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Clinical case

Microosteoperforations and Use of Reverse Face Mask as Treatment of Skeletal Class III. Case Report

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ABSTRACT

Introduction: Malocclusions have repercussions on the functional aspects of the maxillo-mandibular complex. There are several factors to determine the treatment plan of these malocclusions, such as age, skeletal maturation, habits, and genetics, among others. **Objective:** To correct skeletal and dental Class III problems due to maxillary hypoplasia, by using a reverse maxillary protraction mask and microosteoperforations, an efficient treatment to obtain function and esthetics. **Case presentation:** A male patient attended the clinic, aged 12 years and 10 months, skeletal class III, brachyfacial, with skeletal and dental anterior crossbite, slightly enlarged lower facial third, bilateral molar and canine class III, with narrow airways and no relevant past medical history. The orthopedic treatment plan included a Hyrax screw with bands in maxillary molars and premolars, with the use of a reverse face mask for 10 months, microosteoperforations with 1.5mm x

8mm mini-implants to stimulate bone-dental movement. Orthodontic treatment was performed without extractions, with a passive self-ligation system with tubes in first and second molars. As a result of treatment, dental and facial results were satisfactory. A normal maxillo-mandibular relationship with molar and canine class I and adequate overjet and overbite were achieved; the maxillary hypoplasia was corrected, and a downward and backward rotation of the mandible occurred. The anterior crossbite was also corrected, and coincident midlines were obtained. **Conclusions:** Adequate treatment of these malocclusions may avoid extractions or orthognathic surgery. The results are also determined by the patient's cooperation.

Keywords: facial mask, anterior crossbite, micro-osteoperforations, maxillary protraction mask, reverse mask, self-ligating system.

INTRODUCTION

Different types of malocclusions affect several functional aspects of the maxillo-mandibular complex: phonation, breathing, and mastication, among others. Patients with skeletal class III malocclusion are characterized by a concave profile, depressed middle third, anterior and posterior crossbite, and dental class III. There are many factors that determine the treatment plan for these malocclusions, such as age, skeletal maturation, presence of habits, and genetics, among others[1,2].

It is estimated that less than 5% of the population presents a class III malocclusion; there is an incidence of 3% in Caucasians, 4-14% in Koreans, Japanese, and Chinese, 6.3% in the African American population, and 9% in Latinos, similar to the 8.3% in Mexican Americans[3,4]. This type of malocclusion presents a very strong genetic influence. A good diagnosis and treatment plan may avoid extractions or orthognathic surgery[5,6]. There are several methods for the correction of anterior crossbite described in the literature[7-9]. One of them is the use of a maxillary protraction mask to avoid orthognathic surgery. Currently, there are different models of face masks, all with the purpose of correcting the maxillomandibular relationship[10].

Dr. Potpeschnigg[8] in 1875 was one of the first to develop the idea of maxillary protraction. Delaire *et al*.[9], at the end of the 1960's, intensified the interest in the use of a facemask and maxillary protraction, but it was Petit[10] in the late 1970's, who modified the anatomical design by Delaire *et al*., changing the shape and ergonomics of the face mask, increased the magnitude of the force generated by the appliance and reduced the treatment time. Sheridan[11] described the importance of performing orthopedic protraction of the maxilla for the skeletal correction of Class III malocclusions, stating that orthopedic effects can be achieved with the sutural morphology and physiology of the eight maxillary joints when orthopedic force is employed. This is done to produce the rupture of the entire sutural system and thus facilitate protraction of the maxilla with the face mask[7]. The sutures that compose this system, which are broken with the rapid expansion of the maxilla, are fronto-maxillary, naso-maxillary, zygomatic-temporal, zygomatic-maxillary, mid-palatal suture, pterygo-palatal, ethmoid-maxillary, and lachrymoid-maxillary.

