THE NEW ARMENIAN MEDICAL JOURNAL
Vol.11 (2017), No 3, p.62-66

EFFECTS OF ORTHODONTIC TREATMENT WITH TEETH EXTRACTION ON SOFT TISSUE FACIAL PROFILE

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Received 21/04/2017;accepted for printing 08/07/2017

Abstract

The concept of esthetics has been slowly and steadily gaining momentum. From the past decades, interest in esthetics from orthodontists, medical professionals and the general population has increased dramatically and certainly continues to rise. Facial esthetics is an important motivating factor for many patients seeking orthodontic treatment nowadays. For centuries, artists and physicians alike have tried to quantify the ideal proportions of the face. These attempts continue to this day, attractive to orthodontists because they provide guidelines for esthetics. Ever since the introduction of orthodontics as a separate specialty branch in dentistry, a variety of techniques have evolved, and methods developed both in the type of devices/instruments used and treatments planned. The discipline of orthodontic aesthetics involves different types of aesthetics: micro and macro aesthetics, gingival, and facial aesthetics. The related literature has demonstrated that distinct ethnic groups possess differences in skeletal, dental and facial profile. Thus, each group should be evaluated differently, considering their racial characteristics, in order to produce better diagnoses and treatment planning. The necessity and acceptability of teeth extraction during orthodontic treatment and its effect on facial profile has greatly concerned orthodontists for many years and has not lost its actuality until now. It will be useful to conduct investigations for further definitions and observations of correlated relationship between hard and soft tissues of maxillofacial system by taking into consideration the patient's age at the time of treatment, type of malocclusion, differences in maxillofacial anatomical structures of various ethnic groups.

Keywords: *treatment planning, soft-tissue profile, retraction of incisors, facial divergence, aesthetics.*

Introduction

Present article aimed to review the current main criteria for tooth extractions in the treatment of malocclusions, deformities and aesthetic considerations. One of the main indications for orthodontic extractions is to achieve a more harmonious profile in patients with excessive facial convexity secondary to dental protrusion. Facial soft tissues are affected by a variety of variables including skeletal relationships, dental positions and soft tissue thickness and function; however, the exact nature of these relationships is still debatable.

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The desire to look attractive is no longer considered as a sign of vanity. In the world of economic, social and personal competition, it is simply necessary to have a pleasant appearance. The desire for aesthetic correction of maxillofacial anomalies is often driven by the desire to improve social and personal status. Attractive appearance is a key component of one's self-confidence, which, consecutively, depends on the state of mental health. According to some authors [*Currie T, Little A, 2009; Little A et al., 2011*], the most important part of the physical attractiveness of the human body is the face. The human face is one of the highest manifestations of natural harmony. The complex anatomical relief of the face, if corresponded to the aesthetic norms accepted in the society, is perceived as a single image of beauty and

attractiveness. Currently, the most common reason for patients to ask for orthodontic care is dissatisfaction with their appearance, in particular, inadequate aesthetics of the face [*Ter-Poghosyan H et al., 2005*].

Review of the relevant literature showed that while comparing the skeletal, dental and soft tissue parameters of people belonging to different ethnic groups, significant differences are revealed [*Burstone C, 1959; Altemus L, 1963; Garner L, 1974; Sushner N, 1977; Fonseca R, Klein W, 1978*]. In 1921 M. Hellman proposed the term "facial divergence". Facial degeneration is defined as the anterior or posterior tip of a part of the face relative to the frontal part and is due to the racial and ethnic origins of the patient. For example, American Indians and Asians have a tendency to anterior facial divergence, and Europeans have a posterior divergence. Like facial divergence, the convexity of the lips is subject of strong influence of racial and ethnic characteristics. So, Europeans often have relatively thin lips with minimal bulge of lips and protrusion of incisors. What refers to the people of southern European and Middle Asian origin, the convexity of the lips and incisors is greater. Accordingly, it is mandatory to develop a specific approach for establishing the correct diagnosis and treatment plan with respect to each group, by taking into account the ethnic features. Definition of optimal proportional relationships characterizing the harmonious structure of the maxillofacial area is marked by many authors as one of the most important tasks in orthodontic diagnosis and treatment planning today. It is well known that orthodontists have the opportunity to influence the change of certain facial features in the course of treatment, and they are faced with the problem of determining the volume, type and convenience of any intervention entailing a change in the appearance of the patient (Figure).

On this basis, clinicians often have a need for certain aesthetic guidelines, on the stages of diagnosis and treatment planning. The perception of soft tissue facial parameters and their fluctuations in the normal range allows treatment plan to be aimed both to correct the dentoskeletal disorders, and to normalize the facial features of every single individual.

