Perception of Nasal esthetics as affecting Facial esthetics-Original Research

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Abstract: *Nose is the most prominent structure in the profile of face. It continues to grow downward and forward till growth ceases. This research aims at assessing if nasal esthetics is viewed in consonance by orthodontist, otorhinolaryngologist, oral surgeon, prosthodontist, first and final year professional dental students. The Materials used in this study were Photographic materials, Adobe Photoshop version 8 and Survey tool. The Parameters included were nasal length, nasal height, nasal tip projection. nasolabial angle and nasofrontal angle . The ideal image selected by the judges was altered by Adobe photoshop and the morphed images produced were rated based on their attractiveness using Likert scale. From the results of this study, It was noted that all group perception was synchronous to Nasal length and Naso-frontal angle therefore these two parameters define nasal esthetics. It was also found that orthodontists were the only one among all the respondent groups who could differentiate between all the nasal parameters. Unmorphed nasal length was found to be most attractive by all the respondent group's while decreased nasal length was found to be least attractive. Therefore; before beginning orthodontic treatment, orthodontist should have clear vision regarding nasal aesthetics.*
Key Word: - *Esthetic, Perception, Facial harmony*


I. Introduction

Facial harmony in orthodontics is determined by the morphologic relationships and proportions of the nose, lips, and chin. The Nose due to its location in the centre of the face serves to provide together with the lips and chin a unique facial appearance to each person. Nasal growth proceeds at a relatively constant rate into adolescence and is almost completed by the age of 16 years in girls and 18 years in boys. Nasal morphology and position may dictate extraction vs Non extraction treatment plan as it may impact the final facial outcomes. Lines et al[1] stated that a more prominent nose can be seen in males as compared to females stated that a more acute nasal tip angle is preferred in males than in females. Nasolabial angle is preferred to be more obtuse in females than males. Fitzgerald et al[2] developed a new method of constructing the nasolabial angle, which also evaluated the relative inclination of lower border of the nose and upper lip, as well as their relationship to each other.

When planning an orthodontic treatment, orthodontic standards must concur with the public's esthetic perception and norms. As facial esthetics has been found to be an important determinant of self and social perceptions, Orthodontist chooses to analyze the face before treatment by means of observation, photography, cephalometric tracing, or direct measurements. The orthodontist should keep in mind the age and growth factors inherent in the face of the individuals. It must also be remembered that these changes have to be harmonized with many variations that will take place, regardless of orthodontic treatment to the end that a desirable result is achieved. During treatment planning, the orthodontist must take into consideration the nose, its growth potential and most important its shape changes in analysis of facial profile. The size and shape of the nose must be considered when the position of the incisors and amount of lip support are evaluated. The larger the nose, the more prominent the chin must be to balance it and greater amount of lip prominence that will be esthetically acceptable. Thus, Nasal imbalance is intensified during orthodontic treatment. Finally, one must use their own sense of aesthetic judgment to evaluate total facial harmony. Therefore, the purpose of the present study was to

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assess the correlation between a set of morphologic nasal parameters in perception of orthodontist, otorhinolaryngologist, oral surgeon, prosthodontist, first and final year professional dental students.