As with transverse expansion, it is easier and more effective to traction the maxilla forward at younger ages, although some recent studies reveal that some anteroposterior changes may occur until early adolescence[7,8]. The literature reports various methods of accelerated

orthodontics, most of which describe multiple cases both in animals and humans with excellent results; most of them involve undergoing more complex surgeries in which another specialist must intervene, either a maxillofacial surgeon or a periodontist, to perform these procedures, increasing costs and post-treatment care[12]. Düker[13] and several authors support that treatment should begin as early as possible to produce a more significant response to protraction therapy, since at younger ages there is a greater growth potential that can be stimulated by orthopedic therapy.

CLINICAL CASE PRESENTATION

A 12-year-old male patient attended the Orthodontics Clinic of the DEPeI of the Faculty of Dentistry, UNAM, where we obtained his photographic (Figure 1), radiological (Figure 2), and digital (Figure 3) records. The facial diagnosis consisted of a concave profile, lower procheilia, and euriprosopic biotype. Cephalometrically, the patient presented a combined skeletal Class III (retrusion and prognathism), with a horizontal growth type (Figure 2. B). He had a bilateral molar and canine class III and anterior crossbite.

The treatment of choice consisted of two phases: orthopedics and, later on, orthodontics. It started with the placement of a 7mm Hyrax screw (Figure 4. A), with reverse face mask and initial 12oz elastics. A reverse face mask was used for 10 months, gradually increasing the strength (Figure 4. B-C). Subsequently, microosteoperforations (MOPs) were performed on 3 occasions in the subapical (vestibule) area between teeth 13 to 23 with 2mm x 10mm stainless steel mini-implants at 8-week intervals to stimulate the intermaxillary sutures and promote maxillary traction.

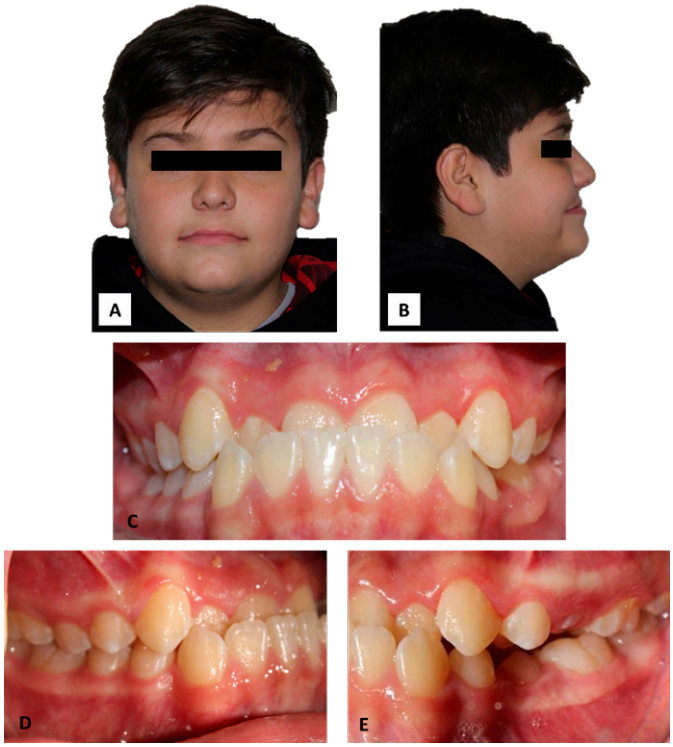

Figure 1. Initial images. A. Frontal extraoral photograph. B. Lateral extraoral photograph. C. Intraoral photograph in frontal view. D. Intraoral photograph in right lateral view. E. Intraoral photograph in left lateral view.

