

Changes in Facial Aesthetics Arising From Dental Retraction in Class II Malocclusions Division 1

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Abstract

Objective: This study aimed to perform a literature review addressing the changes in orofacial aesthetics caused by orthodontic dental retraction mechanics after tooth ex-tractions in Angle division 1^a Class II malocclusion.

Methods: A bibliographic survey was conducted with articles published from 1950 to 2018 in the PubMed, MEDLINE and Google Scholar databases. The keywords “Angle Class II Malocclusion”, “Aesthetics”, “Orthodontics” were used. Articles referring to orthosurgical treatment, Class I and III Malocclusions, theses, dissertations and literature review articles were excluded.

Results: According to the studied literature, it was observed that there is a relationship between the retraction level of upper and lower incisors, and lip retrusion, which is accompanied by a tendency for a nasolabial angle to open, but with low predictability.

Conclusion: All these changes can strongly affect the aesthetics of the lower third of the face, but without prejudice, when this treatment modality is well indicated.

Key Words: Malocclusion, Angle class II, Esthetics, Orthodontics

Introduction

The concern for facial aesthetics is not recent in Dentistry. In 1950, Riedel was already questioning whether orthodontic therapy affected the face and how this facial relationship could be altered [1]. The researcher reported that beauty was one of the 3 goals of corrective orthodontics and that it reinforced the need to study dentofacial relationships on aesthetic balance and facial contours. For Subtelny [2], the position of the soft tissues that cover the mandible, as well as the mandibular and maxillary dentoalveolar areas, is strongly dependent on the position of the underlying hard tissue, although not all soft tissue on the face has the same dependence. Suggesting, it is of great importance for the dentist to know the interrelation between the lips and the dental structures.

Talass et al. [3], believe that a possible variation in the soft tissue response to orthodontic treatment should be discussed with the patient before the start of therapy, as well as non-orthodontic measures, such as rhinoplasty (or rhino modeling), genoplasty (or genomodeling), because Necessary tooth movements can cause undesirable soft tissue changes. The researchers also recommended the need to investigate in more detail the relationship of the upper lip and nose to orthodontic treatment, and the comparison between different ethnicities.

Due to the strong relationship between facial aesthetics and the underlying hard tissues, there is a fear that retrusive tooth movements may cause facial flattening [4]. Thus, the need for a complete diagnosis to act on lip aesthetics also involves dental analysis, so that the results are more predictable and have fewer side effects [5]. From this context, it is questioned what changes in facial aesthetics that orthodontic treatments with dental extractions cause after tooth retraction in patients with Angle Class II malocclusion.

This study aimed, through a systematic review, to gather scientific studies that address which most significant facial changes occur due to orthodontic movement of tooth retraction in treatments involving extractions in patients with

class II division 1 malocclusion, as well as whether these changes can interfere with facial harmony.

Methods

For the present study, a literature review was carried out based on the consultation in the PubMed, Lilacse Google Scholar databases, in January 2019. The descriptors used were: “Angle Class II malocclusion”, “Aesthetics” and “Orthodontics”. The search strategy included original scientific research articles in English and Portuguese and dealing with the topic. 29 articles published in journals between the years 1950 and 2018 were included. Articles related to Angle's Class I and Class III malocclusion, orthosurgical treatment, theses, dissertations and literature review articles were excluded. The searches were performed by two researchers to compare the results found.

Results

Angle's class II malocclusion

Class II malocclusion is characterized by the occlusion of the lower first molars more distally than what is considered normal, with the upper first molars and exceeding more than half the cusp, caused by the retrusion of the arch and/or by a lack of mandibular development of the entire the jaw. This condition of distalized occlusion is the determining characteristic of this malocclusion, in which there are two divisions, with two subdivisions each, with a difference manifested in the positions of the incisors. In the 1st subdivision, the incisors are protruded, the upper arch is narrow, the upper lip is short and has virtually no function, the lower lip is thickened and located between the upper and lower teeth, accentuating the malocclusion. In the 2nd subdivision, the incisors are retracted, the arches are closer to normal and the lips are normally functioning (Angle, 1907).

The treatment of Class II malocclusion can be performed with or without extractions of two or four premolars. However, regardless of the facial pattern and the relationship

between the maxilla and the mandible, greater success is expected with the extraction of two upper premolars [6].

