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The Influence Of Orthodontic Treatment On Facial Aesthetics And Symmetry

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Abstract
The research aims to assess the orthodontic treatment on facial aesthetics and symmetry in 100 patients. There were 75 women and 25 men. A quantize research method was chosen, and data were collected concerning the types of malocclusions, procedures used in treatment, and FAR both before and after the treatment. Class II malocclusion was the most common type of malocclusion amongst patients. Various orthodontic treatments were performed, including labial, lingual, and invisible braces, with labial treatment being the most common. A statistical analysis showed significant increases in FAR concerning frontal, profile, and overall photo types, thus resulting in an aesthetically improved facial appearance after treatment. Females benefited remarkably in terms of attractiveness, with males achieving consistent and significant gains, although smaller in size.

Keywords: Facial Aesthetics, Symmetry, Attractiveness, Orthodontic Treatment, Maxillary Anterior Teeth.

1. INTRODUCTION

Facial aesthetics and symmetry play a very important role in how people perceive the individual. Arrangement of teeth and alignment of the jaw can dramatically affect not only the oral health but also the overall facial contour of the individual. Malocclusion, which is characterized by improper dental alignment, can give rise to evident aesthetic concerns like asymmetry, thereby affecting the individual's confidence as well as self-image. Facial aesthetics and symmetry are among the most critical factors involved in the making of social perceptions and interpersonal interactions. The appearance of an individual's face, especially with regard to the alignment of their teeth and the position of the jaw, greatly impacts the qualities of the first impressions made and general attractiveness in many social contexts. Malocclusion or improper positioning of the dentition does not constitute a problem in the dentition alone, but often can give rise to aesthetic issues such as facial asymmetry and so may act adversely on the self-confidence and image of an individual. As a result, orthodontic treatment has become one of the most critical interventions aimed at the very alignments of these with the dual objectives of improving both dental functionality and facial aesthetics.

There is a vast literature supporting that facial symmetry does indeed play a role in beauty perception in psychology and the sociocultural sciences. Repeated studies show that patients or subjects prefer well-ascribed positive ascriptions such as health and youthfulness to asymmetrical faces, indicating the attribution of attractiveness. Facial symmetry often forms an important element of the beauty criteria of many different cultures. Orthodontic treatment, which can have an effect on the facial aesthetics of a patient, has drawn much attention. Consequently, researchers are focusing on different types of anthropometric procedures such as 2D photographic analysis, 3D imaging, and cephalometric measurements, to assess the changes in facial structures

both prior to and after the treatment. These methodologies will provide with a more accurate measurement of how orthodontic treatment will enhance facial aesthetics.

The results of many research studies suggested strong evidence for significant improvements in facial aesthetics resulting from orthodontic treatment. Indeed, correcting dental malocclusions seems to do much more than just creating proper alignment of the teeth; often, improvements seem to arise in the interaction between the upper and the lower facial structures. Case reports show that patients who receive brace or aligner therapy typically present much improvement in facial profiles that contribute to better aesthetical balance.

Beyond the aesthetic gains, orthodontic treatment offers psychosocial benefits of the same magnitude. For themselves, patients repeatedly attest to dramatic gains in levels of self-esteem and self-confidence following their treatments. Since perceptions of facial aesthetics significantly affect the self-concept and social relationships, especially during critical periods of youth development, for example, adolescence, improved facial balance also tends to promote more positive self-concepts, thus giving them the confidence to be more participating individuals in their social worlds. For example, only the fulfilled patient is very likely to accept social contacts and close communication, leading not only to improvement of personal but also to the professional life.

The far-reaching implications of orthodontic treatment have an enhancement of the quality of life in general. Increased self-esteem, and above all, a healthy background for positive social contact result in better mental health and well-being. Therefore, one needs to understand the intricate relationship between orthodontic treatment, facial aesthetics, and psychosocial outcomes in appreciating the comprehensive benefits of dental interventions. As social and aesthetic expectations of beauty are always shifting, orthodontic treatment will continue to play an essential role in dental practice, greatly influencing the lives of those people seeking a better appearance and symmetry of the facial structure.