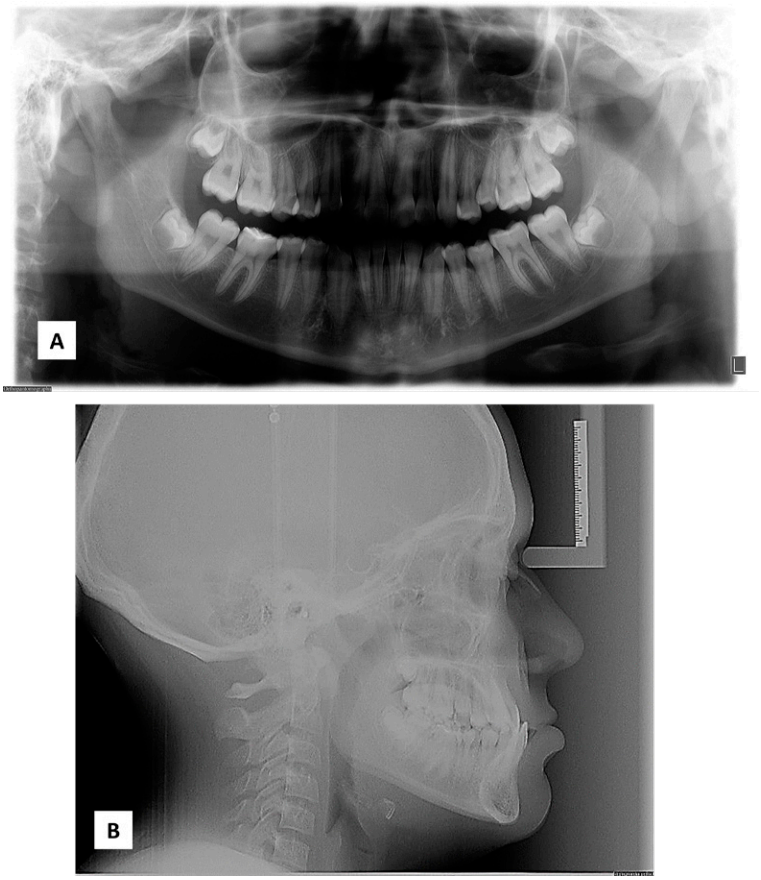

Figure 2. Initial radiographic images. A. Orthopantomography. B. Lateral headfilm.

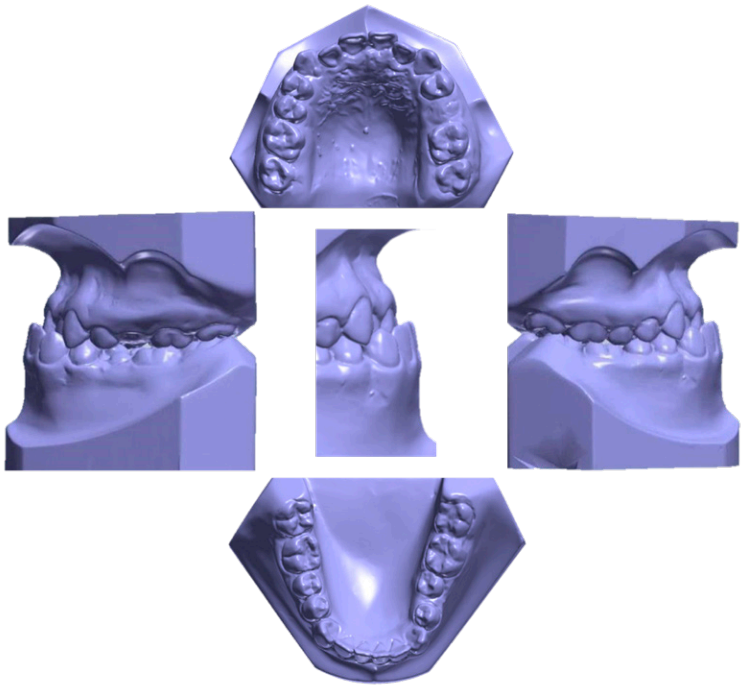

Figure 3. Initial digital study models.