Discussion

Orthodontics plays an essential role in enhancing facial esthetics of an individual. The contours of the face reflect the underlying facial skeleton and inevitably affect the facial soft tissues. There

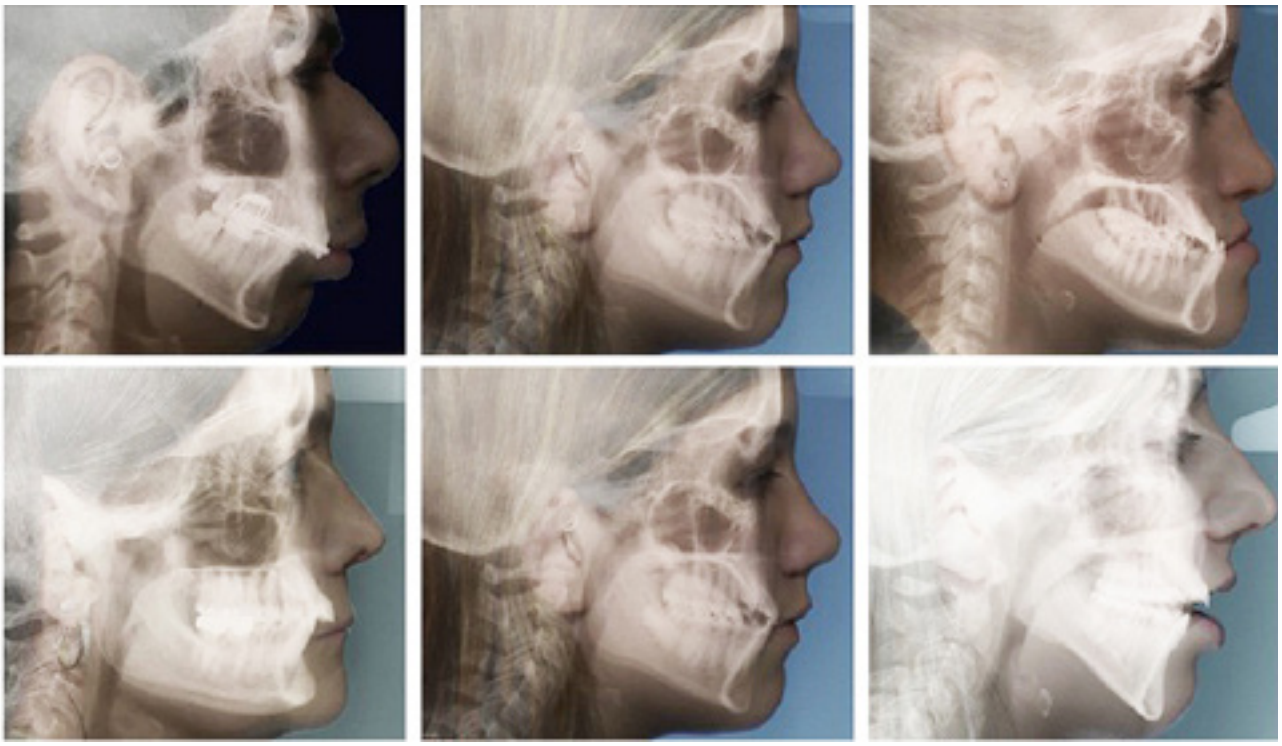

Figure. *Facial soft tissues reflects the underlying skeletal configuration*

has been a transition in orthodontic diagnosis and treatment planning towards the soft tissue paradigm in which the primary goal of treatment is to obtain best possible adaptation and proportions of soft tissues of face and mouth.

Back in 1967, C.J. Burstone turned to the question of the role of soft facial tissues in orthodontics. In the article "The position of the lips and its importance in treatment planning", he mentioned that the position of the lips is a critical element for achieving not only a full-face aesthetics, but also post-therapeutic functional stability. Deciding on extraction involves more than just the need to obtain space in the arches, be it designed to align teeth or retract anterior teeth. Sometimes, an extraction made to align teeth can compromise facial esthetics, rendering the profile more concave. However, obtaining space at the expense of moving posterior teeth distally can also compromise aesthetics by making the lower facial third longer, which can make it more difficult to achieve adequate lip closure. The position of the lips, according to C.J. Burstone, should be taken into account when choosing the location of the upper and lower incisors during orthodontic treatment, to achieve stability of the achieved results and avoid relapse. Lip closure can be determined by the height of the lower third of the face, the length of the lips, the value of the interincisal angle and the position of the incisors in the basal bone. When planning orthodontic treatment, the factors mentioned above should be taken into consideration. The vertical ratio of the line of the lip closure and the level of the occlusal plane in the vertical direction is a variable, which changes with age. For example, in orthodontic correction of the distal occlusion (retraction of the frontal segment of the maxilla) the occlusal plane rotates clockwise frequently. When choosing the technique of treatment, it is very important to take into consideration all factors discussed above.