Orthodontic treatment serves as a pivotal solution to address these misalignments, aiming to improve both dental functionality and facial aesthetics.

1.1. Impact on Facial Symmetry

Research has revealed that people generally want a better facial symmetry, however facial symmetry has long been linked to beauty and attractiveness. Orthodontic treatment with regard to facial symmetry is one area in which more research has been conducted. There are various anthropometric methods through which alteration in facial symmetry is measured before and after treatment. Some of these methods include 2D photographic analysis and 3D imaging combined with many variations of cephalometric measurements, thereby precisely measuring facial structures.

Orthodontic interventions have been proven to show significant alterations leading to enhancement in facial symmetries. A good example is correcting the dental malalignment often shows a higher degree of harmony among the upper and lower parts of the face. This is evident in some studies, where the quantifiable changes have been recorded and it has given evidence that orthodontics can relate to the improvement of facial harmony that may be held positively in the social setting.

Analysing individual patient cases may serve to more conclusively present how orthodontic treatment impacts facial aesthetics in terms of symmetry. For example, some patients often show significant improvements in their facial profiles following braces or aligner treatment, thereby experiencing greater symmetry and a generally more balanced look to their face.

1.2. Psychosocial Benefits

Orthodontic treatment's aesthetic gains were not only related to the physical appearance but also have psychological and social significance. Many studies reported that patients receiving orthodontic treatment experienced improved self-esteem and confidence. The perception of one's facial aesthetics is a critical factor in the way one perceives himself/herself and how one relates to others. Better facial symmetry tends to translate into much better self-perception, which happens to be fundamental during these formative years, especially amongst adolescents.

Better aesthetics may also create a basis for more friendly social relationships. Individuals who are satisfied with their appearance or looks are more likely to be more friendly and amiable toward others. Better relationships for the person and his professional career may also be established through this aspect. This may also be applicable in cases where job interviews or public speaking are concerned, where the individual's first impression is of paramount importance.

The quality of life of individuals does substantially improve if they undergo orthodontic treatment. They develop better self-esteem and interact more freely with other people, thus improving their overall social lives and, by extension, having a healthy mental life.

2. LITERATURE REVIEW

Kouskoura et al. (2022) assessed the impact of orthodontic treatment on facial excellence by directing an intensive evaluation of twenty papers, involving three randomized controlled preliminaries (RCTs) and seventeen non-randomized examinations. The review involved the Loot 2 apparatus for RCTs and the ROBINS-I device for non-randomized examinations to evaluate the gamble of predisposition. With a mean distinction (MD) of 9.05 (95% CI: 4.71; 13.39), the outcomes showed that orthodontic treatment expanded facial engaging quality scores by 9% when contrasted with untreated controls. Moreover, contrasted with orthodontics alone, a 5.5% expansion in engaging quality was seen when orthodontic treatment and orthognathic medical procedure were consolidated (MD: 5.51/95% CI: 1.55; 9.47). While one RCT had an okay of inclination, one more had concerns, and the third had a high gamble of predisposition, most of non-randomized preliminaries showed hazy or high dangers of predisposition.

Coppola et al. (2023) assessed the effect of orthodontic treatment on attractiveness of a smile. ROBINS-I judgment placed nine at high risk for serious bias and one at moderate risk. Due to significant heterogeneity between studies, meta-analysis was not feasible. However, the authors concluded that orthodontic treatment, particularly including premolar extractions, increased attractiveness by 22% compared with no treatment.

Runte and Dirksen (2021) discussed the evolutionary and functional importance of bilateral facial symmetry, mainly on the influence on masticatory function and aesthetic perception. The review pointed out how symmetry became essential in facial recognition and attractiveness. They argued that maxillofacial surgery and dentistry can actually correct asymmetries and help in restoring form and function. Some methods in quantifying facial and dental asymmetries using landmarks and 3D surface models were also covered within this study. It links facial symmetry to aesthetic perception.