II. Methodology

Ethical approval was sought and granted by the Institutional Ethics committee (IEC), India (Reference**:** DJD/IEC/2017/A-01)**.** Nikon D7100 with 105 mm macrolens and point flash mounted on a tripod with the camera parallel to the floor at the level of subjects head. Indirect illumination of the subject was done from two 110V AC flash units in soft-box (Simpex) mounted on tripods and oriented at 45˚ to the subject. The subject was positioned on a line marked on the floor, and placed behind the subject was a vertical measurement scale divided into millimeters fixed on A3 sheet. The subjects were seated in natural head position with lips in repose, with the Frankfort Horizontal plane parallel to the floor on an adjustable stool with the chair to background distance of 2.5 feet, while the camera to subject distance was standardized at 5 feet. 10 subjects (05 males & 05 females) with well balanced nasal architecture, meeting the inclusion criteria, were selected and the photographs were captured following the predetermined guidelines. The images of the subjects were subsequently transferred to the Adobe® Photoshop® version 8. To eliminate the confounding influences of variations in background facial appearances, it was decided to include only the cropped image of the nose. The vertical limit of the image was considered from glabella to the labralesuperius, while the horizontal limits were traced from the perpendicular dropped down from the zygomatic prominence. The image was then cropped to these limits.
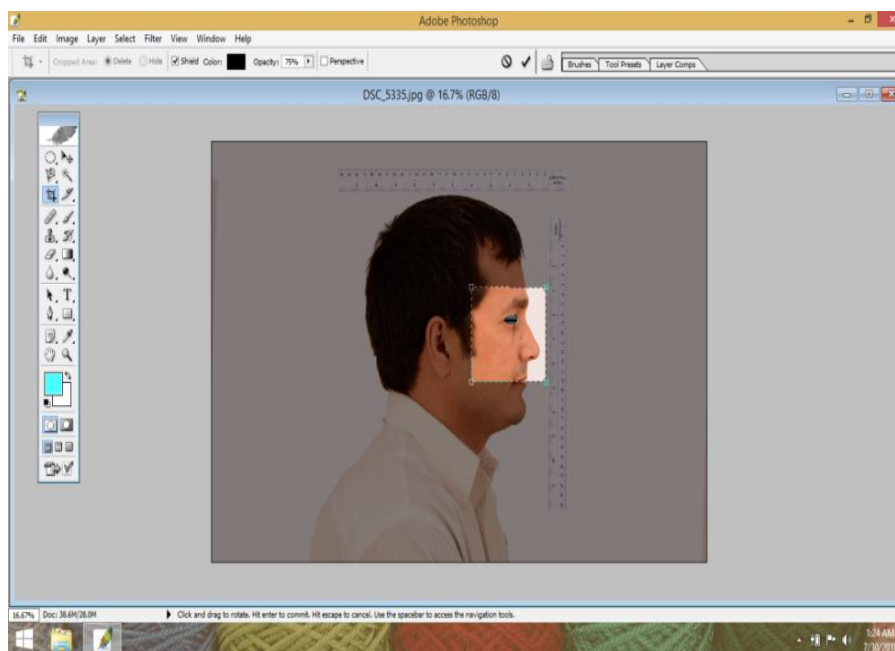

Chin was excluded from the images so that nasal prominence could be appreciated distractions. Standardized photographs of 1:1 ratio of all images were cropped and printed and then were randomly divided into two separate albums of male and female category. 04 Departmental heads were selected as jury members for the selection of ideal nasal profile which were otorhinolaryngologist, orthodontist, oral surgeon, prosthodontist. The panel of judges was asked to grade the photographs on a Likert scale of 1 to 5 which was anchored by least attractive at 1 to most attractive at 5. Hence, the subject with the highest score was selected as the ideal nose for conducting the study. The image selected as the ideal nose by the judges was subsequently transferred to Adobe® Photoshop® Version 8, (Adobe Systems, San Jose, CA, USA) for manipulation of the five parameters under consideration in this study. The ideal images were morphed to modify the following nasal parameters:-

S.No	Nasal parameters	Variations		
01.	Nose Length	2mm	Normal	+ 2 mm
02.	Nose Height	2mm	Normal	+ 2 mm
03.	Nose Tip Projection	2mm	Normal	+ 2 mm
04.	Nasolabial Angle	+ 10°	Normal	- 10°
05.	Naso-Frontal Angle	+ 10°	Normal	- 10°