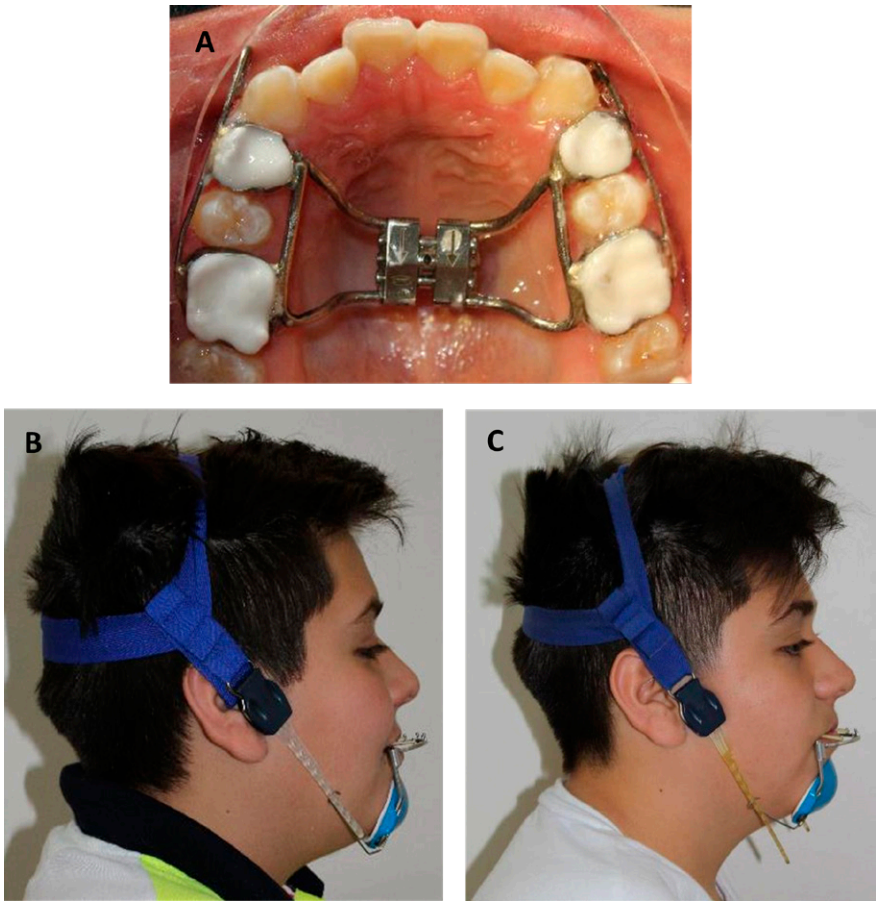

Figure 4. Orthopedic phase. A. Placement of band-cemented Hyrax. B. Lateral extraoral photograph with reverse face mask. C. Lateral extraoral follow-up photograph, 10 months of reverse face mask use.

After 10 months of orthopedic treatment, passive self-ligating appliances were placed, with tubes in the second and first molars. 0.014" CuNiTi archwires were placed in both arches, and no extractions were performed. It was decided to perform MOPs again in the interproximal areas of the alveolar bone to induce bone formation and accelerate dental movements. These perforations were made three times between teeth 13 and 23 (Figure 5), with a depth of 7mm. Subsequently, a 0.016" stainless steel archwire was placed with an omega loop mesial to the upper molars to procline the upper incisors, and an elastic chain was used to close the spaces in the lower arch and retroincline the lower incisors. Afterwards, an upper 0.014 "x 0.025" CuNiTi and a 0.018 "x 0.025" lower archwire were placed with ligature wire from teeth 12 to 22. Elastomeric chain and an open spring were placed to mesialize the upper cuspids, and 3.5 Oz Class III vector elastics.

Spaces were closed after mesialization of cuspids, first and second bicuspids, 5-5 wire ligatures were placed with 7-7 e-link to close spaces between molars. Upper 0.021 "x 0.025" and lower 0.019 "x 0.025" braided archwires were placed, and 6 oz. seating elastics were used. Subsequently, an occlusal adjustment was performed, and the fixed appliances were removed (Figure 6), where the final results were observed and confirmed with the imaging studies (Figure 7). Due to the characteristics of the patient, it was decided to use a *Prefinisher* retainer (Figure 8).