Da Pozzo et al. (2020) A stereophotogrammetric longitudinal analysis of 18 Class III skeletal malocclusion patients who underwent bimaxillary osteotomy to improve facial symmetry was carried out. The facial images were analyzed preoperatively and at 6, 12, and 24 months after surgery and were compared to values found in a control group of patients with Class I occlusion. The authors noted that more asymmetry prevails in malocclusion patients than in controls, especially in the lower third of the face. The facial asymmetry was improved significantly post operatively, though there was no statistical difference in the three time points of the study.

Dong, T et al. (2020) studied makes use of 3D facial imaging technology to assess opinions about the deformities of chin asymmetry. Results showed that even orthodontists, general dentists, and laypersons perceived a deviation of the chin as much as 4 mm, though deviations with greater magnitudes evoked stronger wishes for orthodontic treatment. Orthodontists and general dentists considered an 8 mm discrepancy to be significant enough to warrant intervention, whereas lay individuals found an 8 mm excursion to the right and a 10 mm excursion to the left to be severe asymmetry sufficient to warrant intervention. Statistical analysis confirmed high correlations between the degree of asymmetry and the requirement for surgical intervention ($P < .001$).

Deng et al. (2024) leded a complete report whose goal was to decide the relationship between's the maxillary sagittal place of foremost teeth and facial profile feel among grown-up female Tibetan and Han Chinese females. In the pursuit of completing the study, 100 participants from each of the two groups, Tibetan and Han, composed of 100 participants each were recruited and had an average facial symmetry. For capturing the aesthetic profile, photographs with a smiling face were obtained so that maxillary central incisors and forehead were always fully covered. The study made use of photo measurement techniques and software to enhance the image and uniformise the head position to quantify anteroposterior (AP) positions of maxillary central incisor in relation to forehead inclination. Significant trends in forehead shape were established among the participants in this study. A rounded forehead was the most common one encountered, at a frequency of 93% among the Tibetan females and 55% among the Han females. Further investigation of the maxillary focal incisors showed that 85% were situated between as far as possible line-the Nerve line-and the objective front cutoff line-the Fall line-while the leftover 15% put behind the Fall line. This interindividual variety related exceptionally with the incisors and point of the brow, returning a R^2 of 0.742. For female Han, 83% of maxillary focal incisors were situated among Fall and Nerve lines, 12% were found back to the Fall line, and 5% front to the Nerve

line. The distinction between these two gatherings emerged from having a more huge association between incisor position and temple tendency in the R^2 esteem 0.827.

Ren et al. (2021) Assessment of Attractiveness of Orthodontic Patients Before Treatment by Perception of Facial Features. To determine the contribution of different facial features and forms to facial attractiveness. The frontal, lateral, and smiling aspects of 100 orthodontic patients' photos were rated by 24 laypersons and 24 orthodontists on visual analog scales. Results: There were highly significant correlations between facial attractiveness and selected facial features. The most important features the average non-expert chose as important were the chin, eyes, and lips. For the non-experts, chin proved to be remarkably responsible for variation in attractiveness, constituting 45.1% while those of the eyes emerged as the most important for orthodontists with $r = 0.789$ (62.2% responsible for variation), followed by those of the eyes and hair. It proved to be a study demonstrating an important component of the assessment of facial attractiveness: that is, the subjective nature of the assessment of facial attractiveness and the different emphasis laid down on different features by laypersons and professionals in the field.

Ghiu et al. (2024) examined the perception of facial attractiveness when the nose and/or the teeth are seen in isolation, and also when the two features are shown together. Their study aimed to determine the effects of disharmony when it comes to those specific features on ratings of attractiveness and compared lay respondents with practitioners of dentistry who were rated six manipulated images of a model's face. The different alterations in the photographs with respect to nasal symmetry and the misalignment of the teeth were made so that the effects on attractiveness could be properly judged. The subjects rated the photographs with the 10 cm VAS. The rating scale demonstrated that regardless of the laypersons whom one considered for the study, laypersons always rated images with aligned teeth as the most attractive while scores for images in which the teeth were not aligned straight were the lowest with a mean difference of 2.88 cm. In addition, scores among the three images with aligned teeth were not significantly different. However, there was significant similarity in preferences of dentists, which implies that there is a consensus on the appropriateness of dental alignment for overall facial attractiveness. This study further emphasizes the importance of nose and teeth orthodontic treatments in changing the perception of beauty as well as the need for an integrative approach to orthodontic treatments.