FIG 2; Nasal Parameters & its Morphing Variations
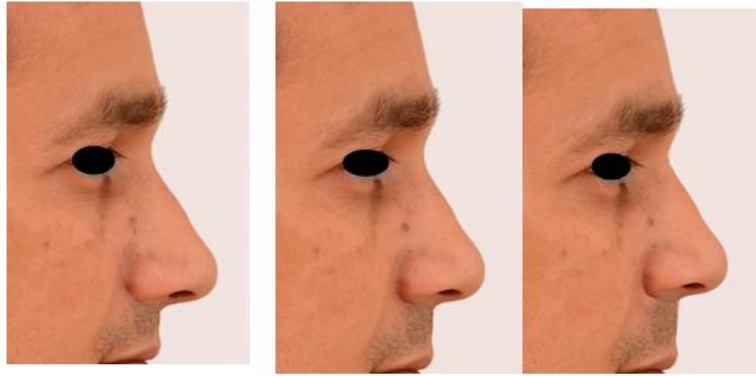
Nasal Height and modifications
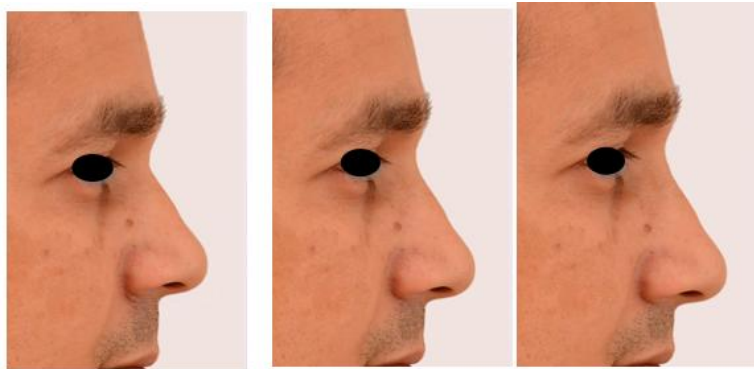
Nasal Length and Modifications

Nasal Tip Projection and Modifications

Nasolabial angle and Modifications

Nasofrontal angle and Modifications

On completion of the computerized manipulation of the original Nose, 15 images were generated. These altered images were adjusted in order to achieve the image size in a template of 3.5×4.5 inches. An electronic survey sheet was generated using the website www.surveymonkey.com. The survey sheet consisted of 15 morphed nasal images with their respective codes, which were randomly arranged along with a 5-point likert scale underneath each image.Each respondent was asked to rate the overall perception on the basis of attractiveness, of each Nasal image on the survey sheet on the 5-point likert Scale provided below each image. The classification system of the likert was as follows: - 1. Poor, 2. Average, 3. Good,   4.Very good,   5. Excellent. The prepared survey was e-mailed to 60 respondents on their respective mail and asked for their assessment. The data was collected from Monkey Survey Sheet and tabulated. All the data collected and entered in MS excel. The statistical analysis was done by using SPSS 16.0 for windows. The normality of data was tested by Shapiro wilks test. Descriptive statistics, including the mean and Standard.deviation, S.E.M. were calculated for all measurements. The significance of difference of means between the groups, i.e. inter group comparison was tested by one way ANOVA followed by Bonferroni test. Intra group comparison was tested by paired t test. The level of significance and confidence interval were 5% and 95 % respectively.

III. Summary & Results

Nasal Length:-

GROUP	MOST ATTRACTIVE	LEAST ATTRACTIVE	SIGNIFICANT/NON SIGNIFICANT
O	NL 2	NL 1	0.001 –Highly Significant
ENT	NL2	NL 1	0.033 - Significant
P	NL2	NL 1	0.001 –Highly Significant
OS	NL2	NL 1	0.000 – Highly Significant
DF	NL2	NL 1	0.001 – Highly Significant
DS	NL2	NL 1 & NL 3	0.081 – Not Significant

NL1 = -2 mm; NL2 = 0 mm; NL3 = +2 mm)

❖ Normal Nasal Length with 0 mm morphing was rated as most attractive by all the six groups of respondents.
❖ Decreased Nasal Length was rated as Least Attractive by all the Respondent Groups.

Nasal Height:-

GROUP	MOST ATTRACTIVE	LEAST ATTRACTIVE	SIGNIFICANT/NON SIGNIFICANT
O	NH 2	NH 1	0.003 – Highly Significant
ENT	NH 1	NH 3	0.269 – Not Significant
P	NH 2	NH 1	0.010 – Significant
OS	NH 2	NH 3	0.269 – Non Significant
DF	NH 2	NH 3	0.070 – Not Significant
DS	NH 2	NH 3	0.168– Not Significant

(NH 1 = -2 mm; NH 2 = 0 mm; NH 3 = +2 mm)

❖ Normal Nasal Height with 0 mm morphing was rated as most attractive by Orthodontist, Prosthodontist, Oral Surgeon, Final year and First year dental students.