A study that evaluated a sample composed of adult Brazilian white blood cells indicated a prevalence of malocclusion in 93% of the participants. Thus, there was a higher prevalence of Class I (48%), followed by Class II division 1 (36%), Class II division 2 (6%) and Class III (3%) [7]. In another study with patients enrolled for orthodontic treatment at the Faculty of Dentistry of Bauru (USP), the prevalence was higher for Class II division 1, followed by Class I, Class II division 2 and Class III [8].

The stretched lower third of the face

Reis et al. [9] studied a sample consisting of 100 Brazilians, adults and leucoderms, who presented passive lip sealing, 50 of which were male and 50 were female, with an average age of 23 years and 7 months, ranging between 18 and 36 years. The criteria used for the inclusion of participants in the sample were the presence of an adequate facial muscle balance, represented by passive lip sealing, absence of previous orthodontic treatment or facial surgery, in addition to the availability to participate in this study. Standardized photographs and plaster models of their arches were obtained from each individual and this material was subjected to the subjective aesthetic evaluation of 32 individuals, including orthodontists, artists, and laypeople. The researchers concluded that the increase in facial convexity in males and the reduction in females were aesthetically more unfavorable.

Almeida et al. [10] produced 28 photographs depicting the facial profile of four adult individuals, two white and two blacks of both genders. Each initial photo was digitally manipulated to simulate 6 more images in different degrees of retrusion and mandibular protrusion. Eighty evaluators were recruited, including 20 orthodontists, 20 oral and maxillofacial surgeons, 20 plastic artists and 20 laypeople, with complete or incomplete higher education. As a result, for the facial profile of the black man, the skeletal Class I profile was the best accepted, whereas, for the white man, the most attractive face presented the most prominent jaw. In the female faces, the straight profile was preferred, with skeletal discrepancies that simulated Class III being the most rejected.

Orthodontic treatment of angle class II malocclusion with extractions

Yamaguto et al. [11] selected cephalometric analyzes of lateral norm telerradiographies of thirty Brazilian patients, of both genders, aged 12 to 17 years with Class II malocclusion, 1st Angle division, treated with extractions of four premolars by the technique from Edgewise. They compared the beginning of orthodontic treatment with the end of the dental leveling phase and the end of the retraction phase. The maximum retraction of the incisors (in severe cases of class II) contributed to the improvement of the facial profile and the changes in the soft tissues correlated more with the retraction of the upper incisors than with the lower incisors.

Montero et al. [12] evaluated sixty telerradiographs (initial thirty and final thirty) of thirty patients with Class II division 1 malocclusion, treated orthodontically with extractions of premolars and Edgewise mechanics. The mean age was 14

years and 10 months at the beginning of treatment and 18 years and 8 months at the end of treatment. They concluded that the orthodontic treatment associated with extractions of premolars resulted in an average retraction of 4.68 mm of the upper incisors, influencing the anteroposterior position, the labial thickness (average increase of 3.19 mm related to the relief of tension) and its length (0.94 mm on average of the upper lip). The retraction of the upper incisors caused an average posterior displacement of 1.82 mm from the upper lip, with a retraction ratio of 1: 0.4, approximately, at the end of the treatment period. Although a correlation was observed between the retraction of the incisors and the anteroposterior position of the upper lip, it was not possible to make predictions due to the great individual variation.

Brant and Siqueira [13] also analyzed a total of sixty cephalometries obtained before and after corrective orthodontic treatment of thirty female patients with Class II division 1 malocclusion. Participants were allocated equally to two groups. The first group underwent extractions of the first four premolars and the second group without extractions. The authors observed that, from the registration of linear and angular measurements, there were no significant changes between groups for measures of nasal projection, length and thickness of the upper lip and the increase in the nasolabial angle, decrease in the measures of the thickness of the lower lip, interlabial space, the contour of the mandibular groove and the angle of the facial profile. Thus, the researchers suggest that, when properly indicated, extractions do not compromise the patient's facial profile at the end of treatment.

Almeida et al. [14] carried out a similar study with thirty young women with Class II division 1 malocclusion, where half of the sample was treated with extractions of the first premolars and the other treated without extractions. They observed that the nasolabial angle increased with treatment, especially in cases submitted to tooth extractions. Also, they noticed a relationship between the alteration of the inclination of the upper incisor, the upper lip and the nasolabial angle, besides that there was no significant variation in the nasolabial angle in the group without dental extractions. In the group submitted to extractions, changes in the inclination of the incisors and upper lip and nasolabial angle had final measurements similar to those in the group without extractions.