Saleh et al. (2023) studied, 28 adolescents, who had skeletal Class III malocclusion with posterior crossbite, were evaluated after a sequence of rapid maxillary expansion (RME) combined with fixed orthodontic treatment in terms of soft tissue asymmetries. The average age of participants was set at 9.37 years old with 11 females and 17 males. A 3D facial imaging system was used to provide quantitive measurements of soft tissue change. It photographed the subjects at three critical stages: prior to the application of ME & P (T0), six months post-procedure (T1), and after the removal of all orthodontic appliances (T2). The analysis included 34 linear and 16 volumetric measurements of soft tissue. Results showed a great improvement in asymmetry with most progress of facial regions pointing to the region of the lower face area. These results therefore show the efficiency of RME combined with fixed orthodontic treatment in correcting soft tissue asymmetries, thus indicating that treatment planning for Class III malocclusion should be in consideration of this improved potential for facial harmony.

Abbasi et al. (2023) In addition, a cross-sectional study included 169 patients. Photographs were made under a frontal view of a resting patient and when smiling in order to measure selected landmarks on both sides of the face. The authors have used AI to analyze facial symmetry in both states. The study correlated a symmetric smile criterion with general facial symmetry, and differences in symmetry criteria between the rest state and during social smiling. This research considers facial symmetry in orthodontic evaluations and will suggest whether treatment will interfere with the aesthetic outcome.

3. RESEARCH METHODOLOGY

This study used a quantitative research design, investigating the effects of orthodontic treatments on facial aesthetics and symmetry.

3.1. Research Design

The sample included 100 patients who received different forms of orthodontic treatments-from women to men. The study analyzed both the FAR before and after treatments, exploring differences between various kinds of malocclusion and different approaches to treatment.

3.2. Data Collection

Data collection was done using clinical and photographic evaluation. Patient demographics and orthodontic treatment information were recorded from the clinical records. The malocclusions are classified into Class I, Class II, and Class III. The treatment included labial, lingual, and invisible braces, premolar extractions, and also orthognathic surgery. Facial attractiveness ratings were assessed by measuring a facial attractiveness score by taking photographs of every patient before and after treatment using frontal and profile views. A panel of orthodontic specialists was consulted in the rating of these photographs against a standardized rating scale.

3.3. Statistical Analysis

A suitable statistical software package was adopted to determine the mean values of FAR before and after orthodontic treatment. Summary descriptions of patient demographics and their treatment details were conducted using descriptive statistics. Inferential statistics like paired t-tests were also used to compare the pre and post-treatment mean differences in the FAR score between two photo types and between two sexes of patients based on sex. Calculation of P-values established whether the differences found are statistically significant or not. A P value of 0.05 was adopted as a cut-off for significance.

3.4. Ethical Consideration

Institutional review board approval of the study was conducted. All patients were solicited for consent prior to their being included in the study. Total patient confidentiality and anonymization of data for the purpose of protecting personal information were maintained. The participants were made aware of their rights to withdraw from the study at any time without any implications concerning their treatments.

4. RESULT AND DISCUSSION

From the analysis of information provided in Table 1 about patient data and types of orthodontic treatment, some insights into the prevalence and management of different malocclusions were clearly brought out from this sample of 100 patients, of which 75 are females and 25 males. The prevalence data indicate that Class II is the most common malocclusion, as it affects 39 patients. It signifies a higher requirement for orthodontic treatment that aims at remedying this type of malocclusion where the upper jaw is more prominent than the lower one. Class III malocclusion, being the second in ranking, appeared in 35 patients. Class III, or mandibular prognathism, poses aesthetic and functional challenges and often requires comprehensive treatments. Class I malocclusion, though the least common, occurs in 26 patients and usually comes with a normal bite, but all teeth are not aligned perfectly but without any major discrepancies in jaws.