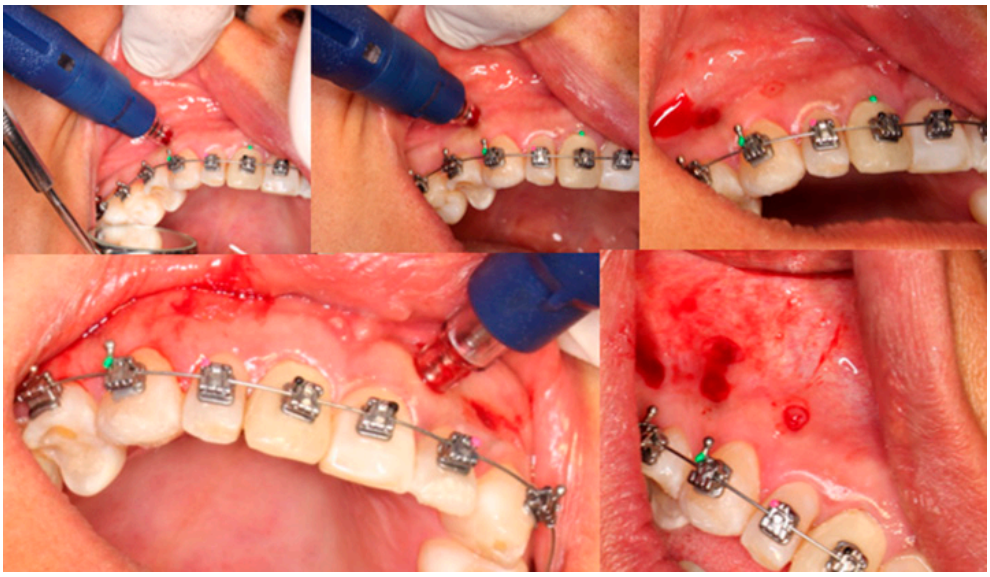

Figure 5. Intraoral photographs showing the MOP procedure in the inter-radicular area of 13-23.

The changes obtained both clinically and radiographically were considerable, and the dental and facial results were satisfactory. A Class I molar and canine maxillomandibular relationship and an adequate overjet and overbite were achieved, while also correcting the maxillary hypoplasia and providing a downward and backward rotation of the mandible, correcting the anterior crossbite, and obtaining matching midlines.

Figure 6. Final intraoral photographs, after removal of the fixed appliance.

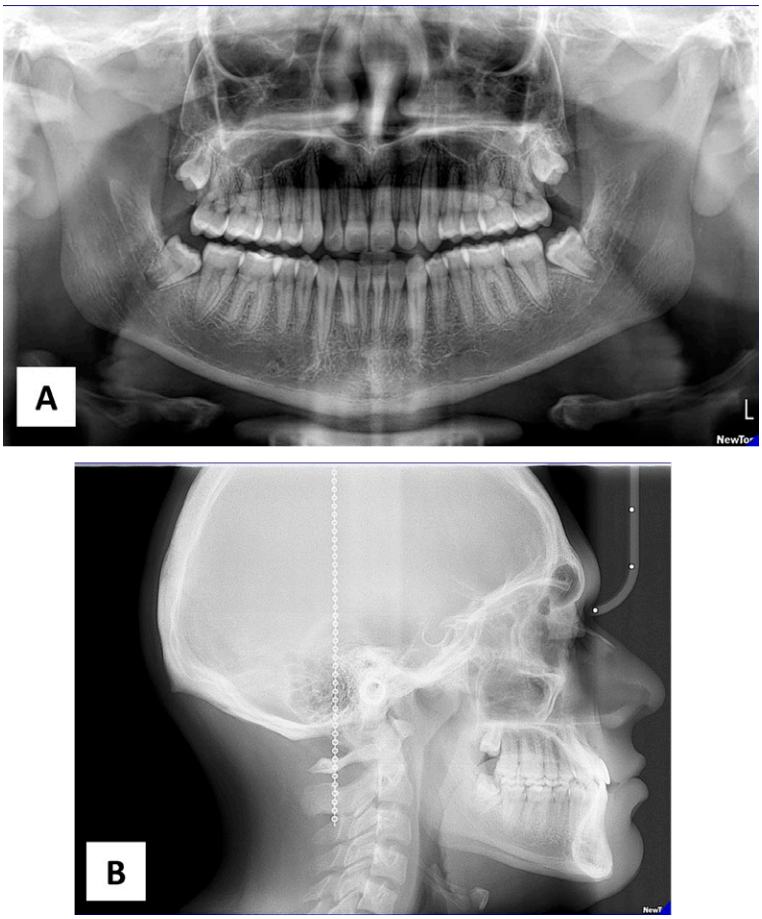

Figure 7. Final radiographic images. A. Orthopantomography. B. Lateral headfilm.