Ramos et al. [15] selected 16 patients with Class II division 1 malocclusion (seven women and nine men) and divided them into group 1, with lip seal at rest and group 2, which did not exhibit the seal. All were treated with extraction of the first maxillary premolars and received metallic implants in the nasal spine and in the zygomatic process bilaterally to avoid confusing the effects of the treatment with the growth and facial development. In the end, they concluded that the retraction of the upper lip accompanied by retraction of the incisor for both groups was similar and that the lip and nasolabial angles tend to open after the retraction of the incisors, but with little predictability. Also, they concluded that the individuality of the growth of the nasal base and not necessarily the anatomy of the upper lip is the probable cause of the variability in the nasolabial angle. Thus, although the sample is small, the results confirm that there is a wide range of individual variation and that an obtuse nasolabial angle

may have other factors besides the retraction of the upper incisors.

Oliveira et al. [16] compared cephalometries of thirty young people of both genders, with an average age of 12 years and four months, with Class II division 1 malocclusion. They compared cephalometric measurements of maxillary and mandibular incisors about vertical and horizontal positioning, as well as changes in the lips and nasolabial angle before and after treatment. A significant increase in the nasolabial angle at the end of orthodontic treatment was observed in the study, with an average variation of 2.8 degrees per millimeter of retraction of the upper incisors, although there was great variability. Therefore, the poor predictability of the positioning of the lips does not seem to have an unfavorable effect on the facial profile, as long as the extractions are well indicated, taking into account the amount of crowding, the facial pattern, the thickness and tone of the lips.

Delalibera et al. [17] underwent initial and final cephalometry analysis of seven female patients with Class II malocclusion, who underwent corrective orthodontic treatment with extraction of at least two premolars and started treatment at 16 to 26 years of age. Each patient had his interview recorded on video, transcribed and analyzed. Study models, telerradiographies and photographs of the medical records were used to assess five quantitative parameters: facial contour, nasolabial angle, interincisive golden ratio, facial and dental midline, and incisal silhouette in the smile. Considering the methodology used and the sample size limitation, it can be concluded that the orthodontic correction of Class II patients in the present study improved facial aesthetics, altering the measurements of the soft tissue of the face, the smile, and personal relationships, but to the patients, it did not seem to interest them that the angles and proportions of their faces were outside of what is proposed mathematically as aesthetic, as long as these were within the standards of normality accepted by them and established by society.

Amirabadi et al. [18] examined the initial and final cephalometries of 15 females and five males aged 15 years or older, diagnosed with class II division 1 malocclusion. All had horizontal overlap equal to or greater than 4 millimeters, with the extraction of the first premolars for orthodontic treatment and without the use of an extra buccal device. The patients were divided into different groups: patients with four millimeters or less crowding, patients with more than four millimeters crowding. The authors concluded that the extraction of upper first premolars in patients with class II division 1 malocclusion resulted in the normal position of the lips, which play a role in the aesthetic profile. However, the amount of retraction of the lip was different from patient to patient, related to the amount of initial crowding. They also concluded that this treatment modality significantly increases the upper lip thickness (1.4 mm on average), which recovers its tone due to the retraction of the incisors resulting in a normal position of a harmonic profile.

Omar et al. [19] compared cephalometries of two groups of patients diagnosed with class II malocclusion. The first group consisted of 48 patients, 20 of whom were male and 28 were female, with an average age of 13 years, who were treated orthodontically with the extraction of the first four premolars.

The second group consisted of 33 patients, 11 male and 22 female, with an average age of 13.3 years old, treated with extraction of the four-second premolars. They stated that there was no statistically significant difference in the mean nasolabial angle or the position of the upper lip and lower lip between the two groups. However, it was observed almost twice the amount of retraction of maxillary and mandibular incisor teeth in the treatment group that had the first premolars extracted compared to the treatment group that had the second premolars extracted. The position of the upper and lower lips was more protruding in both groups before treatment, and, in the post-treatment, for the group that had the first premolars removed. There was a relationship between the amount of retraction of the maxillary incisors and the upper and lower lip retrusion.