- Increased Nasal Height with was rated as Least attractive by Otorhinolaryngologist, Oral Surgeon, Final and First Year dental students.

Nasal Tip Projection: -

GROUP	MOST ATTRACTIVE	LEAST ATTRACTIVE	SIGNIFICANT/NON SIGNIFICANT
O	NTP 2	NTP 1	0.006 –Significant
ENT	NTP 2	NTP 1	0.033 – Significant
P	NTP 2	NTP 1	0.279 – Not Significant
OS	NTP 2	NTP 1 & NTP 3	0.832 – Non Significant
DF	NTP 2	NTP 3	0. 343 – Non Significant
DS	NTP 2	NTP 3	0.177 – Non Significant

(NTP 1 = -2mm; NTP 2 = 0 mm; NTP 3 = +2 mm)

- Normal Nasal Tip Projection with 0 mm morphing was rated as most attractive by all the six group of respondents.
- Decreased Nasal Tip projection was rated as Least attractive by Orthodontist, Otorhinolaryngologist, Prosthodontist and Oral Surgeon.

Nasolabial angle: -

GROUP	MOST ATTRACTIVE	LEAST ATTRACTIVE	SIGNIFICANT/NON SIGNIFICANT
O	NLB 2	NLB 1	0.005 –Highly Significant
ENT	NLB 1	NLB 3	0.840 – Non Significant
P	NLB 2	NLB 1	0.153 – Non Significant
OS	NLB 2	NLB 1 & NLB 3	0.269 – Non Significant
DF	NLB 2 & NLB 3	NLB 1	0.002 – Highly Significant
DS	NLB 1 & NLB 2	NLB 3	1.00 – Non Significant

(NL1 = +10°; NL2 = 0 °; NL3 = -10°)

- Normal Nasaolabial Angle with 0° morphing was rated as most attractive by Orthodontist, Prosthodontist, Oral Surgeon, Final year and   First year dental students.
- Decreased Nasolabial angle was rated as Least Attractive by Orthodontist, Otorhinolaryngologist, Prosthodontist and Oral Surgeon.

Naso-Frontal angle: -

GROUP	MOST ATTRACTIVE	LEAST ATTRACTIVE	SIGNIFICANT/NON SIGNIFICANT
O	NF 2	NF 1	0.000 –Highly Significant
ENT	NF 2	NF 3	0.005 – Highly Significant
P	NF 2	NF 1	0.140 –Non Significant
OS	NF 2	NF 1	0.196 –Non Significant
DF	NF 2 & NF 1	NF 3	1.00 – Non Significant
DS	NF 2	NF 1	0.045 – Significant.

(NL1 = +10°; NL2 = 0 mm; NL3 = -10°)

- Normal Naso-Frontal Angle with 0° morphing was rated as most attractive by all the respondent groups.
- Increased Naso-Frontal angle was rated as the Least Attractive by Orthodontist, Prosthodontist, Oral Surgeon and first year dental students.

IV. Discussion

Facial harmony in orthodontics is determined by the morphologic relationships and proportions of the nose, lips, and chin. A recent study by Tanikawa & Takada[3] on facial profiles determined that the nose-lip-chin relationships are exceedingly important in determination of facial aesthetics. The nose dominates the middle portion of the face and is in close harmony with lips and chin as it defines the characteristic facial appearance of an individual. Nose serves as a main guideline while planning orthodontic treatment. Numerous studies have been put forth by authors about the role of lips, chin and nose in determining facial aesthetics but *nose* as an individual parameter has usually been neglected therefore; in this research lips and chin were eliminated to exclude confounding factors creating bias by the respondent group and the judges. Hence, the study design restricted assessment to the nose in exclusively. Otorhinolaryngologist, Orthodontist, Oral & Maxillofaccial Surgeon, Prosthodontist are conscious of facial aesthetic outcomes. The group of dental specialist are conscious of how the face is affected by the positioning of dentition and dental basal bone in the face. Hence this study focused on this informed conscious group to ascertain if any degree of consonance existed amongst the various medical professionals involved in delivering treatment which could impact facial aesthetic positively or negatively based on position and morphology of the nose. The current research was unique as partially informed and sensitized group were considered as controlled group i.e., 1st and final year BDS professional students. It is interesting to note the validity of and including these two student groups as by studying inter group differences between the 1st year and final year students who would throw light of education in clinical subjects and able to modify perception and sensitivity to the nose as an important parameter in esthetics. Russell et al[4], Stephan et al[5], Abdulrasheed & Eneye[6], Naini et al[7] conducted several studies based on perception.

