"PERCEPTION ANALYSIS OF FACIAL PROFILE IMAGES OF SIMULATED ORTHOGNATHIC SURGERIES BY ORTHODONTISTS, ARTISTS AND LAYPERSON USING DOLPHIN IMAGING SOFTWARE: A COMPARATIVE STUDY"

By

REG. NO. II0220001

Dissertation

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KLE VISHWANATH KATTI INSTITUTE OF DENTAL SCIENCES,
KAHER, BELAGAVI, KARNATAKA.

2020 – 2023

KAHER, BELAGAVI

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ABSTRACT

Introduction: Social acceptance and the patient's psychological wellness are majorly influenced by the appearance of the face. A combination of oral and maxillofacial surgery and orthodontic treatment becomes the major and trending. In evaluating people with dentofacial abnormalities, the research found that skilled orthodontists and surgeons had substantial disagreements modality for the correction of skeletal and soft tissue deformity of the dentofacial complex. The Orthodontist and the orthognathic surgeon must understand general population goals and the perception of a normal facial profile and how it differs from his or her perception of a normal facial profile and aesthetic goals. In addition to assessing a patient's smile in geometrical and objective terms, it is also necessary to scientifically understand facial profile being pleasant from the point of view of laypeople, orthodontists and artist. This study is to compare the perception of orthodontic orthognathic surgery simulated profile photographs by orthodontist, Artist and lay people

Materials and methods: In this study,20 orthodontist,20 laypeople and 20 artists has evaluated simulated profile of orthognathic surgery using Dolphin imaging software.58 patient having skeletal discrepancies meeting the inclusion criteria were selected. The lateral profile photographs and the lateral cephalogram are uploaded in Dolphin imaging software version 11.95. After digitizing the lateral cephalograms the photographs are superimposed on it. For each patient three different treatment modalities simulation is done i.e., orthodontic camouflage, Uni-Jaw orthognathic surgery, Bi-jaw Orthognathic surgery. These photo graphs are evaluated by three group of people orthodontist, Artist and Laymen

Results: The mean rating of laymen group was 2.91± 0.36, the mean value was 2.17±0.33 in case of artist group and 2.89±0.25 in case of orthodontist group. Statistically significant difference was observed between the mean values of laymen and artist group and between orthodontist and artist group($p<0.001$). The average rating in layman group was found to be 3.290±0.44 while the mean value in artist and orthodontist groups were observed to be 3.062±0.36 and 2.543±0.43 respectively. The results showed statistically significant difference between mean values of layman and orthodontist($p<0.001$) and artist and orthodontist groups($p<0.05$). The result obtained was found to be highly significant($p<0.001$) indicating significant difference between the means of groups. The highest mean was observed in layman group while the lowest was observed in orthodontist group. The result obtained was found to be statistically significant between the means of layman and orthodontist groups and between artist and orthodontist groups($p<0.001$).

Conclusion: This study was conducted to evaluate and compare the perception of simulated profile orthognathic surgery by orthodontists, artists and laypeople. The study shows that there is a statistically significant difference between the perception of orthodontists, artists and laypeople.There are disagreements between the perception of camouflage treatment by the artist in the other two groups and the perception of bijaw surgery by orthodontists differs from other two groups.The laypeople valued the Bijaw-treated profiles as more pleasant, while the orthodontist valued camouflage treatment as more pleasant and the artist finds.Bijaw-treated profiles more pleasant. The study concluded that orthognathic surgery or orthodontic camouflage should be planned with the patient's preference as one of the major concerns.

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INTRODUCTION

Social acceptance of the patients and their psychological wellness are majorly influenced by the appearance of the face[1]. A combination of oral and maxillofacial surgery and orthodontic treatment becomes the major and trending modality for the correction of skeletal and soft tissue deformity of the dentofacial complex.

Orthognathic treatment is the major treatment in which maxilla and mandible repositioning will be done for patients who outside the envelope of growth modification with moderate and severe skeletal deformities in the dentofacial region. Treatment is done with proper diagnosis, treatment plan and cooperation between the orthodontist and the oral and maxillofacial surgeons. Though orthognathic surgery is focus on both function and aesthetics, studies show that the most of patients approaching the orthodontics treatment had aesthetics as a primary concern[2].

In orthodontics treatment, especially in the case of a patient with a moderate skeletal deformity has three modality of treatment options one is treated at the early stage of the growth where we can modify growth using functional appliances so that the skeletal discrepancy is eliminated as the patient grows the second option is orthodontic camouflage treatment in which compensating the skeletal discrepancy using dentition the third option is orthognathic surgery. This is because huge improvement in the skeletal anchorage system mainly extra alveolar implants However, these treatment selections are controversial and are based on diagnosis and patient preferences. The clinical problem assessment by each practitioner may be the cause of a large portion of the treatment-related disagreement.

In evaluating people with dentofacial abnormalities, the research found that skilled orthodontists and surgeons had substantial disagreements[3]. The precise type of the patient's deformity as well as its severity were assessed differently by the various experts. The divergent views on the severity of the deformity may be made worse by each practitioner's interest in or attention to a particular aspect of the malocclusion, such as skeletal versus dental. in the last two decades, skeletal deformity correction has been improved with surgical correction of the jaw rather than camouflage. This results in part from a significant increase in technology and improvement in the experience of both surgeons and orthodontists in treating surgical patients

Studies show that dentofacial correction employing orthognathic surgery has increased the patient's confidence level in themselves[4] Though the results achieved by orthognathic surgery look promising to an orthodontist, sometimes it may not be appreciable to surgical patients, especially in terms of aesthetic profile improvement. This may be due to the reason that surgical patients cannot view profile improvement as much as the frontal view[5].

The negative effects of surgery on patients have been greatly reduced as a result of the use of rigid fixation techniques and shorter inpatient hospital stays. Whereas 20 years ago patients stay 3 to 4 days in hospitals, now surgical patients don't stay more than 2 days. Another major reason for the increase in orthognathic surgery is the use of rigid fixation techniques which eliminates the maxilla mandibular fixation. However still patients with moderate skeletal deformity seek orthodontic camouflage rather than surgery, the patient's preference is more critical than the orthodontist and surgeon's opinion. So, it is essential to understand the

laypeople's perception of difference between the camouflage and orthognathic surgery.

Literatures are available which compare the perception of profiles by various professionals and laymen. Bell and co-authors studied that laypersons are significantly less likely to give a higher grade to the profile drawing than orthodontics and surgeons[6]. Genetic, cultural, and environmental influences all play a part in how people judge someone's facial appearance[7]. There is conflicting evidence regarding whether surgical correction genuinely improves social accomplishments and self-concept.[8]

There are studies which have been done to answer the question of whether there is a difference in consideration of what is an aesthetic profile by the orthodontist and laypersons. While some studies revealed differences in opinion between orthodontists and laypeople[9–11], some investigations found similar outcomes[12,13].

Society plays an important role in the perception of the profile, it is not just an individual perception when an orthognathic surgical patient approach and orthodontist.So it is essential know the perception of various professionals perception about beauty.

Artists are professionals who are well-versed in facial proportions. They are one of the profession who are well versed with the golden proportion, symmetry, geometry of the profile beauty. There is an unavailability of literature about the artist's perception of facial proportion which will help frame the proper facial proportion during the treatment plan of orthognathic surgery. There is a lack of availability in the literature on artist perception of surgical outcomes.

The Orthodontist and the orthognathic surgeon must understand general population goals and the perception of a normal facial profile and how it differs from his or her perception of a normal facial profile and aesthetic goals. In addition to assessing a patient's smile in geometrical and objective terms, it is also necessary to scientifically understand facial profile being pleasant from the point of view of laypeople, orthodontists and artist

This study is to compare the perception of orthodontic orthognathic surgery simulated profile photographs by orthodontist, Artist and lay people

AIM AND OBJECTIVES

AIM:

To evaluate and compare perceptions of facial profile images of simulated orthognathic surgeries by orthodontist, artist, and layperson.

OBJECTIVES:

- To evaluate the perception of simulated lateral photographs by orthodontists
- To evaluate the perception of simulated lateral photographs by artists.
- To evaluate the perception of simulated lateral photographs by laypeople.
- To compare the perception of layman, orthodontist and artist perceptions**.**

RESEARCH HYPOTHESIS

Null hypothesis – There is no difference between perception of orthodontist, artist, and layperson on aesthetics in simulated profiles of various treatment modalities of jaw discrepancies.

