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Evaluation of Post Treatment Maxillary Incisor Position in Finished Class I Cases

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Abstract

Introduction: In modern era of Orthodontics, facial esthetics hold an utmost important role in terms of aptitude, likeability, socialization and success potential.[1] Maxillary Incisor placement in three planes of space holds an important position in facial aesthetics. Aim of this study is thus to find out post treatment upper incisor position in finished class I cases.

Methodology: This Cross-sectional study was conducted at Fatima Memorial Hospital /College of Medicine & Dentistry, Lahore between 03-09-2022—03-03-2023 after receiving an informed consent from each patient. Sixty four orthodontically treated patients having an age range 14-27 were included in this study. Their post treatment cephalometric radiographs were taken, which were then analyzed for maxillary incisor position.

Results: The mean age of the patients was 19.47 ± 3.9 years. The mean distance from maxillary incisor to Forehead Mid Plane FMP was 2.33 ± 1.07 mm, the mean distance from upper incisor to Forehead Facial Plane FFP was -2.38 ± 1.42 mm, the mean distance from upper lip to S-line was 0.73 ± 1.65 mm, the mean distance from lower lip to S-line was 0.93 ± 1.48 mm and the mean incisor show at rest was 2.71 ± 0.88 mm. Regarding axial inclination of incisors it was normal in 29 patients, proclined in 14 patients and retroclined in 21 patients.

Conclusion: Patients with proper maxillary incisor position in prescriptive of maxillary incisor norms have improved facial aesthetics.

Keywords: Incisor AP position, Incisor Vertical position, Incisor angulation, Class I occlusion

Introduction

In modern era of Orthodontics, as far as diagnosis and treatment planning are concerned facial esthetics hold an utmost important role in terms of confidence, likeability, socialization and success potential.[1] Maxillary incisor placement with respect to nose-lip complex and chin has been a key consideration for aesthetics. Whenever a person speaks or smile the first thing that is noted are the maxillary incisors. Their color, hue, transparency though are important but their placement in the arch and its relationship with soft tissues is also pivotal and can compromise the dento-facial aesthetics.[2]

Human face is divided into three equal halves and lower half of the face is from subnasale to menton point, when evaluating the lower half of the face, the location of facial soft tissue, especially lip relative to the inclinations of incisors both upper and lower is critical. Therefore, the angulation of the incisors especially upper incisors is a fundamental factor to determine facial esthetics of a person's face; the harmony of face which depends upon the equilibrium in morphology and proportion between the nose, chin, and lips.[3]

The location and placement of upper incisors has great impact on the soft tissue contour of the individual, his aesthetics, confidence and

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socialization. Orthodontic treatment can alter maxillary incisor position to a more acceptable one and aesthetic bends (1st, 2nd and 3rd order bends) either through wire bending or bracket prescription have been the means for final positioning of maxillary incisors. Different bracket prescriptions have also been introduced for finished aesthetics.[3-5] In recent days with the advent of Clear aligner therapy incisor position and placement have gain an additional importance and defined in different perspectives again.[6] In one of the studies by Gidaly MP et al, it was concluded that ideal incisor position in sagittal plane has great effect on profile aesthetics.[4] Schlosser et al concluded the results based on Andrew`s study that 1st premolar extraction effects incisor position dramatically and arch broadness, buccal corridors, incisor show at rest and smile, incisor angulation, inclination, midline and vertical position are the primary aesthetic determinants. They further added that (FALL: Forehead anterior limit line) and (G-line: perpendicular line passing by soft tissue glabella) being comparatively stable reference lines can effectively be used to assess the final sagittal position of incisors. They found that maxillary incisors lying at or between the G line and (FALL) were considered more aesthetically pleasing and reported noticeable discrepancy in aesthetic assessment with each anteroposterior milli-metric change in the upper incisor position in a smiling profile.[5]

In another study Micheal A W et al concluded that aesthetically acceptable position of maxillary incisors was -2.2mm and -2.6mm in females and males respectively behind the Forehead facial plane (FFP) and 1.6mm & 3.4mm in females and males respectively in front of the Forehead mid plane (FMP). They further added that the maxillary incisors should be positioned between Forehead Facial Plane (FFP) and Forehead Mid Plane (FMP) in an esthetically pleasing profile with regard to forehead inclination of individual.[1] Non-numerical facial analyses have also been given due weightage such as Cento- graphic analysis to assess facial aesthetics specially maxillary incisor impact on aesthetics. [6]