Maria and Rossato [20] investigated the cephalometry of forty young patients, twenty of whom were male, with a mean age of 12.3 years, and twenty of female, with a mean age of 12.4 years. All were treated with extractions of four premolars, with 23 presenting Class I malocclusion and 17 Class II malocclusion, division 1. The results obtained concluded that the average increase of 6, 11° of the nasolabial angle was due to the retraction of its lip component and influenced by the anteroinferior nasal growth. In relation to the upper lip, there was an increase in thickness of 1.63 mm in the vermilion region (greater in males) and 1.45 mm in the region of the labial sulcus, and it is not possible to say whether this occurred due to the retraction of the incisors. Higher self or growth. There was also no presence of lip tension that affected the lip thickness. In general, in the male gender there was greater lip thickening, therefore, less retraction and greater growth of the nose, while in the female gender, the increase in the thickness of the upper lip and the growth of the nose were smaller.

Vitoreti et al. [21] examined the effect of retraction of the upper incisors on the vertical and horizontal positioning of the upper lip and its relationship with the nose in adult patients from a sample of 28 patients, 14 men, and 14 women. In this study in question, the upper lips showed a significant change after retraction of the upper incisors, with a rate of 0.8 mm of posterior repositioning for each millimeter of retraction of the incisors. The retraction of the upper incisors in adults was associated with the posterior movement of the upper lip, accompanied by a tendency to increase the nasolabial angle. There was also a lower repositioning of the anterior border of the upper lip.

Maetevorakul and Viteporn [22] evaluated initial and final cephalometries of orthodontic treatment of 104 patients, aged 8 to 16 years, with Class II division 1 malocclusion, treated in different ways, comprising: extraoral appliance, traction mechanics and extractions. The researchers concluded that changes in the facial profile vary according to gender, age, treatment modality, previous condition of dental morphology, bone tissue and soft tissues. The change in the position of the upper lip was similar in the treatments with the extra buccal appliance and in the treatment with extractions of four premolars. The group submitted to intermaxillary traction had little effect on the horizontal position of the upper lip.

Conley and Jernigan [23] studied a sample of 27 Caucasian patients with Angle Class II division 1 malocclusion through their initial and final cephalometries. Participants had an average of 8.62 mm overjet and had only the first upper premolars extracted. The results found showed that the average retraction of the maxillary incisors was 5.27 mm and the upper lip, 2.03 mm, and that, unexpectedly, there was also a decrease in the lower lip projection, but due to its verticalization and abandonment of its position in the space between the upper and lower incisors (due to overjet and overbite).

Ozaki et al. [24] studied a group of 33 patients with Class II division 1 malocclusion, who underwent extraction of the first four premolars and two molars, with 24 of them having the first upper molars extracted and 9 the first lower molars extracted and compared with a control group treated only with extractions of the four premolars. They concluded that the extraction of the molars contributed to the maximum retraction of the incisors (in severe cases of class II) contributing to the improvement of the facial profile and the soft tissue alterations correlated more with the retraction of the upper incisors than with the lower incisors.

Paranhos and Ramos [25] analyzed 28 cephalometric telerradiographs in lateral norm of the pre- and post-treatment phases of patients with Class II malocclusion Division 1 of Angle. The sample consisted of 14 patients aged 9 to 12 years of age, seven males and seven females, with an ANB angle and horizontal overlap greater than or equal to four millimeters, all treated with BaltersBionator and fixed apparatus, with interval average between telerradiographies (initial and final) of five years (minimum of 4.5 years and maximum of 5.5 years). The researchers concluded that for this age group there was a difference between genders regarding the position of the lip. In relation to the incisors, the male gender presented thickening of the soft tissue, masking the effect of the retraction.

Allgayer et al. [26] evaluated the effect of several premolar extraction protocols on the profile of 87 Angle Class II patients using lateral norm cephalometry. Patients were divided into three groups: the first group was treated with extractions only from the first upper premolars; the second group with extractions of the first four premolars; and the third group with extractions of the first upper and lower second premolars. Through Holdaway's analysis, they found that in all groups there was an increase in nasal prominence and a decrease in the depth of the groove of the upper lip in the convexity of the skeletal profile. There was a greater increase in the thickness of the upper lip and its tension in groups one and two and an increase in the depth of the groove of the lower lip and approximation of the lower lip of line H in groups two and three.