Research hypothesis – There is difference between perception of orthodontist, artist, and layperson on aesthetics in simulated profiles of various treatment modalities of jaw discrepancies.

REVIEW OF LITERATURE

Posnick et al (2019)[14]**–** conducted research on the effects of short faces (SF) and dentofacial deformities (DFD) on individuals' social perception with fifteen topics. The average patient age at surgery was 33 years.

According to the study's findings, short-face subjects as a whole were judged to be significantly more reliable, amiable, clever, attractive, and dominant after jaw reconstruction surgery and after the end of orthodontic therapy (T2). Individually, 70% of individuals were thought to be substantially more handsome, 60% to be intellectual, 50% to be significantly more sociable, 30% to be more trustworthy, & 30% to be significantly more dominant (P0.05).

Andréa Rocha et al (2019)[15]**–** conducted a study on the assessment of the pleasantness of the facial profile as indicated by two Class II treatment regimens. The sample included silhouettes of the faces from the pre-and post-treatment cephalograms (T1 and T2) of 60 patients separated into two groups**.**

A mandibular advancement device (Forsus) was used to treat the second group of 30 patients, who had a mean age of 12.81 years. One group of 30 patients had their maxillary first premolars extracted (mean treatment time: 2.7 years) (mean treatment duration of 2.49 years)

T2, between laypeople and orthodontists (orthodontists given higher scores), and between T2 and T1 (larger scores for T2 compared to T1), however, there was no major difference across the treatment procedures. Both techniques improved the aesthetics of the facial profile, according to orthodontists and laypeople alike.

The examiners, 60 orthodontists and 60 laypeople, evaluated the profiles for face agreeability using a Likert scale, and the study found a significant difference between T1 and T2

Rego et al[16] the perception of soft-tissue profile changes following Herbst appliance therapy by contrasting facial profile silhouettes taken before, right after, and two years following treatment by orthodontists, dentists, and laypeople.

The sample consisted of 21 patients, with a mean age of 9.5 +/- 0.5 years, who received Herbst appliance therapy for an average of 12 months. Total 3 lateral cephalograms were taken: one at the beginning, one right after the Herbst appliance was taken out, and one two years later. 120 examiners split into three groups of orthodontists, dentists, and laypeople, evaluated the 63 profile silhouettes that resulted from the experiment.

All examiner groups favored the post-treatment profiles, the study found. However, quantitative analysis revealed that the profile's magnitudes of changes were inconsistent and rather tiny, with laypeople estimating the change with the highest magnitude.

Robert g et al(1984)[17]-conducted a study in which Life-size lateral photographs of two male and two female subjects that had been altered to simulate varying degrees of surgical correction of mandibular retrognathism and prognathism were evaluated by, 52 orthodontists, 51 oral and maxillofacial surgeons,51 ‘orthognathic surgery’ patients, and 100 laypeople. More than 50% of the laity groups typically did not notice a horizontal difference at the PG of less than 4 mm.

Even though the dental groups are more accurate, they did not reach better < 80% recognition until a shift of 6 mm. The female and prognathic participants were more readily recognized as having changed by both the lay and dental groups. Dentists typically pointed to the chin and lips when asked what feature had changed.

Romani et al (1993)[18] conducted a study to assess changes in the face profile simulating the results of different orthognathic surgical methods, and a new video image processing technology was employed. Images of male and female subjects underwent gradual alterations to simulate the effects of set-back or mandibular advancement, maxillary set-back or advancement, and maxillary impaction.

An evaluation of the degree of sensitivity to the facial profile's changes and the preferences for different profiles was done using questionnaires that were completed by 22 doctors and 22 laypeople.

The results show that both orthodontists and laypeople are sensitive to very slight horizontal alterations in the facial profile when analyzing genuine colour video images. While orthodontists are more sensitive to changes in horizontal mandibular than to very big vertical changes, the reverse is true.

Bell et al (1985)[6] conducted a study in which Eighty patients who had previously been determined to need 'orthognathic surgery' by an orthodontist and an oral surgeon filled out questionnaires assessing their perception of their profiles.

To repair their jaw malformations, 50% of the patients chose to have surgery, while the others opted not to. In addition, brochures with images of all 80 patients before treatment were sent by mail to 43 laypeople, 46 orthodontists, and 37 oral surgeons. Using the identical grading scales that patients had used, these 3 groups of evaluators

evaluated the patient profiles. Except for soft-tissue AN-pg (mean difference = 2.4 °) and ANB (difference in mean = 1.8 °), all skeletal and soft-tissue measurements between the two patient groups were statistically equal. In later data analysis, variations in these dimensions were considered.

The result leads to the conclusion:

1. Despite the fact that surgical therapy may be advised by the dentist and indicated by cephalographic measurements, the patient's decision to choose surgical correction is more influenced by their own opinions of their profile;

2. Their decision not to have surgery to repair their jaw abnormalities may have been influenced in part by others' perceptions that their profiles are more desirable;

3. Orthodontists and oral surgeons both analyze facial profiles, although surgeons mostly suggest a surgical correction.

4. Orthodontists and oral surgeons are less likely than laypeople to judge a person's profile as normal

Prahl-Andersen et al (1979)[19]**,** conducted a study in which Parents, general dentists, and orthodontists evaluated 11 drawings of face profiles and 11 pictures of dentitions for normality and the need for orthodontic treatment. utilized a three-point scale.

Ten of the eleven face profiles and seven of the eleven photos of dentitions revealed a significant discrepancy between the parent and professional groups' assessments.

Overall, compared to expert groups, parents found more samples to be acceptable and do not require orthodontic treatment. Only the "ugly duckling" example (image 22, higher abnormal rating by the dentists) and the profile example 10 showed substantial differences in the dentists' and orthodontists' ratings). The condition in picture 10 may be a Class II Division 2 malocclusion, and as such, some orthodontists may have given it an aberrant score.

Imani et al (2018)[20] On profile pictures of a young man and a young woman, software (Dolphin software.) was utilized to change the mandibular position. Nine construction profile photographs were created using G'-Sn-Pg' angles that were adjusted incrementally at 2° intervals (6° to 22°). We asked 32 orthodontists, 32 laypeople and 32 maxillofacial surgeons, to rate each of the 18 profiles on a scale from 1 to 10. Additionally, they assessed if each profile required 'orthognathic surgery' to enhance facial aesthetics.

The result showed the three groups' scores varied, particularly for the females. Similar in their preferences, the orthodontists preferred a mandible that protruded a little further (G'-Sn-Pg', 12°–14°). The scores of laypeople were the most erratic, and they tended to choose a retrognathic profile (G'-Sn-Pg', 14°-18°). Regarding the requirement for 'orthognathic surgery' for facial convexity angles exceeding 8° in women and 20° in men, there was no statistically significant link.

The study concluded that most participants preferred a more protruding mandible for male models as opposed to female ones, however, the laypersons' impressions were different from the professionals.

Vincent et al (1998)[21] In this work, five aspects of lateral profile photographs of 11 patients slated for mandibular advancement or set-back surgery were animated using video imaging and specially designed morphing software. The patient, a close friend or family member, three orthodontists, and three oral surgeons all assessed each patient profile. The zone of acceptability was established by holding down the computer mouse button when the altering feature became acceptable and leaving the button when the image was not acceptable anymore as the feature animated between 2 extremes.

The participants were asked to choose the position that they found most appealing in a different activity. A significant variation in the field of acceptability for each of the five profile traits was discovered using an analysis of variance (P .017) across all sets of assessors. The order of the field of acceptability was orthognathic patient, oral surgeon, significant other, and orthodontist, going from smallest to largest. The median of acceptance and the most appealing distortion among patients, professional groups and significant others, did not show any persistent variations. In conclusion, it was shown that (1) patients undergoing 'orthognathic surgery' were able to use this new video imaging method to inform clinicians of what they found tolerable and (2) despite having similar preferences across all groups, surgical patients had the lowest tolerability for deviation from the preferred image.

MATERIALS AND METHODS

SOURCE OF DATA

- The study has been conducted in the Department of Orthodontics and Dentofacial Orthopedics, KLE Academy of Higher Education and Research (KAHER), KLE VK Institute of Dental Sciences, Belagavi.

INCLUSION CRITERIA:

- Maxillary skeletal discrepancies (prognathic/retrognathic)
- Mandibular skeletal discrepancies (prognathic/retrognathic)
- Overjet of 6 to 12 mm which are in an envelope of discrepancy.
- Pre-treatment facial profile photographs and lateral cephalograms of non-growing individuals.
- Both males and females will be included.

