूचना पत्र

1.अध्ययन शीर्षक?

न्यायाधीशों के पैनल द्वारा मूल्यांकन के अनुसार संतुष्टिदायक और गैर-संतुष्टिदायक मुस्कान वाले विषयों में मुस्कान की धारणा पर आर्च की चौड़ाई और दांत की विशेषताओं के प्रभाव का मूल्यांकन करना।

2. निमंत्रण अनुच्छेद?

आपको एक शोध अध्ययन में भाग लेने के लिए आमंत्रित किया जा रहा है। निर्णय लेने से पहले आपके लिए यह समझना महत्वपूर्ण है कि शोध/अध्ययन क्यों किया जा रहा है और इसमें क्या शामिल होगा। कृपया निम्नलिखित जानकारी को ध्यान से पढ़ने के लिए समय निकालें और यदि आप चाहें तो दोस्तों, रिश्तेदारों और अपने इलाज करने वाले चिकित्सक/पारिवारिक डॉक्टर के साथ इस पर चर्चा करें। हमसे पूछें कि क्या ऐसा कुछ है जो स्पष्ट नहीं है या यदि आप अधिक जानकारी चाहते हैं। यह तय करने के लिए समय लें कि आप भाग लेना चाहते हैं या नहीं।

3. अध्ययन का उद्देश्य क्या है?

अध्ययन का उद्देश्य संतुष्टिदायक और गैर-संतुष्टिदायक मुस्कान वाले विषयों में मुस्कान की धारणा पर आर्च की चौड़ाई और दांत की विशेषताओं के प्रभाव का मूल्यांकन करना है, जैसा कि न्यायाधीशों के पैनल द्वारा मूल्यांकन किया गया है।

4. मुझे इस अध्ययन के लिए क्यों चुना गया है?

किसी रोगी की आवश्यकता नहीं है।

5. क्या इसमें मुझे भाग लेना चाहिए?

मान्य नहीं।

6. मुझे क्या होगा यदि मैं इस अध्ययन में भाग लेता हूं।

मान्य नहीं।

7. मुझे क्या करना है?

मान्य नहीं।

8. किस प्रक्रिया का अध्ययन किया जा रहा है?

इस प्रक्रिया में संतुष्टिदायक और गैर-संतुष्टिदायक मुस्कान वाले विषयों में मुस्कान की धारणा पर आर्च की चौड़ाई और दांत की विशेषताओं के प्रभाव का मूल्यांकन शामिल होगा, जैसा कि न्यायाधीशों के पैनल द्वारा मूल्यांकन किया गया है।

9. इस शोध में कौन से हस्तक्षेप दिए जाएंगे?

• समूह को संतुष्टिदायक और गैर-संतोषजनक समूह में विभाजित करने के लिए न्यायाधीशों के एक पैनल द्वारा सामने की तस्वीरों को रेटिंग देना।

• समूह को संतुष्टिदायक और गैर-संतुष्टिदायक समूह में विभाजित करने के लिए न्यायाधीशों के एक पैनल द्वारा निचली तीसरी मुस्कुराती तस्वीरों को रेटिंग देना

• संतुष्टिदायक और गैर संतुष्टिदायक विषयों वाले विषयों में सूक्ष्म और लघु सौंदर्य संबंधी विशेषताओं का मूल्यांकन करना।

• संतुष्टिदायक और गैर-संतोषजनक विषयों के बीच मुस्कान सौंदर्यशास्त्र की विभिन्न विशेषताओं की तुलना करना।

• संतुष्टिदायक और गैर-संतुष्टिदायक पुरुष और महिला विषयों के बीच मुस्कान सौंदर्यशास्त्र की विभिन्न विशेषताओं की तुलना करना।

10. इस अध्ययन में भाग लेने के क्या दुष्प्रभाव हैं?

मान्य नहीं।

11. इस अध्ययन में भाग लेने के संभावित जोखिम और नुकसान क्या है?

मान्य नहीं।

12. अध्ययन में भाग लेने के संभावित लाभ क्या है?

मान्य नहीं।

13. क्या होगा यदि कोई नई जानकारी उपलब्ध हो जाती है?