The question of the necessity and possibility of tooth extraction during treatment has been the subject of severe discussions in orthodontic literature for many years, and does not lose its relevance to this day. Decision-making on treatment with or without teeth removal plays an important role in considering the quality of the results achieved in functional and aesthetic aspects, as well as in the clinical practice of the treatment itself. Although, the current trends encourage to avoid extractions in the treatment of dentoalveolar anomalies, in some cases (for example, when a lack of space in the dentition> 3.5 *mm* per quadrant) a full treatment without extractions of single tooth seems difficult to achieve. Alternatives to extractions are the concept of Headgear distalization appliances, Pendulum appliances and orthodontic implants [*Wehrbein H, 1994*].

In modern orthodontic literature, authors dealing with this problem can be conditionally separated into two camps [*Oliver B, 1982*]. One group of scientists indicates a high degree of correlation between the retraction of incisors and the change in the position of the lips, suggesting a pronounced relationship between soft tissues and underlying bone structures [*Stoner M, et al., 1956; Garner L, 1974; Lew K, 1989; Diels R et al., 1995*]. Another, no less numerous, demands that pronounced proportional changes in soft tissues are not a necessary consequence of changes in the dentition [*Burstone C, 1959; Neger M, 1959; Subtelny J, 1961; Angelle P, 1973; Wisth J, 1974*; *Talass M et al., 1987*; *Janson G et al., 2016*]. For example, many authors compared changes occurring in the soft tissue profile with orthodontic treatment in extraction versus nonextraction cases, and determined the hard and soft tissue parameters [*Khan M, Fida M, 2010*]. Although Pearson's correlation revealed statistically significant correlations between the upper and lower lips and upper and lower incisors ($p<0.01$), post-treatment comparisons showed that both groups finished within the same soft tissue parameters. In 2013 S. Verma and co-authors studied the data of 100 post-pubertal female patients of Class II malocclusion and the soft-tissue facial profiles of the extraction and non-extraction samples were the same following active treatment. In their study G. Janson and co-authors (2016) also did not find significant relationship between hard tissue and soft tissue parameters, treatment of full Class II division 1 malocclusion with and without extractions did not influence facial attractiveness, age appearance, and overall soft-tissue measures in the long-term. According to the results of the study, it was concluded that the change in the lips cannot be correctly predicted when using the existing norms in the sagittal dimension. Along with this there are number of studies that point to a direct relations between changes in soft tissue profile and orthodontic treatment with extractions. Other authors studied the records of 15 fe-

males and 5 males on the availability of the relationship between retraction of the upper incisors and profile changings, and found a complex interaction between dental parameters, bone tissues and soft tissue profile [*Amirabadi G et al., 2014*]. The relationship of upper and lower lip to E-line and B-line had significant reduction. Dental variables of U1-NA (*mm*), U1-NA (°), overjet and overbite showed statistically significant reduction. In one study [*Mattos C et al., 2012*] were selected 20 people (5 boys and 15 girls). All measurements of authors showed significant changes after treatment ($p<0.05$). There was a positive correlation between the retraction of incisors and the change of upper and lower lips (0.803/0.925; $p<0.001$). In their study A. Hodges and co-authors (2009) found that upper and lower lip retraction in four first premolar extraction cases can be predicted with moderately high levels of accuracy. On average, patients treated with extraction observed protrusion of the lips up to 1.8 *mm* less than the treated ones without extraction.

Conclusion

Despite the large number of publications in this field of research, to date there is no complete vision of its measure, the issue of determining the correlation dependence between the parameters characterizing the skeletal and soft tissue profiles of patients with various occlusion anomalies is insufficiently clarified. The lack of identical methodology for evaluating soft tissue parameters, the difference in the methodology of study, age and ethno-anatomical features of the patients, complicates the identification of general patterns in the treatment planning and the prediction of changes after end of treatment. Even the results of identical studies in this area frequently contradict each other; thus, prevent the creation of a universal view of the problem, complicating the full-fledged orientation in choosing the optimal method of treatment, appliances and procedures to achieve a high final morphofunctional and aesthetic result.

Thereby, it seems essential to lead research aimed to determination of correlation between hard and soft tissues in the maxillofacial system, with taking into account: the age of the patient at the time of treatment, the type of anomaly, the anatomical features of the representatives of a distinct ethnic group and the structure of the maxillofacial region and a number of other factors.

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