EXCLUSION CRITERIA:

- Patients who have undergone cleft surgery
- Patients who have undergone orthognathic surgery previously
- Patients with syndromes
- Growing individuals
- Asymmetric facial pattern
- Skeletal deformities

SAMPLE SIZE ESTIMATION

Sample size estimation - The sample size (n) is derived by using the "comparing two means" formula:

$$n = \frac{(\sigma_1^2 + \sigma_2^2/\kappa)\,(Z_{1-\alpha/2}+Z_{1-\beta})^2}{\Delta^2}$$

Where, σ 1 = standard deviation of Group 1,

σ 2 = standard deviation of Group 2

Δ = difference in group means (master article reference –Rocha AD et al)

κ = ratio = n2/n1

Z1-α/2 = two-sided Z value (eg. Z=1.96 for 95% confidence interval).

Z1-β = power

Substituting the values in the above formula,

$$n = \frac{\{(0.49)^2+(0.42)^2\}\,(1.96 + 0.84)^2}{(2.61-2.37)^2}$$

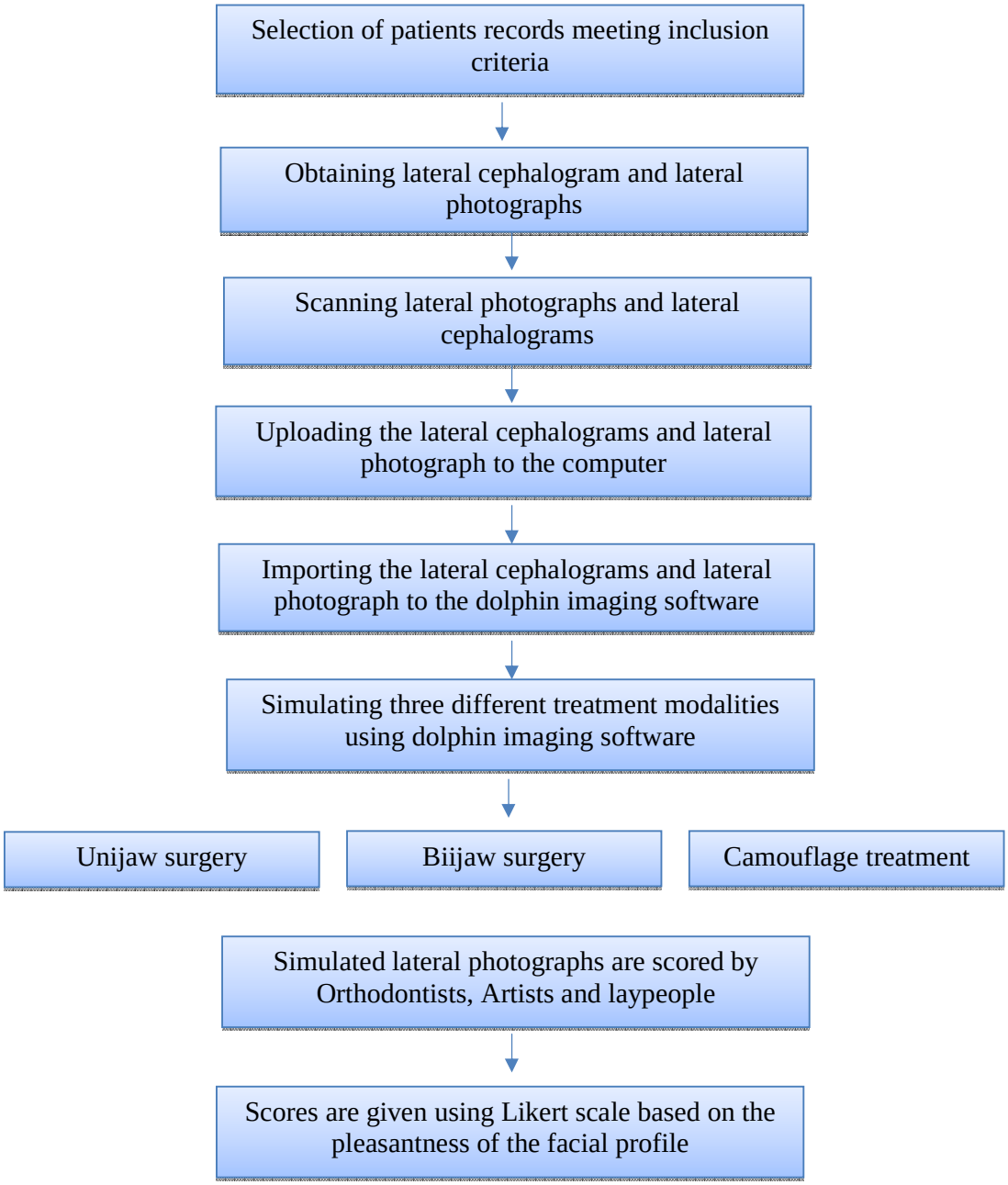
A total sample size of 56.8~ 57 patients/photographs is derived and a total of 57 evaluators are estimated.

METHODOLOGY

INSTRUMENTS AND MATERIALS:

- Pre-treatment lateral photographs of jaw discrepancy cases
- Pre-treatment lateral cephalograms of jaw discrepancy cases
- A computer with Dolphin imaging Premium (Version 11.95.08.58)
- A scanner-Epson perfection V800 photo

PATIENTS CONCERN: Patients were informed and the records are taken with the patient consent



FLOW CHART OF METHODOLOGY

The study included a total of 58 patients both male and female (32 female and 26 males) with age 18 to 35-year-old matching the inclusion criteria

Patient records with maxillary and mandibular discrepancies with overjet of 6 to 12 mm were obtained from the Department of Orthodontics and Dentofacial Orthopedics, KLE VK Institute of Dental Science, KLE Academy of Higher Education and Research, Belagavi

Lateral cephalograms and facial profile photographs were obtained from the patient records meeting inclusion criteria. The profile photographs were taken using the Canon 1500d with Tamron 90mm macro lens. Patients' models were used for space analysis.

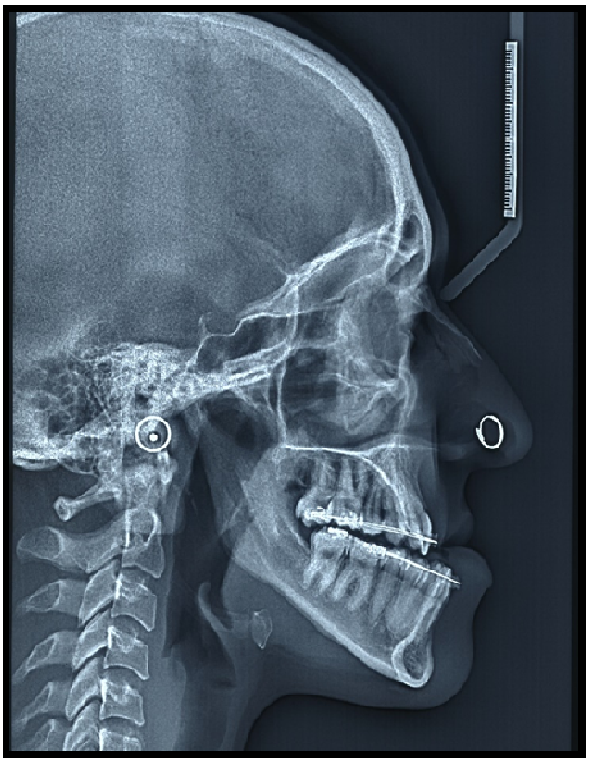


Fig -1a-Scanned lateral cephalogram

The lateral cephalograms and the facial profile photographs were scanned using the Epson perfection V800 photo scanner (Fig 1a and 1b).