Literature search indicates that no previous study has been conducted on assessment of aesthetic parameters of the nose amongst the unique contribution of Otorhinolaryngologist, Orthodontist, Oral & Maxillofacial surgeon, Prosthodontist. Indices have been created to measure variations in nasal esthetics based on a relatively standardized set of variables. These esthetic indices assess treatment need according to facial beauty. Few studies have compared group perceptions of facial aesthetics however as perception are subjective and learned, the effect of race, culture gender cannot be diluted. Orthodontist routinely analyzes the face before treatment by means of observation, photography, cephalometric tracing or direct measurements. Photography has been a diagnostic armamentarium for times immemorial and often called as *Poor man's Cephalometry.* Cephalometrics for numerous years till the advent of soft tissue paradigm was considered as the gold standard. However, with digital photography; a new landmark to be able to create and repeat with cost benefit efficiency and diagnostic effectiveness is now considered a gold standard in the world of soft tissue as the final outcome with added superior advantage of non radiation modality. All 2D methods of measurements will be operation dependent and may incorporate errors. The Nasal parameters in the current research were measured by a single operator using Adobe Photoshop version 8. To reduce intra observor errors, randomly measurements were remeasured to check variations and errors. In the current research, No errors were found, the present project was aimed to be environment conscious and exploit the digital explosion. *The World Wide Web* makes the world a flat playing ground. Hence monkey survey, a web based data collection and study technique was used to connect and collect data from the respondents based in different parts of the country with ease. Using a web-based survey provided data to be gathered from a wide geographical area and perception can be judged on a wider scale. The data was collected using a Likert-type rating scale. Each respondent was asked to rate the overall perception on the basis of attractiveness, of each Nasal image on the survey sheet on the 5-point likert Scale provided below each image. The Likert-type rating scale is largely accepted in the psychology literature as the most useful rating method and has been widely appreciated by several authors. Naini et al[7] in their study used seven-point Likert scale to rate different images in terms of attractiveness.

The Results of the current research is assessed under two main categories:-1) Qualification of perception difference in between the variables. 2) Qualify the differences and commonality in the viewers' parameter study. These groups were to be looked at individual as 0 orthodontist, otorhinolaryngologist, oral surgeon, prosthodontist, first year dental students and final year students. However, deeper study at the group may be further categorized into i) Medical group (otorhinolaryngologist) ii) Dental group (orthodontist, oral surgeon, prosthodontist) iii) Informed laymen group (first and final year dental students).

The five nasal parameters used in this study are Nasal Length, Nasal Height, Nasal Tip Projection, Nasolabial angle, Nasofrontal angle. These parameters play an important role in enhancing a beautiful facial aesthetics if it is in the acceptable range of golden proportion.

Nasal length proved to be a remarkable parameter in this study. It is the distance between soft tissue nasion (N') and Pronasale (Prn). The distance from the soft tissue nasion to pronasale is equal to the distance from the stomion to the menton. It usually measures between 45 to 50 mm. Among all the parameters, Nasal length was the only parameter which was easily distinguished by all the respondent groups except 1st year dental students who could not differentiate the variations in nasal length. All the respondent groups rated normal nasal length as the most attractive as compared to its variations and rated decreased nasal length as least attractive and

were statistically significant (p<0.05) except 1st year dental students whose data provided was not statistically significant. Jafarpour et al[8] described the mean value of normal nasal length as 46.3 ± 5.4 and in class I, II and III malocclusions as 45.6, 46.9 and 46.4, respectively which was not statistically significant. Linear measurements of the nose are significantly different in males than females as the mean value in female and male samples are 43.5, 49.4, respectively. They stated that the nasal length in males is increased as compared to females. Gulsen et al[9] stated that nasal length, prominence, and form are associated with height and length of the maxilla and the mandible, the Posterior-inferior development of the face results in a convex nasal profile, whereas anterior development produces a straight or concave nasal profile.