There is the female to male ratio for the types of malocclusions indicated that women are diagnosed more often with malocclusions within each category, which may suggest some level of sensitiveness or predisposition on the part of women to the receipt of orthodontic care perhaps on the basis of sociological awareness of beauty and self-esteem. This way, the dynamics can be involved to help raise orthodontists' considerations of treatment plans and focus them on the unique needs and aesthetics of their female patients.

Table 1: Patient Information and Orthodontic Treatment Measures

Category	Female	Male	Total
Malocclusion Type (Dental Diagnosis)			
I	22	5	26
II	28	10	39
III	25	10	35
Orthodontic Treatment Methods			
Labial	30	13	43
Invisible	13	5	19
Lingual	32	6	38
Premolar Extraction			
Yes	40	9	48
No	35	16	52
Orthognathic Surgery			
Yes	19	10	29
No	57	15	71

Bimaxillary Protrusion			
Yes	13	5	17
No	62	20	83
Mandibular Retrognathia			
Yes	35	10	45
No	40	15	55
Total	75	25	100

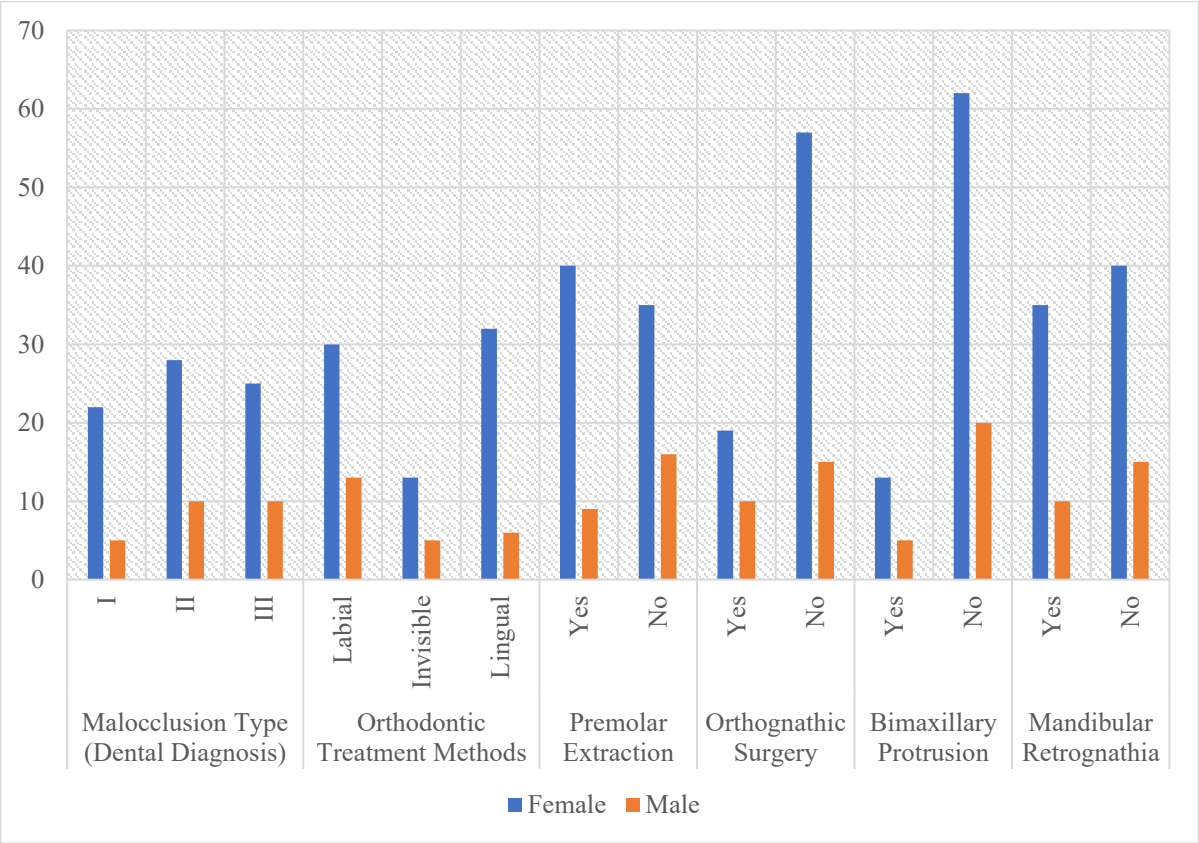

Figure 1: Patient Information and Orthodontic Treatment Measures

The treatment methods adopted in this group are more clearly indicative of therapeutic approaches. The most common method adopted is labial treatment, as evidenced by 43 patients. This mode of intervention comes with braces on the front side of the teeth, which is largely preferred by female patients: 30 females vs. 13 males. Lingual treatment, fixing braces inside the mouth, not on the forward side of the teeth, was applied in 38 cases, as such patients liked the discreet appearance. Invisible orthodontic procedures, such as clear aligners, were used in 19 cases, representing people requiring also aesthetically pleasing solutions that are less visible than traditional orthodontic braces. For example, 48 patients' premolars needed extraction, which were more common in females. Crowding creates space in the oral cavity for occlusion or other severe malocclusions. On the other hand, extraction was not needed for 52 patients thereby showing treatment needs differ from one patient to another due to their specific dental and facial characteristics. Therefore, variation supports the fact that assessment needs to be done along with specific treatment planning in orthodontic practice.