Fig 1b-Scanned lateral photograph

These facial profile photographs and the lateral cephalograms were uploaded to the computer which is again uploaded to the dolphin imaging software. (fig 2)

The uploaded photograph and lateral cephalogram were fed into the Dolphin imaging software. The lateral cephalograms were digitized in which the lateral cephalograms are standardized using the measuring ruler points in the lateral cephalograms. Cephalometric for orthognathic surgery (COGS) analysis was used to digitize and measure the linear and the angular values[22] (fig 3)

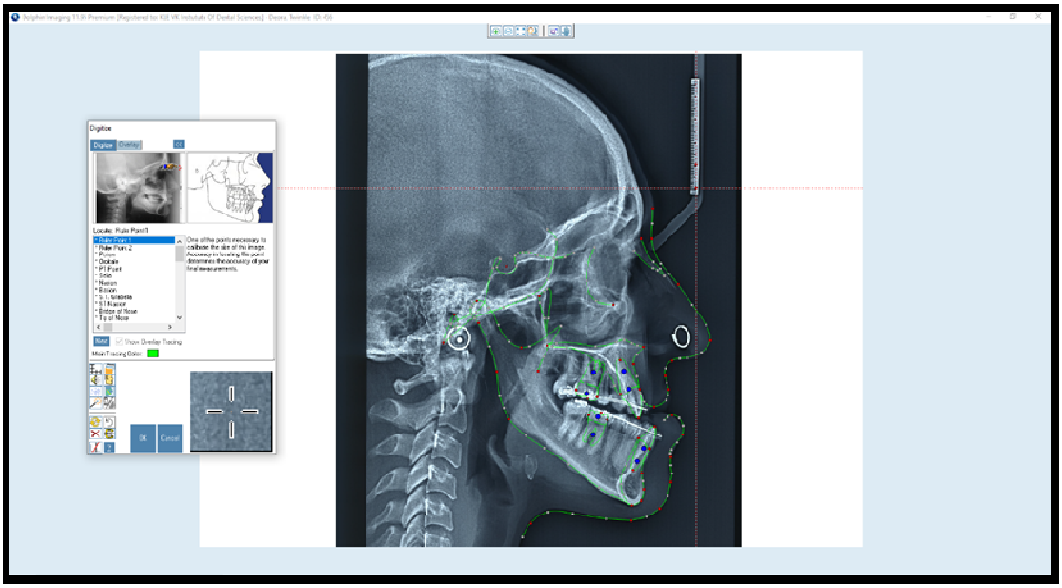


Fig 3-lateral cephalograms uploaded and digitized

The digitized lateral cephalograms were superimposed on the patient lateral cephalograms using the two major soft tissue landmarks soft tissue glabella and sub nasale. These two landmarks were made superimposed on the respective point on the lateral cephalogram

The superimposed photographs were subjected to decompensation treatment using the software in which the dental compensation is eliminated according. Depending on the crowding level and the space availability the decompensation is done with or without extraction. The treatment goal of orthodontic decompensation included achieving ideal IMPA and U1SN values. (fig 4)

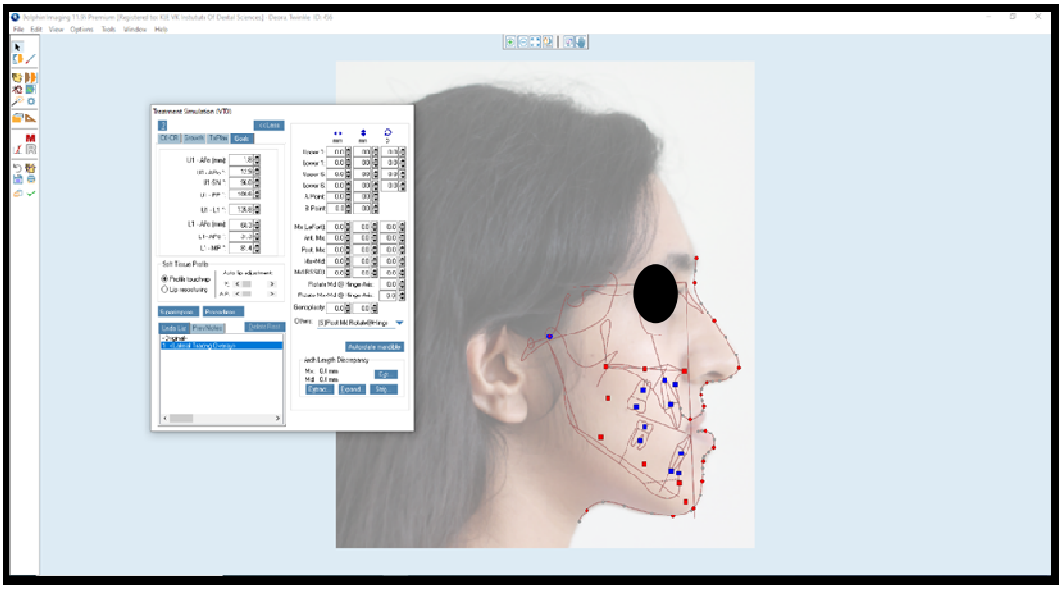


Fig-4-Decompensation Treatment

Following decompensation, the surgical simulation is done using dolphin software (Fig 5). The advancement or the setback surgeries are carried out based on the ideal values of the COGS analysis[22] For each patient three treatment plan is simulated the first one is camouflage treatment where only orthodontically compensation is done, the second treatment plan has uni jaw orthodontic treatment and third treatment plan include Bijaw treatment plan where orthognathic surgery is done for both upper and lower jaw.

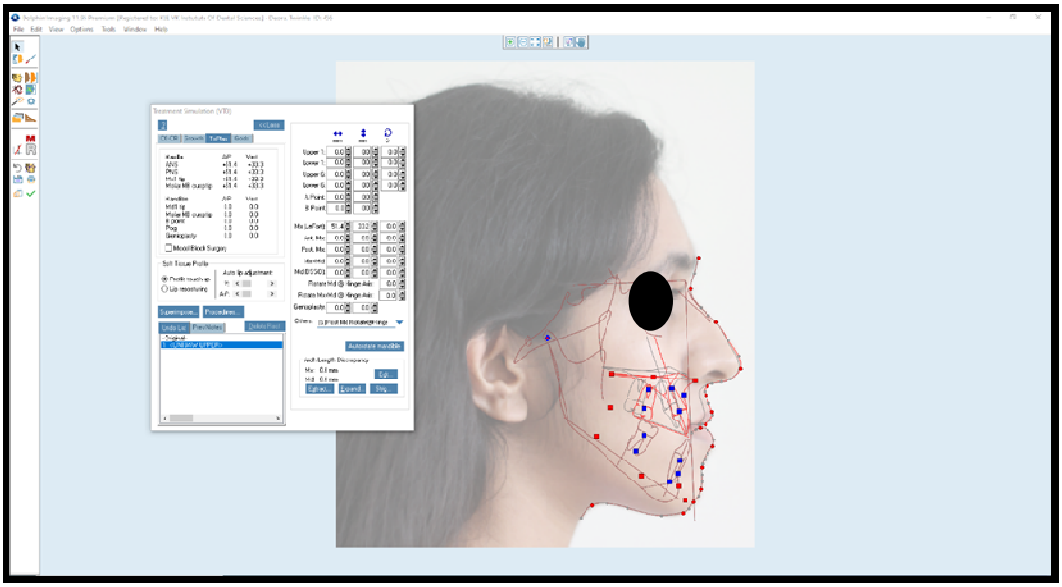


Fig 5-Orthognathic surgery simulation

The simulated surgical final photographs are named A (fig 6a) for camouflage treatment B (fig 6b) for uni jaw surgery and C for Bijaw surgery (Fig 6c).

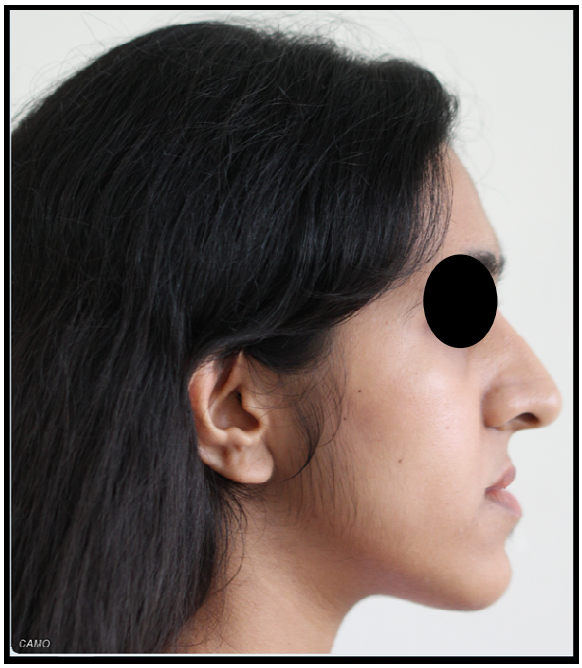


Fig 6a-Photograph A (camouflage treatment)

Fig 6b-Photograph B (Unijaw treatment)

