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Abstract

The treatment of class II malocclusion during adolescence is an important challenge for orthodontists, moreover, if there are other growth factors that hinder the reaching of a normal occlusion.

Maxillary molar distalization is an orthodontic treatment method that has obtained an important diffusion since last years for correcting pure dental Class II malocclusion. In the past, several appliances including headgear, pendulums, Jones jigs, and distal jets have conventionally been used for maxillary molar distalization.[1-3] However, distalization is often associated with adverse effects such as anchor loss and uncontrolled tipping. The first problem for the clinical is the undesired tooth movement in response to the application of forces for correcting the dental malpositions and obtaining an acceptable occlusion. This is the concept of anchorage which represents the base in every orthognatodontics treatment planning. With the use of TADs (temporary anchorage devices) it's possible to obtain a good control of anchorage and, thus, to have a predictable tooth movement without the risks of malocclusion relapses. Nowadays, TADs are used to enforce anchorage in many devices, with a great standard of success. The aim of this study is to examine the application of TADs in orthodontic treatment planning and, in particular, for obtaining molar distalization and a proper anterior retraction in the therapy of II class malocclusion.

Introduction

The treatment of Class II malocclusion during adolescence is an important challenge for clinicals. At the first, the Angle Class II malocclusion was defined only considering the relationship of the upper and inferior molars, in which there is a relative advancement of the upper first molars. This simplified view of malocclusions by Angle led to the loss of use in dental radiograms. As soon as the spreading use of the lateral cephalometric radiograms have conducted to the idea that the II class malocclusion was often relate to a wrong relationship of the jaws.

In orthognadontics, it's possible recognise mainly three types of skeletal class II malocclusions due to a: length deficit of mandible; maxillary excess in dimensions and a mixed form of them. When there is not a favourable growth, the treatment of Class II relationship in adolescents is problematic and the treatment planning is based upon the idea that even we cannot expect the growth of the mandible, a forward movement of the lower jaw relative to the maxilla can contribute to reach a proper occlusion. Without the extraction of second molars, it can achieve only a minimal distal movement of the molars superiors, in addition to the space after molar derotation. The norms want that if we need more than 4 mm for the retraction of the upper incisor, the treatment plan requires extraction of premolars. Bring the lower teeth ahead of 2 mm compared to their bone base determines a condition of instability that, in all likelihood, also be unacceptable from an aesthetic point of view. Unless there is a certain favourable mandibular growth, the extraction of the premolars seems to be necessary to have a stable orthodontic correction in most of the problems of Class II in teenagers.

Distal movement of upper teeth

If superior molars could be moved back, it's possible to do a correction of molar Class II. The movement could also provide more space in which antero-superior teeth could be retracted.

If the first upper molars are rotated in lingual medial sense, as generally it happens, we must correct the rotation, and this get a small space mesial to the molars.

The only way to determine a significant distal movement of the first molar when there is no more growth, is the extraction of the second molar in order to create a sufficient space. In this way the distalization of the other upper teeth can successfully correct a moderate Class II malocclusion in mature teenagers. However, even after second molar extraction, you should not wait more than 4 mm distal movement. The ideal patient for this type of planning should permit this to be an entity which has a molar ratio of less than Class II half cusp.

Both the headgear that Class II elastics can be used to determine this type of movement, and each of these approaches has advantages and disadvantages. The

headgear provides heavy and intermittent forces rather than soft and continuous, and it is ineffective, unless the patient ports it full time. This concentration system between the force is necessary and can help to modify the growth.

In order to correct a dental Class II malocclusion, an alternative method is represented by the use of II class elastics after the extractions of first and/or second premolars, obtaining the correction of both the molar relationship and the excessive overjet. In this way, it can be possible to retract upper incisor, and take forward the lower molars. Without extraction and with the exclusive use of II class elastics, at the end of treatment the patient will present a molar class II relationship, and a normal overjet.

It's important to considerate how if there are problem of space is not possible to use the space gained with the extraction to use it in way to resolve the crowding, thus we have to considerate how the extraction space is useful just when the teeth are already aligned. Is not possible to use for the two scope the space. A consideration to do is how, in this way, we correct a just the occlusion. If the II class is linked to an underdevelopment of mandible, retract superior incurs to correct overt, it's like to adapt maxillary at the wrong arch (the mandible), so it's easy understands how this is not the best treatment. Moreover, another consideration to do is the eruption with the use of II class elastic of upper incisor that at the end made a "gummy smile" that is not desirable.