More invasive surgical intervention to correct jaw discrepancies was undertaken in 29 patients, comprising 19 females and 10 males. The result highlights the requirement for surgical intervention if there is severe malocclusion or jaw mal-alignment. However, the larger majority of the patients, 71, did not undergo surgery, and thus most patients might achieve satisfactory results through orthodontic treatment alone, without a need for surgical correction. Consequently, the selection of treatment typically depends on the severity of the malocclusion and the needs of the patient. Specific conditions such as bimaxillary protrusion and mandibular retrognathia exemplify how complex the case scenario could be for an orthodontic treatment within this group. Bimaxillary protrusion was present in 17 females, thereby suggesting that aesthetic consideration is an essential

issue relating to these female patients. At the same time, the presence of mandibular retrognathia in 45 patients, with females showing a higher incidence than males, highlights the need for orthodontic and potentially for surgical intervention of this nature of condition.

malocclusion as well as the treatment approach in this patient population reflects the intricacy of orthodontics care, such that the Class II malocclusions are highly dominant and that the female patients dominate the patient cohorts seeking orthodontic care. The findings from this evaluation may go a long way in guiding orthodontic practice to emphasize individualized approaches that would address aesthetic as well as functional outcomes for the correction of malocclusions. Knowledge of the differences in gender preferences will help develop better plans for educating and satisfying orthodontic treatment.

Table 2: FAR Before and After Orthodontic Treatment

Photo Type	Sex	FAR Before	FAR After	FAR Difference	P-value
Frontal	Female	4.47	4.76	0.30	6.06×10^{-3}
	Male	4.18	4.33	0.15	0.20
	All	4.40	4.66	0.26	4.00×10^{-3}
Profile	Female	4.21	5.08	0.87	2.73×10^{-8}
	Male	3.55	4.39	0.85	5.82×10^{-3}
	All	4.05	4.91	0.86	1.03×10^{-9}
Overall	Female	4.28	4.97	0.69	4.60×10^{-7}
	Male	3.79	4.57	0.78	6.05×10^{-3}
	All	4.16	4.87	0.71	1.64×10^{-8}