The **Nasal Height** (N'-SN) is important when assessing the profile of individuals. It is the distance between subnasale and Soft tissue N. In the current research, the morphed images of nasal height were easily distinguished by orthodontist and prosthodontist as compared to other respondent groups (p<0.05). All the respondent groups found normal nasal height as most attractive except otorhinolaryngologist who found decreased nasal height as most attractive but were not statistically significant (p>0.05). Orthodontist and prosthodontist found decreased nasal height as least attractive and were statistically significant (p<0.05). All the other group found increased nasal height as least attractive but were not statistically significant (p>0.05). A study by Hellman[10] revealed that in individuals with dentition in normal occlusion, nasal height was normal in 71% and in 29% it deviated from normal. According to the study by Jafarpour et al [8], the mean value for normal nasal height is 50.2 ± 5.8 and Mean value in class I, II and III malocclusions are 50.6, 51.2 and 49.1, respectively which was not statistically significant. Normal nasal height in female and male are 47.9 and 53.3, respectively states that males have longer nose as compared to females.

Nasal tip projection is a key point of facial harmony. Nasal tip are defined by their projection, rotation and contour definition. Arnett & Bergman[11] stated that the nasal projection measured horizontally from subnasale to nasal tip is normally 16 to 20 mm. In the current research, orthodontist and otorhinolaryngologist could differentiate all the variations in nasal tip projection. The Nasal projection is an indicator of maxillary anteroposterior position. This length becomes particularly important when contemplating anterior movement of the maxilla. In the current research, all the respondent groups rated normal nasal tip projection as the most attractive as compared to its morphed images. The decreased nasal tip projection was found to be least attractive by the medical and dental group while increased nasal tip projection was found to be least attractive by informed laymen group.

The **Nasofrontal angle** is a potentially important factor in the perception of facial profile attractiveness. It is the anterior angle formed by drawing a Line from nasion tangent to glabella, and another line tangent to the nasal dorsum, intersecting at nasion. The angle may be used to analyze the relationship between the glabella region and the nasal dorsum in profile view. The magnitude of this angle will depend on the morphology of the glabella region and the nasal bridge. The nasofrontal angle of an idealized silhouette male Caucasian profile image is between 106 and 148 degrees. In the current research, orthodontist, otorhinolaryngologist and 1st year dental students were able to differentiate nasofrontal angle and its variations (p<0.05). All the respondent groups found normal nasofrontal angle with 0° morphing as most attractive and reduced nasofrontal angle as the least attractive except otorhinolaryngologist and final year dental students who found increased nasofrontal angle as least attractive. Naini et al[7] in their study stated that reduced nasofrontal angles, simulating a nasal hump deformity, were deemed to be the least attractive.

The **Nasolabial angle** is representative of the soft tissue profile and remains an excellent clinical and cephalometric parameter to reveal the anteroposterior position of the maxilla and consequently to establish the treatment planning of dental and skeletal malocclusions. In the current research, orthodontist and final year dental students were able to distinguish the variations in nasolabial angle. The nasolabial angle was formed by the intersection of a line originating at subnasale tangent to the lower border of the nose and a line from subnasale to labralesuperius. The mean range of nasolabial angle is 102 ± 8. The nasolabial angle is usually 95 to 100 degrees in females, and 90 to 95 degrees in males. In the present study; Normal Nasolabial Angle with 0° morphing was rated as most attractive by all the respondent groups except otorhinolaryngologist who found decreased nasolabial angle as attractive. The entire respondent group found decreased nasolabial angle as least attractive except otorhinolaryngologist and final year dental students who found increased nasolabial angle as least attractive. Magnani et al[12] assessed the average values for the nasolabial angle in young Brazilian black individuals with normal occlusion and found the mean value of the nasolabial angle in Brazilian black youths as 88.14° ± 12.52°. The nasolabial angle was statistically smaller among females demonstrating the occurrence of sexual dimorphism. Alhuwaizi et al[13] conducted a study to evaluate the nasolabial angle and results showed that the mean value of the nasolabial angle was 101.3° for males and 98.8° for females and there was no significant gender. According to Magnani et al[12], Most Asians from Korea or China want to have their nostrils less visible than the current Caucasian standard.