Hayashida et al. [27] examined initial and final cephalometries of 33 Japanese women over 17 years of age, with an average of 23 years, who underwent orthodontic treatment to correct Class II division 1 malocclusion, with extractions of two or four pre-molars and retraction of anterior teeth. The cephalometric evaluation indicated that for each millimeter of dental retraction there was 0.45 mm of retraction of the upper lip and 0.38 mm of retraction in the lower lip and

for every millimeter of intrusion of the upper incisors, it caused 0.54 mm of upward movement of the upper lip. The upper lip and 0.66 mm of the lower lip. The researchers concluded that it is relatively difficult to predict lip position after tooth retraction. However, through the parameters used, they were able to explain with a confidence above 62% that the amount of change in the position of the lips should differ between genders, ethnicities and/or types of malocclusions.

Kima et al. [28] compared the interference in the facial profile of the dental retraction mechanics in patients with Class II division 1 malocclusion, who underwent orthodontic treatment with extraction of upper and lower first molars. The researchers analyzed the initial and final cephalometries of the sample of 57 participants, divided into two groups, one group with moderate retraction and the other group with maximum retraction. They concluded that there was a retraction of 2.3 mm of the upper lip and 3 mm of the lower lip in the group with moderate retraction. In the group with maximum retraction, there was a retraction of 4 mm of the upper lip and 5.3 mm of the lower lip. In the group with moderate retraction, the position of the upper lip was influenced only by dental variables, while the position of the lower lip was influenced by dental and skeletal variables. In contrast, in the group with maximum retraction, no variable was found that significantly influenced the retraction of the upper lip, although similar behavior was found in the lower lip. These results suggest that periodic evaluation of the lip profile is necessary for treatments with maximum anchorage due to the low predictability of the soft tissue response.

Allgayer and Mezomo [29] reported that tooth extractions have been avoided as an orthodontic treatment protocol, as they can damage the facial profile. Through a clinical case report, they concluded that, although many innovative techniques have emerged in recent years, traditional treatment is still an excellent alternative, providing lasting results for cases in which there is a lack of space or crowding. Extractions of second premolars can ensure the integrity of your profile when the objective is to find space in cases of the negative discrepancy. This study reinforces that professionals must be aware of the diagnosis and planning of the ideal pattern of tooth extractions to achieve aesthetics of the profile and facial balance, as well as functional occlusion and stability.

Discussion

The orthodontic treatment of Class II division 1 malocclusion produces an increase in the nasolabial angle at the end of the retraction mechanics to close the spaces of extractions [11,14,15] and the upper lip increases its thickness and length [12,13,20,23,26].

Several studies have found a relationship between the position of the incisors and lips [12,14,19,25]. This relationship between the amount of retraction of upper and lower incisors and lip retrusion is accompanied by a tendency to open the nasolabial angle [19,21] in women, and increased lip thickness in men [20,25] thus masking the effect of retraction.

It is difficult to predict the final measurement at the end of treatment [12,15,27], the position of the upper lip [16] and the

lip angle, due to the low predictability due to the individuality of each person and the growth of the base of the nose [15], due to differences in gender, ethnicity, and malocclusions [27], and especially in cases where mechanics are applied of maximum retraction [28].

Treatment with extractions, provided it is well indicated, will not compromise the patient's facial profile [13,16,17,24] and may even improve facial aesthetics [16,18]. Therefore, the measurements of the upper lip and the nasolabial angle in this type of treatment tend to be similar to the cases treated without extractions at the end of treatment, similar to the cases treated with extra-oral apparatus and without significant differences between treatments with two or four extractions [13]. And, in cases of extraction of second premolars, there is less amount of retraction [19], therefore, greater conservation of the integrity of the facial profile [29].

Conclusion

The mechanics of dental retraction in Class II division 1 malocclusion cause changes mainly in the nasolabial angle, in the horizontal position of the upper and lower lip, their thickness, their length, strongly affecting the aesthetics in the lower third of the face.

It is known that the facial profile of the individual with Class II malocclusion is the one with the highest prevalence in the population that seeks dental services and with low aesthetic acceptance. When well-founded, tooth extraction in orthodontic treatment will not compromise the patient's facial profile.

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