Use of elastic of II class. Sometimes we do not have the necessity to do extraction in way to carry forward the mandible. With a prolongation of use of second class elastics it is possible, to obtain great result, but it's possible only if the initial malocclusion is link to a backward mandibular position. Only in this case it's possible to obtain a correction with a more forward replacement of the lower jaw. We have to keep in mind that a post rotation (backward and down) of the mandible may occurs if there is not a sufficient skeletal growth.

Another consideration is that if there is the necessity to bring forward more than 2 mm the inferior incisor this would lead to a relapse and instability. Because off the pressure of the lips on the incisor bring to a relapse of crowding, overjet and overbite. Thus without an adequate growth the protracted use of elastic to correct a second class relationship will lead to a convex outline of the face, protrusion of lower incisor and a pronounced lower lips.

Starting from the preview condition, we know how it's important an Anchorage control of orthodontic treatment. A therapy that requires a molar distalization had as essential condition a good anchorage, gained with various intraoral appliances. There was used, pendulum appliances, distal jet and techniques such as distalizing arches.

After predictable molar distalization an efficient treatment necessitated subsequent incisor retraction without "burning anchorage." Moreover, these devices require full patient cooperation, which is sometimes not possible and is unpredictable.

Introduction of implants in orthodontics have solved this problem. Implants have become one of the best sources of reliable anchorage. Mini implants have revolutionized the field of anchorage in orthodontics. Use of implants as a source of anchorage has number of advantages. They don't require patient cooperation, the use is easy for the patient, and there is a shortening of treatment time, and a good and predictable control on tooth movements. *Simplify the active and reactive components*.

Miniscrew avoids the problems of the "anchorage loss", because there is not a movement of the reactive unit, like it can exist on a continuous arch wire where is possible a movement of the posterior unit of teeth in response to the movement of the anterior one.

Predictable force system

With the use if miniscrew we have benefits to have a predictable force system. In fact, we use just a single force with a line of action that is the same to the elastic chain or coil spring use to connecting the miniscrew to the attachment. In this way the force can be easily visualized, and also the magnitude.

Intrusive component of force

With the use of miniscrew there is a great component of force with a vector of intrusive component, and it is thanks to the placement in the interradicular area. This effect can be useful for the correction of hyper divergent face. Indeed, we well know how at moment is very difficult to find an appliance that have a pure intrusive force without an extruding response of the posterior teeth. With miniscrew we have the benefits to be able to do a tooth movement in all three dimensions of the space and this is thanks to the various points of force application, that we can use because of the sites where we can place the miniscrew for their dominion are interradicular spaces, the retromolar area, the midpalatal suture, the palatal slope, and the anterior subapical area.

The use of miniscrews requires at first the determination of the movement, and the line of the force to achieve it. The type of tooth movement should

be determined from both clinical and theoretical standpoints. We have to determinate which is the force system at center of resistance. Once have determinate the line of the force in which our movement had to happens we need to quantifying the force necessary to the system to obtain the desired movement (maybe we need a single force, or a moment with a force). after this we have to determine the insertion site and point of force application of the appliance that is related with the type of movement we have to obtain, and the unit of teeth that we have to move.

The application of monocortical miniscrew-type temporary anchorage devices (TADs) to various orthodontics with the easier and minimal invasiveness at insertion and removal clinical situations demanding movement of either a single tooth or teeth segment has been largely successful. The miniscrews placed at the interdental alveolar bone can deliver forces directly to the tooth or archwire, eliminating the need for additional connectors. The miniscrews are versatile in the posterior segment control, for which extraoral appliances used to be indicated.

Materials and Method

In the recent years, several articles have been published on international literature about the use of alternative methods to treat Class II Malocclusion that could be more effective and more accepted by patients. The TADs have represented a good alternative to other orthodontic appliances because of their possibility to combine them with other devices and, so to enforce them. So a detached research of international literature has been performed using the principal medical databases: PubMed (Medline), Lilacs and Scopus. The keywords used were: *miniscrews, TADs*, *bone anchorage*, *tooth movement* and*, Class II Malocclusion*; to identify all articles reporting on the topic till October 2016.

Review

Use of Miniscrews in the distal movement of Maxillary Molars

For the molar distalization, there are more methods that have been used with the miniscrews. The mini implants have been placed in palatal bones, in zygomatic and in the buccal maxillary. The screws where inserted into the maxillary tuberosity, in the buccal interdental alveolar bone, and in palatal area and they have been used with auxiliary appliances, how we have already mentioned are distal jet, pendulum and first class.