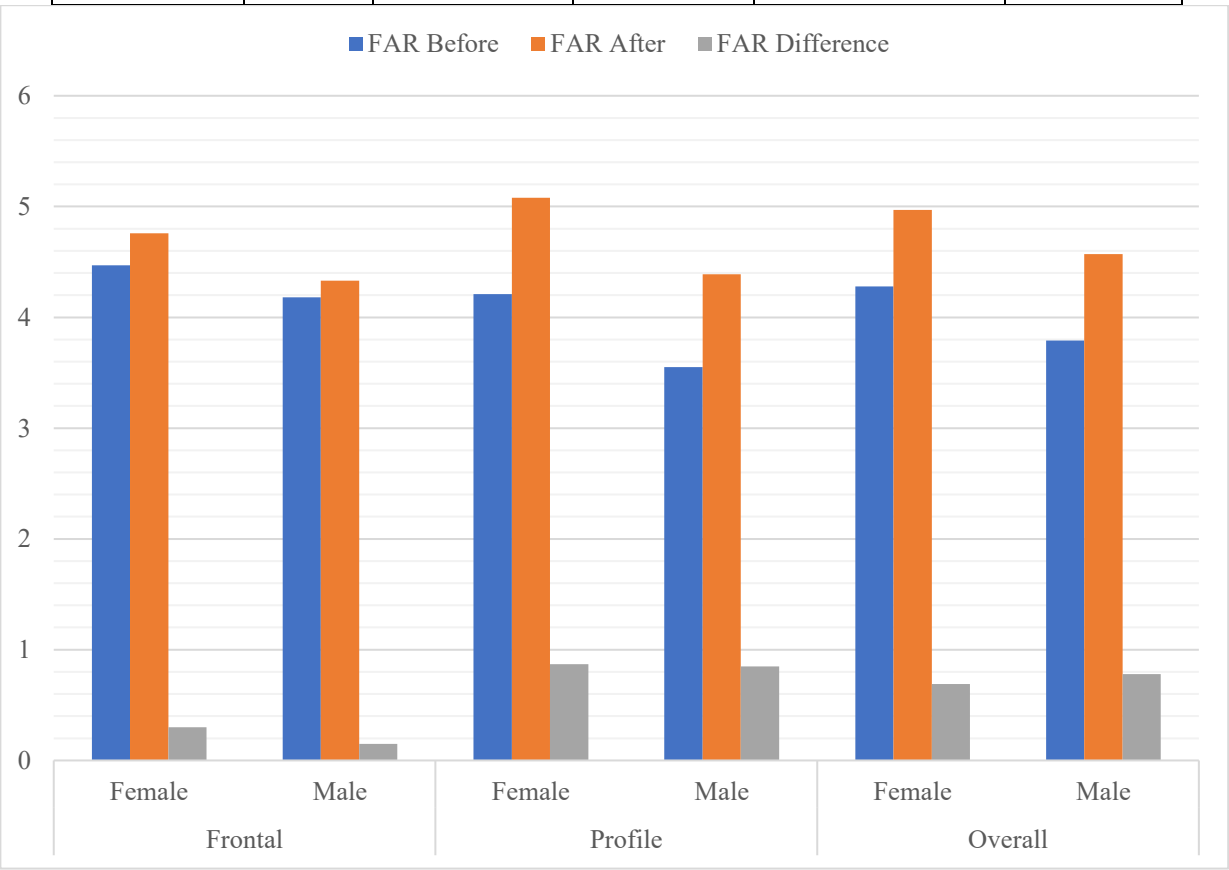

Figure 2: FAR Before and After Orthodontic Treatment

It showed highly significant improvement in all types of frontal, profile, and overall photo types as well as between females and males in the FAR analysis before and after the treatments. It was significant for females to enhance their frontal photos while there was not much improvement, though not statistically significant. For both sexes together, there was moderate and at the same time meaningful improvement in frontal attractiveness after the treatment. Even more striking improvements were seen in the profile views, with the females becoming significantly more attractive. Males improved just as well, and the entire combination for both sexes had a highly significant positive effect on profile appearance after treatment. In general, it was also seen that both females and males became significantly more attractive after the treatment, though males by a small margin. The general improvement in facial beauty was highly significant as shown when the data for both sexes was pooled. This may indicate that the treatment had a marked positive effect.

5. CONCLUSION

Results of the present study found that orthodontic treatment significantly enhanced facial aesthetics and symmetry in patients and importantly; there were significant improvements recorded in Facial Attractiveness Ratings before and after treatment. Analysis demonstrated that the common dental diagnosis was Class II malocclusion, and the types of treatment applied included labial braces, which topped the list of most frequently used treatment modalities. A good and impressive improvement in the profile view both in women and men was realized. This evidence clearly describes an orthodontic intervention that not only effectively accomplishes aesthetic goals but also places orthodontics as an important weapon to correct malocclusions and improve facial appearance, thus having a positive impact on the patients' self-esteem and quality of life.

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