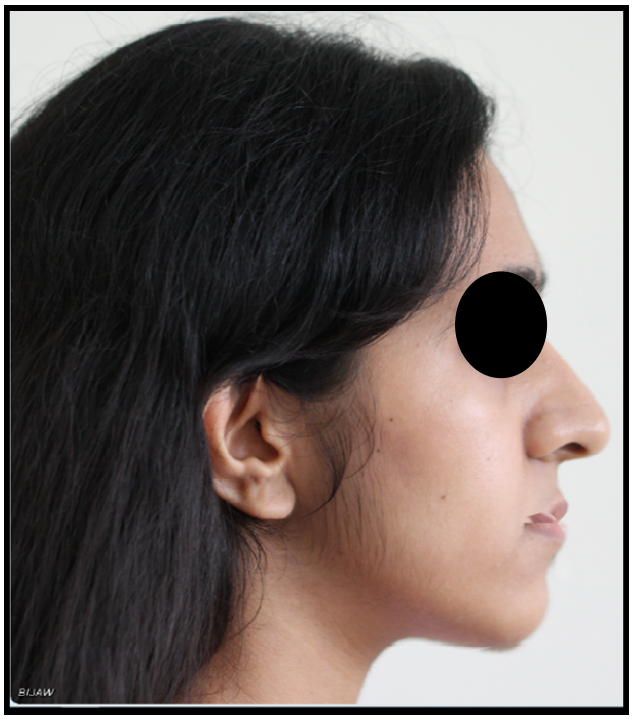


Fig 6c-Photograph C (Bijaw treatment)

For each patient, three photographs are made named A, B, and C. These photographs were made into Microsoft PowerPoint slides each slide contains one photograph. These slides were evaluated by 20 orthodontists,20 artists and 20 laypeople. The age group of the all the evaluators is between 18-40years of age. The evaluators were shown the photograph for 10 seconds that is 30 seconds for three photographs of each subject. The evaluators were asked to score the photographs based on the Likert scale which contains 5 scores based on the pleasantness of the profile (Fig-8).

All the evaluators were selected from the faculties of the Department of Orthodontics and dentofacial orthopedics, VK Institute of Dental Sciences, Belgaum, Karnataka. and Artist are selected from the faculty of JN Bandari School of Arts, Shinoli, Belgaum and all the lay people are selected from the same city.

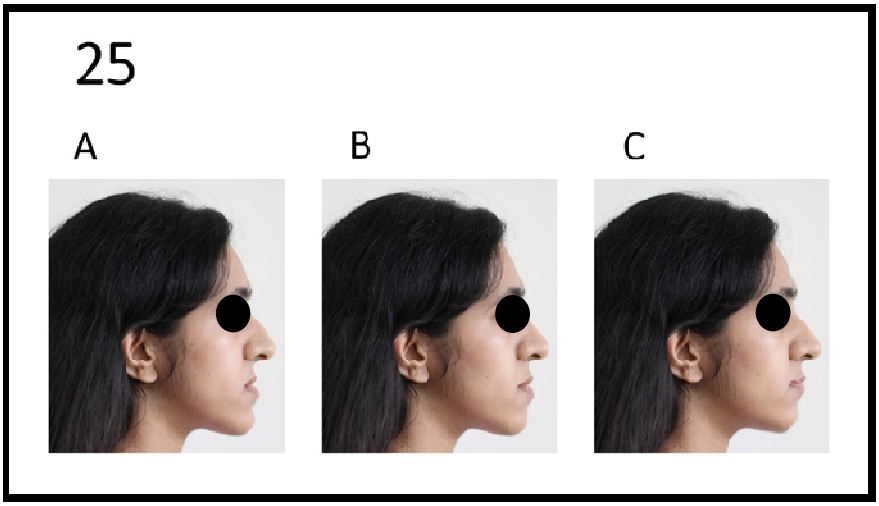


Fig 7. PowerPoint slide showing photographs of one patient

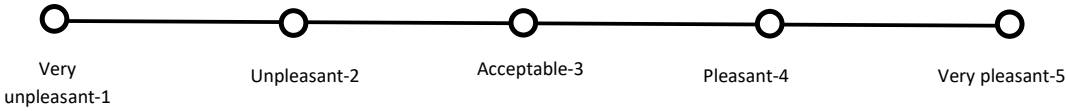


Fig 8 (Likerts scale)

Scoring was done on a scoring sheet which contains 3 columns for three different treatment photographs and 58 rows for subjects.

The data was made in a Microsoft Excel sheet and statistical analysis was done.

STATISTICAL ANALYSIS

STATISTICAL TEST:

- Data obtained was entered in Microsoft Excel 2007/2013
- Descriptive and Frequency analysis was done by using Statistical Product and Service Solution (SPSS) (v.21.0) software.
- One-way ANOVA followed by Post hoc tests (Bonferroni, Tukey's HSD) were performed to determine the within group and inter-group comparisons.
- Chi-square test of proportion was performed, if required for significance within parameters.
- p value of <0.05 was considered statistically significant at 95% confidence intervals.

RESULTS

Table 1 Comparison of the average rating of treatment A between layman, artist and orthodontist (One Way ANOVA)

TREATMENT A	N	Mean	Std. Deviation	p-value
LAYMAN	20	2.91	0.36	
ARTIST	20	2.17	0.33	**0.000***
ORTHODONTIST	20	2.89	0.25	

Table 1 shows comparison of average rating of treatment A between layman, artist and orthodontist using One-way ANOVA test. The mean rating of laymen group was 2.91± 0.36, the mean value was 2.17±0.33 in case of artist group and 2.89±0.25 in case of orthodontist group. The result of analysis was found to be highly significant($p<0.001$) indicating significant difference between the mean values of three groups.

The results show that all the three groups show the different perspective on orthodontically camouflaged profile. However, laymen have given higher ratings for the camouflaged treatment than the Orthodontist and the Artist.

Graph 1:

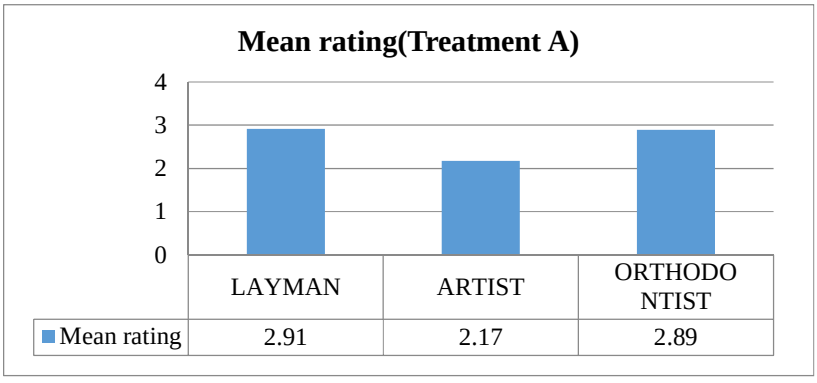


Table 2 Pairwise comparison of the average rating of treatment A between layman, artist and orthodontist (Tukey's post hoc test)

TREATMENT A		MEAN DIFFERENCE	P-VALUE
LAYMAN	**ARTIST**	.73276	.000*
	ORTHODONTIST	.01897	.980
ORTHODONTIST	**LAYMAN**	-.01897	.980
	ARTIST	.71379	.000*
ARTIST	**LAYMAN**	-.73276	.000*
	ORTHODONTIST	-.71379	.000*

Table 2 shows pairwise comparison of the average rating of treatment A between layman, artist and orthodontist using Tukey's post hoc test. Statistically significant difference was observed between the mean values of laymen and artist group and between orthodontist and artist group($p<0.001$). No statistically significant difference was observed between orthodontist and layman group($p>0.05$).

On comparing the group wise rating on Camouflage with the other group, the perspective on the profile is significantly different between the laymen and the artist group and between orthodontist and artist.While the orthodontist and laymen perspective difference is not significant

Table 3 Comparison of the average rating of treatment B between layman, artist and orthodontist (One Way ANOVA)

TREATMENT B	N	Mean	Std. Deviation	p-value
LAYMAN	20	3.290	.4372	**0.000***
ARTIST	20	3.062	.3557	
ORTHODONTIST	20	2.543	.4345	

Table 3 shows comparison of average rating of treatment B between layman, artist and orthodontist using one-way ANOVA test. The average rating in layman group was found to be 3.290±0.44 while the mean value in artist and orthodontist groups were observed to be 3.062±0.36 and 2.543±0.43 respectively. The result was found to be highly significant($p<0.001$).