Jiang T et al in one of their study concluded that Incisor position at final settling with clear aligners needs further workup and studies.[7] El Asmar R et al concluded that achieving Class I doesn`t holds true for incisor aesthetics and lip position, so lip position and maxillary central incisor position should be given due consideration to achieve aesthetics.[8] Zou B et al in their study concluded that maxillary incisor position in Surgical Orthodontic cases holds significant impact on acceptability. It seems thus important to evaluate the aesthetically pleasing position for maxillary incisors in treated cases to Class I so that better outcomes can be achieved in these years of more aesthetic demands.[9]

The purpose of the current study is to ascertain whether there is a variation in how attractive people find smiling and resting facial profiles to be and to identify if there is an aesthetically optimal Anteroposterior position of the maxillary incisors in finished class I Cases.

Methodology

This Cross-sectional study was carried out at Fatima Memorial Hospital /College of Medicine & Dentistry, Lahore between 03-09-2022 & 03-03-2023 after receiving an informed consent from each patient. A sample of size 64 calculated by WHO sample size calculator using 95% confidence level, and 11% margin of error and expected frequency of axial inclination of incisors of retroclined as 27.4% were included. Sampling technique was Non Probability Consecutive Sampling. Patients with age range 14-27 years, permanent dentition (Excluding third molar), treated orthodotically and finished in Class I (Straight Profile, Incisor and molar Class I and ANB 0-4^0) and normal vertical pattern (MMA 25$\pm$4^0) were included. Patients with missing teeth or

supernumeraries, facial asymmetries, craniofacial deformities ad having facial soft tissue injuries or surgeries were excluded. Post treatment cephalograms were taken for each patient treated to Class I as per selection criteria and Steiner`s Analysis was performed. Only those patients who have Skeletal Class I judged from ANB (0-4^0) and MMA (25$\pm$4^0) were included.

The crown of maxillary central incisor and forehead plane was traced on sheet. Anterior cranial base was developed by drawing a line from the roof of orbital to glenoid given by Sassouni, then an analogous line was drawn through the floor of sella turcica; as per figure 1 the landmarks and reference plane are drawn. With a electronic guage, readings were made to 10th of a millimeter from the forehead facial plane and forehead midplane to the frontal view of Maxillary central incisor. A positive and negative sign was designated if an incisor is placed anteriorly and posterior to the plane respectively. Incisor inclination was evaluated a straight line joining tip of crown to tip of root and crosses to orbital point. Maxillary incisor display at rest (MIDR) was evaluated in mm (the vertical distance from lower border of upper lip to the incisor edge),as shown in figure 2. Post treatment cephalometric radiographs were taken and outcome variables were assessed as per operational definition.

Collected data was entered and assessed in computer program SPSS version 25. Mean and SD was calculated for numerical variables like age, linear measurement from upper incisor to FMP, to FFP (figure 1), incisor show at rest depicted in figure 2, upper-lip and lower lip to S-line as depicted in figure 3. Qualitative variables were presented as frequency and percentages like gender, normal upper incisor inclination, proclaimed inclination, and retroclined inclination. Data were stratified for age, and gender. T-test and Chi-Square was applied.