Figure 8. Intraoral photographs showing the placement of the *Prefinisher* retainer.

DISCUSSION

The maxillary hypoplasia with anterior crossbite was corrected with the use of the reverse face mask and micro-osteoperforations. Köle[12] in 1949 made cuts in the cortex of the premaxilla that were highly effective in accelerating tooth movement by correcting the skeletal discrepancy. Düker[13] and AlGhamdi[14] described in their results that neither the pulp nor the periodontium were damaged when corticotomies were performed using the technique established by Köle, which is one of the main advantages of bone cuts or perforations. However, it was a very traumatic surgical act[13]. Nevertheless, when performing MOPs in the zygomatic-maxillary and pterygopalatal sutures in this patient, satisfactory results were obtained, similar to those reported by these authors.

Alikhani *et al*.[15,16], demonstrated that by performing small perforations in the cortical bone, the rate of bone remodeling and tooth movement increases significantly, since the inflammatory response and the expression of cytokines in the periodontal tissues are potentiated[17,18]. Teixeira *et al*.[19] used a device designed to perform micro-osteoperforations, and reported an acceleration in the rate of tooth movement in orthodontic treatment[20].

This article presents the case of a patient who underwent interradicular MOPs on three occasions in the anterior maxilla, obtaining acceleration of tooth movement. These clinical results coincide with those reported by Alikhani *et al*.[15,16,18] and Teixeira *et al*.[19], as well as Prasad and Ravindran[20]. It has been established in several case reports that corticotomies aid in significantly decreasing orthodontic treatment time, as well as in reducing root resorption and increasing post-treatment stability[21,22]. Rapid movements do not damage the pulp vascularization. If the osteotomy cut does not affect the marginal bone, vascular changes will be seen in the free gingival mucosa and will indicate reactions in the periodontium[23].

Williams *et al*.[23] sustain that the improvements obtained in the sagittal position of the maxilla by disjunction and protraction were maintained in the long term, and that the observed relapses were due to mandibular growth, not to a relapse in the maxillary position, so they conclude that the effects of protraction appear to be stable. In the present case, the use of a reverse protraction mask was indicated for the correction of skeletal Class III with efficient vertical control. After the use of the mask, a chin rest is indicated as part of the retention both to maintain the mandibular relationship and to avoid relapse due to mandibular growth.

Deguchi and McNamara[24] affirm that the chin rest is effective as an option in the treatment of class III, even in those with the highest vertical dimension, since they find a decrease in the gonial angle, a decrease in mandibular growth, and a backward displacement of the symphysis without increasing the vertical dimension. In this clinical case, the results coincide with those reported by McNamara *et al*.[25], where sagittal advancement of the maxilla was achieved with formation and remodeling of the alveolar bone.

CONCLUSIONS

The selection of an adequate treatment for Class III malocclusions may avoid extractions and even orthognathic surgery.

As discussed by Ibarra-Ramírez –referenced in the complementary bibliography– the reverse face mask reported by Dr. Ruiz is capable of correcting skeletal Class III with vertical control. The mechanical stimulation of the reverse mask in conjunction with the MOPs achieves a formation and remodeling of the alveolar bone of the maxilla.

The use of the reverse protraction face mask allows vertical control of the maxilla by performing the traction in the sagittal direction. In addition, this mask can be used as a chin rest for retention.

The use of microosteoperforations, as a stimulus to amplify the inflammatory response in the periodontal tissues during orthodontic and orthopedic movements, caused an acceleration in bone remodeling, which was reflected in the final clinical and radiographic results obtained.

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