On comparing the mean Uni Jaw surgery profile average profile by layman group is higher than the orthodontist, while orthodontist found the profile are less pleasantly than the other two groups

Graph 2:

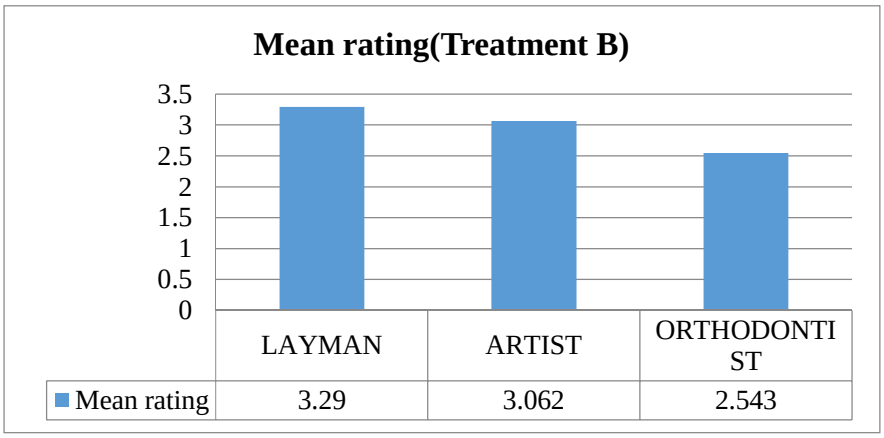


Table 4 Pairwise comparison of the average rating of treatment B between layman, artist and orthodontist (Tukey's post hoc test)

Treatment B		Mean Difference	p-value
Layman	**Artist**	.2276	.195
	Orthodontist	.7466	.000*
Orthodontist	**Layman**	-.7466	.000*
	Artist	-.5190	.001*
Artist	**Layman**	-.2276	.195
	Orthodontist	.5190	.001*

Table 4 shows pairwise comparison of the average rating of treatment B between layman, artist and orthodontist using Tukey's post hoc test. The results showed statistically significant difference between mean values of layman and orthodontist($p<0.001$) and artist and orthodontist groups($p<0.05$). No statistically significant difference was found between layman and artist groups.

The pairwise comparison of the profile rating on the Uni jaw treatment shows that,there is difference between the opinion on the profile between the layman and orthodontist and between artist and orthodontist,whereas the artist and layman have similar opinion on the profiles

Table 5 Comparison of the average rating of treatment C between layman, artist and orthodontist (One Way ANOVA)

TREATMENT C	N	Mean	Std. Deviation	p-value
LAYMAN	20	3.521	.5223	**0.000***
ARTIST	20	3.397	.3781	
ORTHODONTIST	20	2.629	.3376	

Table 5 shows comparison of mean rating of treatment C between three study groups using One way ANOVA test. The result obtained was found to be highly significant($p<0.001$) indicating significant difference between the means of groups. The highest mean was observed in layman group while the lowest was observed in orthodontist group.

The results show that all the three groups show the different perspective on orthodontically bijaw profile. However, laymen have given higher ratings for the camouflaged treatment than the Orthodontist and the Artist.

Graph 3:

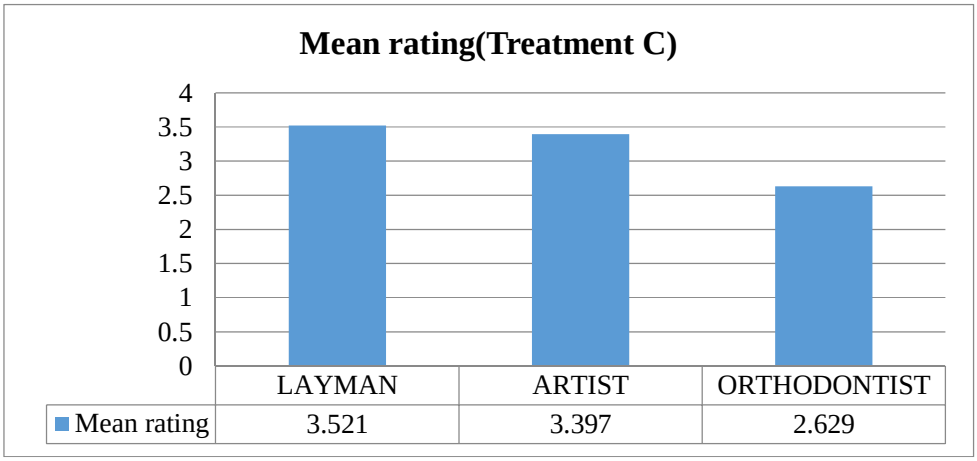


Table 6 Pairwise comparison of the average rating of treatment C between layman, artist and orthodontist (Tukey's post hoc test)

Treatment C		Mean Difference	p-value
Layman	**Artist**	.1241	.621
	Orthodontist	.8914	.000*
Orthodontist	**Layman**	-.8914	.000*
	Artist	-.7672	.000*
Artist	**Layman**	-.1241	.621
	Orthodontist	.7672	.000*

Table 6 shows pairwise comparison of the average rating of treatment C between layman, artist and orthodontist using Tukey's post hoc test. The result obtained was found to be statistically significant between the means of layman and orthodontist groups and between artist and orthodontist groups($p<0.001$). The mean difference between layman and artist group was not statistically significant.

The pairwise comparison of Bijaw treatment profile opinion shows that there is significant difference between the layman and orthodontist and between the artist and the orthodontist.

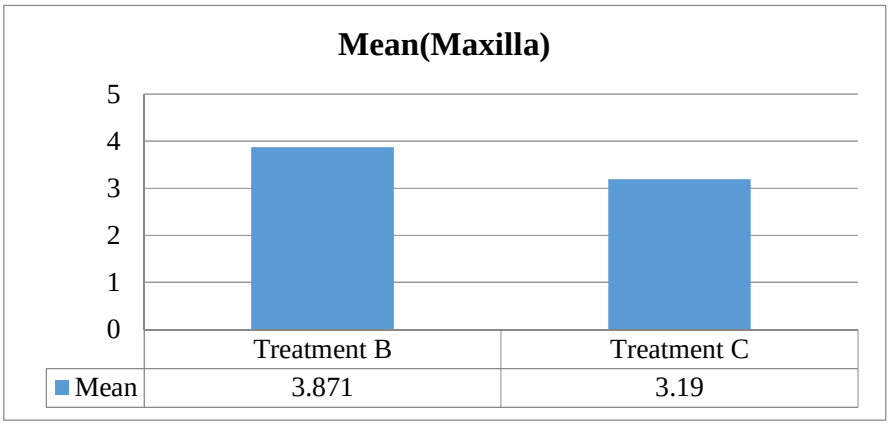
Table 7 Comparison of the maxillary skeletal discrepancy between the treatment B &C (Mann Whitney U test)

Maxilla	N	Mean	Std. Deviation	p-value
Treatment B	58	3.871	2.1715	**0.003***
Treatment C	58	3.190	1.0338	

Table 7 shows comparison of maxillary skeletal discrepancy between the treatment B &C using Mann Whitney U test. The result was found to be statistically significant($p<0.05$) with treatment B showing higher mean value as compared to treatment C.

The results shows that the skeletal changes done in the uni jaw and bijaw surgery on maxilla shows that the in uni jaw treatment the maxillary changes are done than the treatment C

Graph 4:



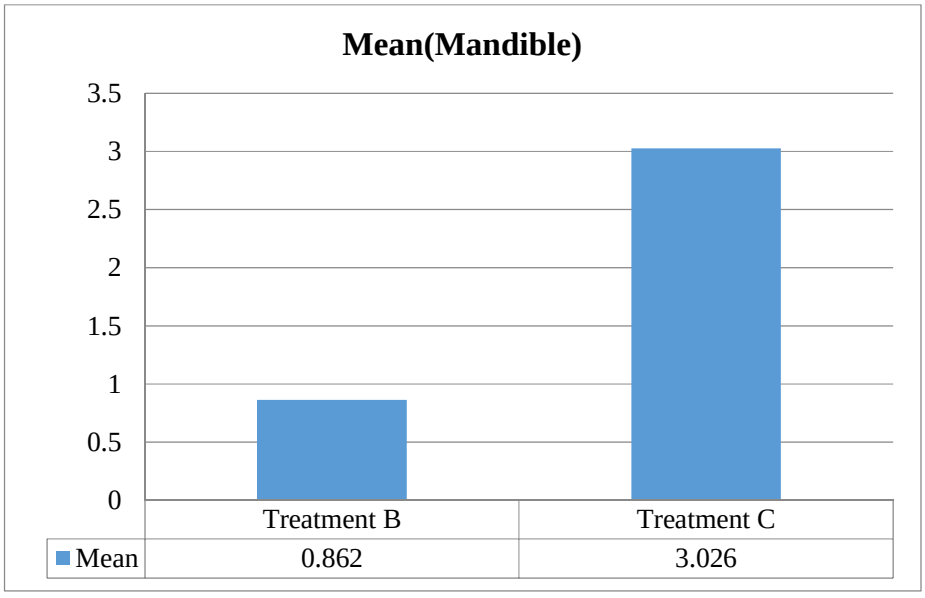
The results show that the skeletal changes done in the Uni jaw and Bijaw surgery on maxilla shows that the in Uni jaw treatment the maxillary changes are done than the treatment C

Table 8 Comparison of the mandibular skeletal discrepancy between the treatment B &C (Mann Whitney U test)

Mandible	N	Mean	Std. Deviation	p-value
Treatment B	58	.862	1.9235	**0.000***
Treatment C	58	3.026	.9339	

Table 8 shows comparison of mandibular skeletal discrepancy between the treatment B &C using Mann Whitney U test. The result was found to be statistically significant($p<0.001$) with treatment B showing lower mean value as compared to treatment C.