मान्य नहीं।

14. क्या होता है जब अध्ययन / शोध परीक्षण बंद हो जाता है?

मान्य नहीं।

15. क्या होगा अगर कुछ गलत हो जाता है?

मान्य नहीं।

16. क्या इस अध्ययन में मेरा हिस्सा गोपनीय रखा जाएगा?

हाँ

17. अध्ययन / शोध परीक्षण के परिमाण का क्या होगा?

अध्ययन के परिणामों का उपयोग संतुष्टिदायक और गैर-संतुष्टिदायक विषयों में मुस्कान सौंदर्यशास्त्र की विशेषताओं की तुलना करने के लिए किया जाएगा।

18. इस अध्ययन को कौन आयोजित कर रहा है और इस परीक्षण के लिए धन कहां से आएगा?

यह शोध अध्ययन शैक्षणिक संस्थान (बीबीडीसीओडीएस) द्वारा आयोजित किया जाता है।

19.क्या सेवाएं शोध खत्म हो जाने के बाद उपलब्ध रहेगी या नहीं?

हां।

20. अध्ययन की समीक्षा किसने की है?

अध्ययन की समीक्षा की गई है और विभाग के प्रमुख, और आईईसी/आईआरसी के द्वारा अनुमोदित किया गया है। निम्न

लोगों से संपर्क करें

21.अधिक जानकारी के लिए संपर्क करें ।

डॉ. आलिया रहमान
ऑर्थोडोंटिक्स और डेंटोफेशियल ऑर्थोपेडिक्स विभाग
बाबू बनारसी कॉलेज ऑफ डेंटल साइंसेज।
लखनऊ-227105
मोब- 9971450902

डॉ रोहित खन्ना (एचओडी)
ऑर्थोडोंटिक्स और डेंटोफेशियल ऑर्थोपेडिक्स विभाग
बाबू बनारसी कॉलेज ऑफ डेंटल साइंसेज।
लखनऊ-227105
मोब-9415037011
bbdcods.iec@gmail.com

पीआईकाहस्ताक्षर .....

नाम .....

दिनांक……

ANNEXURE –V

PLAGIARISM REPORT

DrillBit

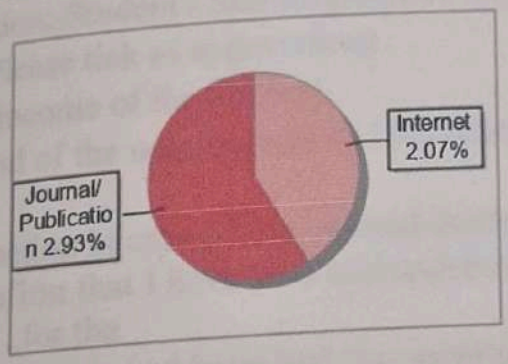
The Report is Generated by DrillBit Plagiarism Detection Software

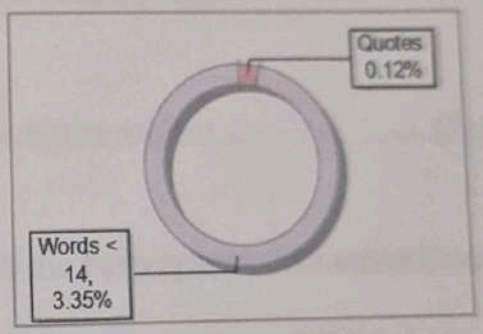
Submission Information

Author Name	Akya Rehman
Title	EFFECT OF ARCH WIDTH AND TOOTH CHARACTERISTICS ON PERCEPTION OF SMILE AESTHETICS
Paper/Submission ID	1449993
Submitted By	amarpal.singh056@bbdu.ac.in
Submission Date	2024-02-20 12:30:19
Total Pages	45
Document type	Dissertation

Result Information

Similarity 5 %





Exclude Information

Quotes	Excluded
References/Bibliography	Excluded
Sources: Less than 14 Words %	Excluded
Excluded Source	0 %
Excluded Phrases	Not Excluded

Database Selection

Language	English
Student Papers	Yes
Journals & publishers	Yes
Internet or Web	Yes
Institution Repository	Yes

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