One study of Lee (Displacement pattern of the maxillary arch depending on miniscrew position in sliding mechanics.) evaluated the anteroposterior and vertical displacement patterns, in a group of women which requiring maximum incisor retraction because of bi-alveolar protrusion. The group was divide in two groups where the mini screw was placed in two different interradicular position, one between the premolar and molar, and in other between the two premolars. The sample previewed to take cephalometric measurements for skeletal and dental changes, before and after space closure in maxillary teeth with the use of sliding mechanics depending on the position of interradicular miniscrews after the extraction of premolars. They find out how in the groups in which were used the miniscrew between the premolar and molar, there was a greater intrusion at both the incisal tip (1.59 ± 1.53 mm) and the root apex (2.89 ± 1.59 mm) than did in the other group. This was a useful evolution of the importance to select the placement site for the resultant displacement pattern of the incisor segment. Discriminative intrusion or retraction might be obtained via strategic miniscrew positioning. Another study, evaluated in a controlled trial the effects of en-masse retraction of anterior teeth with mini-implants as anchor units in the same types of patient (bialveolar dental protrusion) patients undergoing extraction of all 4 first premolars. These authors compared the effect with and without the use of miniscrew, in both groups were analysed skeletal, dental, and soft-tissue changes on lateral cephalograms taken before retraction and after space closure. The results show how mini-implants provided absolute anchorage to allow greater skeletal, dental, and aesthetic changes in patients requiring maximum anterior retraction, when compared with other conventional methods of space closure. The treatment changes were favourable. However, no differences in the mean retraction time were noted between the 2 groups. The group where was placed mini implant showed statistically significant decrease in the facial vertical dimensions, distalization (anchorage gain), intrusion of molars and also facial convexity angle, nasolabial angle, and lower lip protrusion had greater changes. No differences were found in the amount of upper lip retraction between the groups. However, no differences in the mean retraction time were noted.

Another retrospective study of Yao analysed the cephalometric outcomes in patients with Angle Class II malocclusion or Class I bimaxillary dentoalveolar

protrusion were treated by retracting the maxillary dentoalveolar process by using the extraction space of the bilateral maxillary first premolars treated with extraoral headgear or mini-implants for maximum anchorage. Pre-treatment and post treatment lateral cephalograms were superimposed. The skeletal anchorage group had greater anterior tooth retraction (8.17 vs 6.73 mm) and less maxillary molar mesialization (0.88 vs 2.07 mm) than did the headgear group, with a shorter treatment duration (29.81 vs 32.29 months). Translational movement of the incisors was more common than tipping movement, and intrusion of the maxillary dentition was greater, in patients receiving miniplates than in those receiving screw-type bony anchorage, resulting in counter-clockwise rotation of the mandible and a statistically significant decrease in the mandibular plane angle. The results change also with the type of the patients, the ones with a high mandibular plane angle, those receiving skeletal anchorage had genuine intrusion of the maxillary first molar and reduction in the mandibular plane angle, whereas those receiving headgear anchorage had extrusion of the maxillary first molar and an increase of mandibular plane angle. In patients with low to average mandibular plane angles showed no significant difference between groups, although greater maxillary incisor retraction and less mesial movement of the first molar were noted in the mini-implant group. Whereas the previous studies examined the anterior retraction after extraction treatment, Yamada made an evaluation of the validity of the clinical usage of interradicular miniscrews in the distal movement of maxillary molars in non-extraction treatment. Their conclusion showed, after an evaluation of lateral cephalograms and dental casts, how the molars were moved to a distal position, if miniscrews were placed in the maxillary interradicular space placed i between the second premolar and the first molar at an oblique angle of 20 to 30 degrees to the long axis of the proximal tooth. This mechanism provides a successful molar distal movement of 2.8 mm without patient compliance and with no undesirable side effects such as incisor proclination, clockwise mandibular rotation, or root resorption. Park et al previously reported that the maxillary first molars were moved to the distal by 1.64 mm with statistical significance in their study of group distal movement using miniscrew anchorage.

Conclusion

Anchorage control is one of the importante factor for a success in an orthodontic treatment plane. Nowadays after the needed to utilized various appliances that requires an high cooperation of the patient and doesn't have a good predictable results, the use of TADs bring reliable advantages, such as in difficult situation as molar distalization. Our work examines the states of art of the use of TADs, and it's possible to see how they bring reliable results if compared with traditional appliances in terms of molar distalization, and a therapeutic favorable changes in occlusal plane and manibolar position to correct the malocclusion.

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