Graph 5:



The comparison of skeletal changes shows that in Bijaw surgery the mandibular changes are significantly higher than maxilla

DISCUSSION

In 1750, a book by the German philosopher the great A. G. Baumgarten (1712–1762) introduced the term aesthetics as a discipline. The term aesthetic was created by Baumgarten and his master Ch. Wolff, who established this "science of seeing and defining beauty." or virtue.

The effect of works of art from the remaining world on European aesthetic philosophy over the past century or so has been extraordinary. Scholars' thinking was influenced by the enormous diversity they saw, and it became clear that the criteria employed to evaluate Western art could not be applied everywhere in many directions. Each artistic movement has to be judged on its own merits, taking into account the viewer's subjective reaction.

In orthodontics Angle was the first, to this day, to have used conventional treatment formulas and traditional aesthetic notions to improve facial beauty[23]. Two views have often been used to record the three-dimensional face: the whole face from immediately in front and the right or left lateral view at a right angle to this. The phrase "profile," which only refers to the shape of the face from the side, is another name for the lateral view that is frequently used.

One of the main goals of orthodontic treatment is to achieve facial harmony since the correct placement of teeth dentition on the basal bone may change the profile, including the location of the upper and lower lips and the nasolabial and labio mental angles[24].

In 'orthognathic surgery', the changes have pertained towards the profile view than the frontal view[25] This can be reasoning that the majority of the orthognathic surgical treatment is planned with the 2-dimensional simulation of the facial profile.

Orthognathic surgeries involve the treatment of maxilla, mandibular and zygomatic discrepancies by advancing or setback of the maxilla and mandible. It also involves maxillary impaction, autorotation of the mandible, genioplasty and asymmetrical correction.

Though the treatment plan of orthognathic surgeries relies solely on the orthodontist and the surgeon's decision, the perception of the surgical outcome differs with the profession, place and social factors of the observer.

There are studies which compared the opinions of laymen, orthodontists and surgeons on the outcome of orthognathic surgeries[26,27].Thsese studies show the importance of the perception of orthognathic surgeries by people other than those who are trained in dental fields.

In their study Romani et al[18] evaluated the profile pictures of simulated orthognathic surgeries of only two patients by the orthodontist and the laypeople. The questionnaire was completed by 22 orthodontists and 22 laypersons. The study evaluated the number of changes perceived by the laypeople and the orthodontist. The study concluded that the amount of changes perceived in the horizontal direction is more by the orthodontist than the laypeople, whereas in the vertical direction the sensitivity is higher by the laypeople. However, the study didn't compare the difference in pleasantness perceived by the orthodontist and laypeople.

In the study conducted by Bell et al[6] perceptions of 37 oral and maxilla facial surgeons,43 laypeople and 46 orthodontists were evaluated on the pre-treatment photographs of 80 patients. The result of the study shows that laypeople likely to rate individual profiles considered normal than orthodontists and surgeons. This study evaluated the rating of orthognathic treatment requirements and the difference between laypeople and orthodontists.

In our present study, we have compared the perception of laypeople and orthodontists and the artist on the post-simulation profile of different treatments, by this way we can understand the laypeople's opinions on the treatment results and their expectations.

In present study, the simulated photographs are used rather than the post-treatment photographs so that multiple treatment modalities can be compared. The software which is used to simulate 'orthognathic surgery' and camouflage treatment is Dolphin Imaging software version 11.96. There are studies in which the accuracy of the software is done[28,29] These studies show that the accuracy of the dolphin imaging software is comparable to the post-treatment results.

To increase the precision of the simulated orthognathic surgeries, each case is subjected to the decompensation orthodontic simulation before simulating the orthognathic surgeries. The decompensation treatment was preceded by the proper diagnosis of the cephalometric analysis using Cephalometric analysis for 'orthognathic surgery' by Burstone[22] and models for space analysis.

On comparing the camouflage treatment, the laypeople have rated the profile higher than the orthodontist and artist. In laypeople's perspective, the Bijaw surgery simulated profiles were given more ratings in which the maxillary skeletal changes are significantly higher.

In terms of unijaw treatment, the laypeople were given higher values than the other two groups, while orthodontists gave the least rating. whereas in terms of the Bijaw surgery laypeople gave more ratings than the artist and orthodontist

While comparing the perspective of the profile of camouflage treatment among the groups pairwise results show that the Artist's opinion significantly differs from the lay people and the orthodontist, where has difference between the laypeople and orthodontist is not significant

On comparing pairwise mean on Bi-jaw surgery artists and laymen have a similar opinion while orthodontists have a different opinion. While comparing the mean difference among the group in terms of Bi-jaw surgery laymen and artists have similar and orthodontists have a significantly different opinion from the other two groups.

Laypeople have given a higher rating for the Uni-jaw surgery than other treatments, this can be explained by the Uni-jaw group having significantly higher changes in the maxillary skeletal changes. The artist group gave a higher rating for the Bijaw surgery where both the maxillary and mandibular changes are pronounced.

The limitation of this study is that it included only the profile perception while recent advancements in the three-dimensional simulation using the CBCT and the 3D Photography will be useful for further studies on the perception analysis of frontal view.

One of the other modalities which is becoming a major change in orthodontic treatment plan is orthodontic camouflage and the minor surgery like genioplasty combination. Including this treatment modality would have been helpful in deciding the treatment plan

CONCLUSION

This study was conducted to evaluate and compare the perception of simulated profile orthognathic surgery by orthodontists, artists and laypeople. The study shows that there is a statistically significant difference between the perception of orthodontists, artists and laypeople.

There are disagreements between the perception of camouflage treatment by the artist in the other two groups and the perception of Bijaw surgery by orthodontists differs from other two groups.

The laypeople valued the Bijaw-treated profiles as more pleasant, while the orthodontist valued camouflage treatment as more pleasant and the artist finds Bijaw-treated profiles more pleasant. The study concluded that orthognathic surgery or orthodontic camouflage should be planned with the patient's preference as one of the major concerns.

Further studies on frontal view perception using 3D imaging technology can help determine the patients' opinions.

SUMMARY

When it comes to perception of facial profile social acceptance also one of the factors. The beauty of the profile is judged by many professions. The Orthodontist and the orthognathic surgeon must understand general population goals and the perception of a normal facial profile and how it differs from his or her perception of a normal facial profile and aesthetic goals. In addition to assessing a patient's smile in geometrical and objective terms, it is also necessary to scientifically understand facial profile being pleasant from the point of view of laypeople, orthodontists and artist. This study compares the perception of orthodontic 'orthognathic surgery' simulated profile photographs by orthodontist, Artist and lay people

In this study,20 orthodontist,20 laypeople and 20 artists has evaluated simulated profile of 'orthognathic surgery' using Dolphin imaging software.58 patient having skeletal discrepancies meeting the inclusion criteria were selected. For each patient three different treatment modalities simulation is done i.e., orthodontic camouflage, Uni-Jaw 'orthognathic surgery', Bi-jaw 'orthognathic surgery'. These photographs are evaluated by three group of people orthodontist, Artist and Laymen.