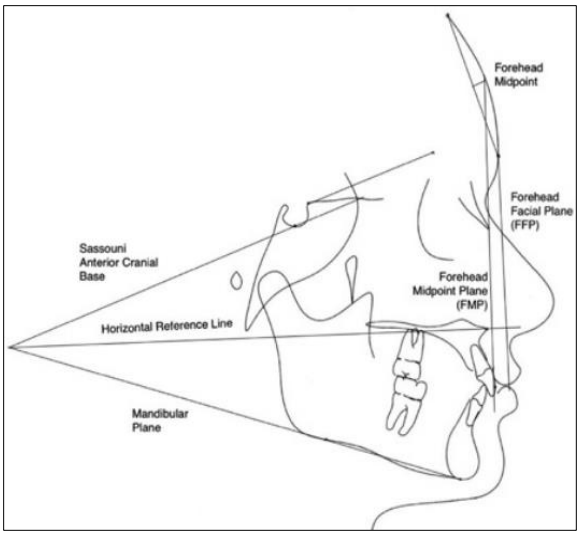

Figure I: locating FFA and FM point

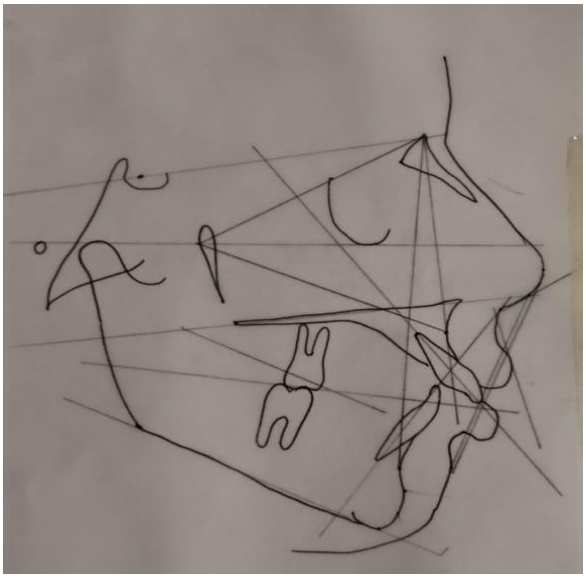

Figure II: Vertical incisor position at rest

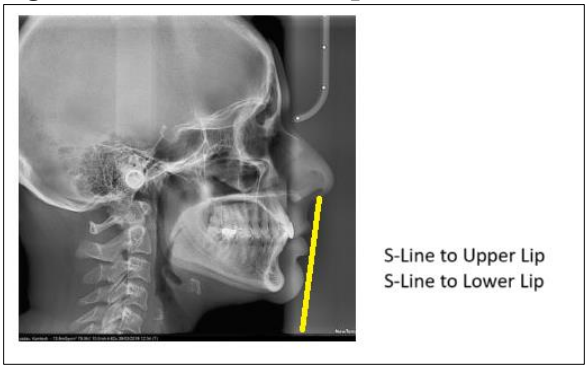

Figure III: Steiner`s Line for Lip assessment

Result

The research was performed on 64 patients. The mean age of the patients was 19.47 ± 3.9 years. The mean distance from upper incisor to FMP was 2.33 ± 1.07 mm, the mean distance from upper incisor to FFP was -2.38 ± 1.42 mm, the mean distance from upper lip to S-line was 0.73 ± 1.65 mm, the mean distance from lower lip to S-line was 0.93 ± 1.48 mm and the mean incisor show at rest was 2.71 ± 0.88 mm (Table 1).

Variables	Mean	Std. Deviation
Age (years)	19.47	3.968
Distance from upper incisor to FMP (mm)	2.33	1.073
Distance from upper incisor to FFP (mm)	-2.38	1.42
Distance from upper lip to S-line (mm)	0.73	1.65
Distance from lower lip to S-line	0.93	1.48
Incisor show at rest (mm)	2.71	0.88

Table I: Descriptive statistics (n = 64)

According to age distribution there were 39 (60.9 %) patients between age of 14 to 20 years and there were 25 (39.1 %) patients between the age of 21 to 27 years. Regarding axial inclination of incisors it was normal in 29 (45.3 %) patients, proclined in 14 (21.9 %) patients and retroclined in 21 (32.8 %) patients (Table 2).

		Age Distribution		Total	P value
		14 to 20 years	21 to 27 years		
Axial inclina -tion	Normal	15	14	29	0.373
		51.7%	48.2%	100.0%	
	Proclined	10	04	14	
		71.4%	28.5%	100.0%	
	Retroc-lined	14	7	21	
		66.6%	33.3%	100.0%	
Total				64	
		63.2%	36.8%	100.0%	

Table II: Stratification of axial inclination with age

According to gender distribution there were 28 (56.3%) male and 36 (43.8 %) female patients in our study. Regarding axial inclination of incisors its was normal in 29 patients, labially inclined in 14 patients and labially incline in 21 patients. (Table 3)

		Gender		Total	P value
		Male	Female		
Axial inclina -tion	Normal	13	16	29	0.37
		44.8%	55.2%	100.0%	
	Proclined	4	10	14	
		28.5%	71.4%	100.0%	
	Retroc-lined	11	10	21	
		52.3%	47.6%	100.0%	
Total		28	36	64	
		41.8%	58.2%	100.0%	

Table III: Stratification of axial inclination with gender

Stratification of axial inclination and incisor show at rest with age and gender can be seen from table no 4 and 5 and no clinical positive correlation was found.