Harmonious facial esthetics and functional occlusion have long been recognized as two of the goals of orthodontic treatment. Lines et al[1] revealed that Orthodontists tended to prefer larger noses on men than did

either Oral-Surgeons or medical and dental students. Clements[14] stated that nasal imbalance was intensified during orthodontic treatment. Conservative mechanotherapy during orthodontic treatment minimized anterior tooth retraction which, in turn, probably prevented irreparable damage to the profile. As an Orthodontist we must understand how the face changes from its embryologic form through childhood, adolescence, and adulthood. It is essential for the orthodontist to have an understanding not only of the changes incident on treatment but also of the amount and direction of growth expected in the facial structures. Chaconas[15] described the downward and anterior growth of the nose. The measurements indicated a general tendency for girls to have slightly more growth than boys during the early period of adolescence but in later stages Chacanos & Bartroff[16] stated that males exhibiting as much as twice the incremental change than that of the females. In all the cases, with the soft tissue nose included in the evaluation, the total face convexity increased. Meng et al[17] indicated that increments in nose height, depth, and inclination are essentially complete in girls by 16 years of age, while continuing to increase in males up to and beyond 18 years. Rudee[18], Posen[19], Mauchamp & Sassouni[20], Chacanos & Bartroff[16], Bishara & Peterson[21], Burke & Lawson[22], Ferrario et al[23] studied growth changes in nasal profile at different age groups and explained the importance of growth in orthodontic treatment planning.

Diagnosis, treatment planning, and treatment execution are the steps involved in successful care of malocclusions. Diagnosis is the definition of the problem. Treatment planning is based on diagnosis and is the process of planning changes needed to eliminate the problems. Treatment is execution of the plan. We in this current research found out that nasal analysis has become more sophisticated and thorough in terms of breaking down the anomaly and identifying the anatomic etiology. Correcting the twisted nose is challenging and requires a more aggressive intervention than previously thought as it could disturb the whole profile of an individual. The reassuring knowledge that the rhinoplasty would be carried out at a later date permits the orthodontist to place the teeth in their optimum positions relative to the supporting bone. Discussing the problem of nasal growth prior to undertaking orthodontic treatment permits a graceful access to the subject following treatment. Soft-tissue changes continue for at least 12 months following surgical intervention. Final evaluation of the surgical result must be delayed until this tissue adaptation is complete.

In this present study, out of all the respondent groups, Orthodontists were the only one among all the respondent groups who could differentiate between all the nasal parameters. Therefore, it can be noted that orthodontist play a key role in determining nasal aesthetics by establishing a well balanced structural balance. Orthodontists should be more aware of the great contribution the plastic surgeon can make to the orthodontic patient with a nasal deformity. We also found out that complete nasal analysis should be considered from a three dimensional rather than a two dimensional perspective and restoration of a youthful three dimensional facial topography should be regarded as the primary goal in facial rejuvenation. 3D models provide a very clear tool for showing areas of deformities, levels of asymmetry and relative relationships between different components of the face. Though numerous studies have been done in the past on nasal aesthetics also but it may never be considered as a closed subject.

V. Summary & Conclusion

❖ There are differences in the perception of studied nasal parameters between orthodontist, otorhinolaryngologist, oral surgeon, prosthodontist, first year dental students and final year students.

❖ In the current research, Orthodontists were the only one among all the respondent groups who could differentiate between all the nasal parameters. This could be due to their intensive training in facial aesthetics while first year dental students were the only group which were not able to differentiate any variations in the nasal parameters.

❖ It was concluded that all group perception was synchronous to Nasal length and Naso-frontal angle therefore these two parameters define nasal esthetics.

❖ Unmorphed nasal length was found to be most attractive by all the respondent groups while decreased nasal length was found to be least attractive.

❖ Before beginning orthodontic treatment, orthodontist should have clear vision regarding nasal aesthetics, complete nasal analysis should be considered from a three dimensional rather than a two dimensional perspective. Gender wise comparison should also be considered for future studies.

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