The results show that there is significant difference between the perception of simulated patient profile of all the three treatment modalities. On camouflage treatment. In terms of camouflage, the mean rating of laymen group was 2.91± 0.36, the mean value was 2.17±0.33 in case of artist group and 2.89±0.25 in case of orthodontist group. For Uni-Jaw surgery, the average rating in layman group was found to be 3.290±0.44 while the mean value in artist and orthodontist groups were observed to be 3.062±0.36 and 2.543±0.43 respectively. For Bijaw surgery, the results showed statistically significant difference between mean values of layman and orthodontist($p<0.001$) and artist and orthodontist groups($p<0.05$)

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ANNEXURE-I-ETHICAL CLEARANCE SERTIFICATE

Research and Ethics Committee
KLE V K INSTITUTE OF DENTAL SCIENCES
KLE University
Accredited 'A' Grade by NAAC Placed in Category 'A' by MHRD (GoI)
Nehru Nagar, Belagavi - 590 010, Karnataka State
☎: 0831-2470362
FAX: 0831-2470640
Web: http://www.kledental-bgm.edu.in
E-mail:principal@kledental-bgm.edu.in

Sl. No. : 1480

CERTIFICATE

This is to Certify that the synopsis titled

Perception analysis of facial profile images of simulated orthognathic surgeries by orthodontists, artists & lay person using Dolphin imaging software : A comparative study

Submitted by

Dr. REG. NO. II0220001 *P. G. Student /*

Staff, Guided by *from Department of*

Orthodontics & dentofacial orthopaedics *has been critically evaluated by committee members and granted ethical clearance to conduct the above mentioned study*

Date : 5/5/21

Member Secretary
Research and Ethical Committee
KLEVK Institute of Dental Sciences
Belagavi

Chairman
Research and Ethical Committee
KLEVK Institute of Dental Sciences
Belagavi

ANNEXURE II-CONSENT FORM

DEPARTMENT OF ORTHODONTICS AND DETOFACIAL ORTHOPEDICS

K.L.E.V.K. INSTITUTE OF DENTAL SCIENCES, NEHRU NAGAR,

BELAGAVI-590010

TITLE……

I, _____aged ___have been informed about the study, in the language that I can understand.

I agree to give my child's personal details like name, age, sex, address, previous dental history and the details required for the study to the best of my knowledge.

I will co-operate with the dentist for my child's intraoral and extra oral examination

I will follow the instructor to utilize the information given by me and the results obtained from the study for the presentation and publication

I will not claim any return in the study, my participation is with my own will and wish

I have read, gone through and understand the above information given by the doctor about the study

I have entered and signed for the study

Signature:

Address:

Phone no:

Dentist Name:

Dentist signature

Address:

Phone number

ANNEXURE -III-SCORING SHEET BY ORTHODONTIST

Orthodontist No.____

Patient NO	A	B	C

1	Very unpleasant
2	Unpleasant
3	Acceptable
4	Pleasant
5	Very pleasant

ANNEXURE -IV-SCORING SHEET BY ARTIST

Artist No. ____

Patient NO	A	B	C

1	Very unpleasant
2	Unpleasant
3	Acceptable
4	Pleasant
5	Very pleasant

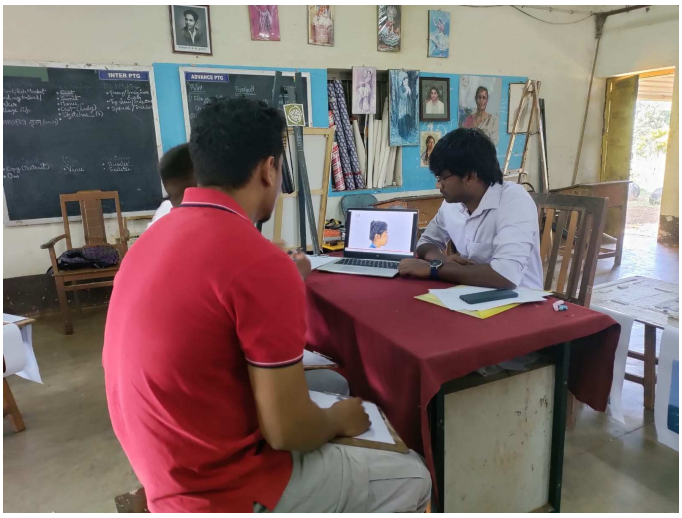
ANNEXURE -V-SCORING SHEET BY LAYMEN

Person. ____

Patient NO	A	B	C

1	Very unpleasant
2	Unpleasant
3	Acceptable
4	Pleasant
5	Very pleasant

ANNEXURE-VI-PHOTOGRAPH



ANNEXURE-VII-MASTER CHART(ORTHODONIST)

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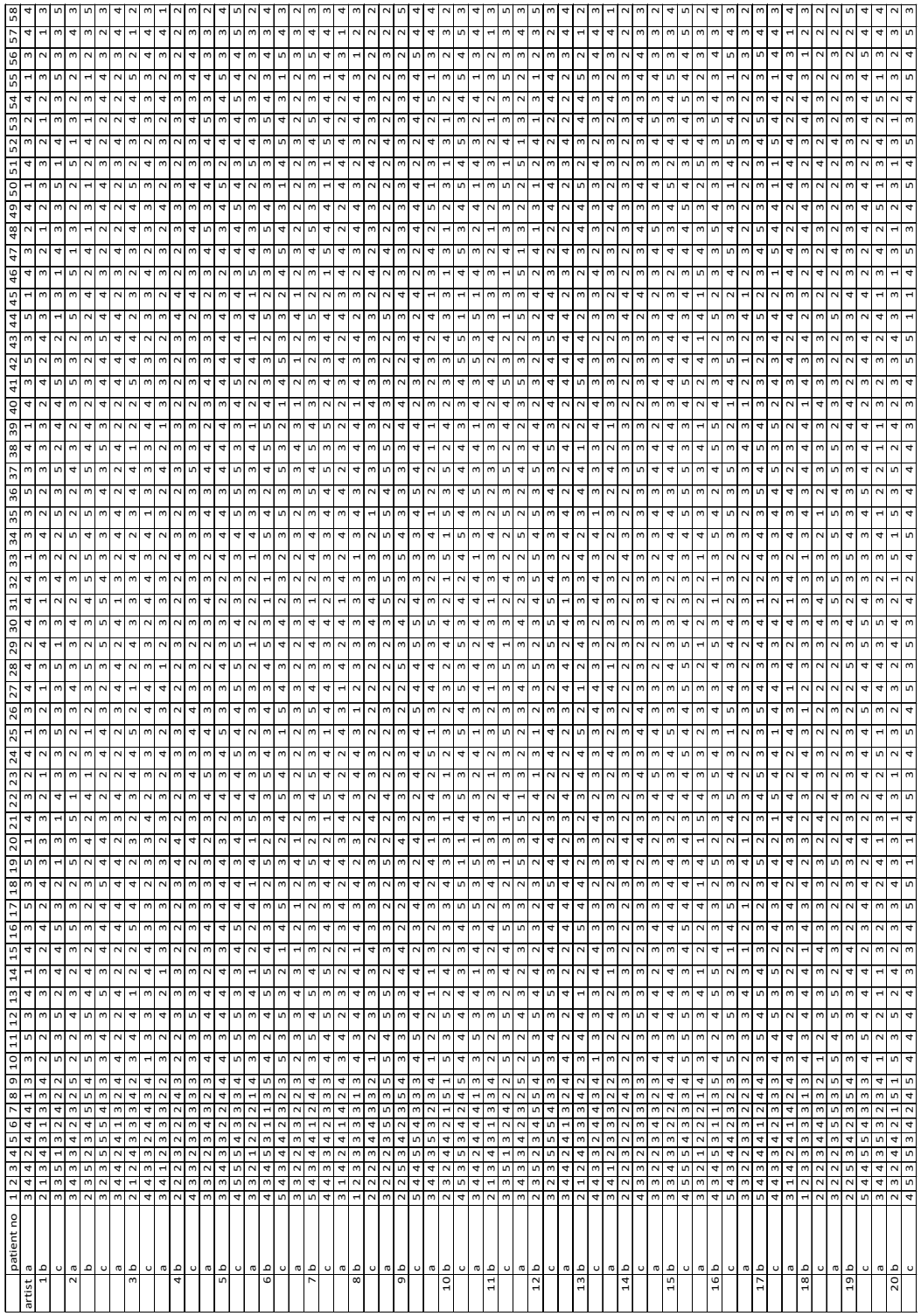
ANNEXURE-VIII-MASTER CHART(ARTIST)



ANNEXURE-IX-MASTER CHART(LAYMEN))

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