	Age Distribution	N	Percent	P value
Incisor show at rest (mm)	14 to 20 years	39	60.9	0.169
	21 to 27 years	25	39.1	

Table IV: Stratification of incisor show at rest with age

	Gender	N	Percent	P value
Incisor show at rest (mm)	Male	28	56.3	0.537

Table V: Stratification of incisor show at rest with gender

	N	Mean	Std. Deviation	Std. Error Mean
Age of the patient	64	19.47	3.968	.496
Upper incisor to FMP	64	2.330	1.0732	.1341
Upper incisor to FFP	64	-2.380	1.4261	.1783
Upper lip to S line	64	.737	1.6527	.2066
Lower lip to S line	64	.930	1.4866	.1858
Incisor show at rest	64	2.719	.8860	.1108

Discussion

The mean distance from upper incisor to forehead mid plane (FMP) was 2.33± 1.073

mm, mean distance from upper incisor to forehead facial plane (FFP) was -2.38± 1.42 mm, the mean distance from upper lip to Stenier-line was 0.73±1.65 mm, the mean distance from lower lip to S-line was 0.93±1.48 mm and the mean incisor show at rest was 2.71±0.88 mm .Regarding axial inclination of incisors it was normal in 29 (45.3%) patients, proclined in 14 (21.9%) patients and retroclined in 21 (32.8%) patients. Our results are similar to a study done by Hemanshu patil et al which also reported the same findings, the mean values of linear measurements from Maxillary incisor To N-Pog was 9.21, A-Line was 1.18, FFP was 9.35 And FMP was 15.8. The SD was 2.791, 2.061, 4.02, and 6.02. The SD was more in maxillary incisor to FMP was because the trichion point on lateral cephalogram was marked approximately. The mean values and SD of Steiner-Line was 1.2 ±1.85mm to Upper Lip, 4.78 ±1.93mm to Lower Lip 4.78 ±1.93 And B-Line to Upper Lip was 4.78 ±1.93 mm and Lower Lip was 5.1 ±2.24mm.[10]

Adams M. Et Al found that in 91% of treated class I patients upper central incisors lie between glabella perpendicular and forehead facial axis while they further concluded that upper central incisors placement and inclination / curvature of forehead were correlated moderately ($r^2 = 0.37$).[11]

Arnett GW et al,indicated that lips would lie normally ahead of the line drawn from soft tissue Sub-nasale to pog'(upper lip 3.5mm, lowe lip 2.2) by using a soft tissue assessment record form. This process assessed lip curvature within soft tissue envelope but did not give any information about upper incisor's Anterioposterior position within the facial profile. Bergman said relying solely on dental and skeletal analysis can lead to aesthetic issues.[12]

Web MA in his study along with his colleagues concluded that In the visually appealing group, maxillary incisor lies behind FFP by −2.2mm in females and by −2.6mm in males; incisors lies in front of the forehead mid plane (FMP) by 1.6mm in females and by 3.4mm in male. The average distance between FMP and FFP was increased in men (6.0mm) than in women (3.8mm), which can be associated to the disparity in forehead structure and the prominent glabella.[13]

Holdaway in his study, suggested that maxillary incisors as best teeth for aesthetic diagnosis as they determine the posture of both lips.[14,15] Riedel used N-Pog line as a reference line to assess the Incisor position in place of A-Pog line as point A is a highly fluctuating point. Nasion is also a inconsistent point but comparatively it is more reliable than point A as maxilla is usually most affected by malocclusion.[2] Zhou X et al in their study concluded that instead of using an average value or norm, orthodontists should customize a patient's ideal maxillary incisor position using dento-skeletal and soft tissue evaluations.[16]

Limitation of the study is that patients were selected on basis of continence sampling technique, patients that were finished in class I incisor, molar and canine relation were included in this study. No patients were added in the study which were camouflaged and finished with Class II molar, canine and incisor relationship, other than that sample size was limited in accordance to parameters defined in research project.

Future recommendations for further researchers is that to include a larger sample number from every hospital across the country to assess treatment effectiveness, and newer diagnostic aids like Proface and CBCT may be used in the future researches for better accuracy and outcome.[17]

Conclusion

Patients with proper maxillary incisor position in prescriptive of maxillary incisor norms have improved facial aesthetics.

Ethical Approval

The study was approved by the Institutional Review Board of Fatima Memorial College of Dentistry, Lahore

Disclaimer

No external funding.

Conflict of Interest

It is declared that the authors don't have any conflict of interest.

Authors' Contribution

MSS: Conception and design of work, data collection, critical revision

AR: Data collection, data interpretation and drafting

MIR: Data collection, data analysis and drafting and final approval

NAC: Data analysis and drafting

SS: Data analysis and drafting

UZ: Statistics and write-up

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