Interdisciplinary Treatment of a Class III Patient with Congenitally Absent Maxillary Lateral Incisors

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ABSTRACT

The purpose of this paper is to present a case report of an adult Class III patient presenting bilateral congenitally missing maxillary lateral incisors that compromised occlusal function as well as smile and facial esthetics. After the interdisciplinary diagnosis, spaces for prosthetic substitution were opened with the help of miniscrews. The orthodontic therapy achieved a better dental relationship, and the final interdisciplinary treatment results represented a significant improvement in function and both dental and facial esthetics.

CLINICAL SIGNIFICANCE

The interdisciplinary treatment of orthodontics and restorative dentistry is very important because the two complement each other in search of the best for the patient. This case demonstrates very well that where orthodontics provided the best tooth position prior to implant placement and restorations.

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INTRODUCTION

The maxillary lateral incisor is one of the teeth with the highest prevalence of congenital absence.[1] Because of the location of this problem, the patients with maxillary incisors agenesis usually seek orthodontic treatment for esthetic reasons and present high expectations. The orthodontist treatment planning these cases usually faces a key question: to open or to close the missing laterals spaces?

The controversy about whether to open or close the spaces of congenitally absent maxillary lateral incisors has long been discussed in the literature.[2–5] Both options present advantages and disadvantages.[6,7] Therefore, the decision to open the spaces for prosthetic substitution or to close them by mesial movement of the canines should be taken on an individual basis after careful diagnosis and a comprehensive interdisciplinary treatment planning.[8] In this way, the aim of this paper is to present a case report of an adult Class III patient presenting bilateral maxillary lateral incisors agenesis in which the individual characteristics of the case led the interdisciplinary team and the patient to decide to reopen the spaces for implant-supported restorations.

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DIAGNOSIS AND ETIOLOGY

A 31-year-old male sought orthodontic treatment and his chief complaint was: "I want to substitute my maxillary front teeth that never came in and improve my smile." Medical and dental histories were noncontributory, and no previous facial trauma or temporomandibular disorder symptoms were reported. The facial analysis revealed a symmetric face, adequate smile line and a slightly elongated lower facial third.

The esthetics of his smile was significantly compromised due to spaces resulting from the congenitally absent maxillary lateral incisors. The profile analysis revealed a mildly concave profile because of a midface deficiency. The nasolabial angle was increased, and his upper and lower lips were thin (Figure 1).

Intraoral examination showed a Class I molar relationship on both sides. The right canines also

FIGURE 1. Pretreatment photographs.

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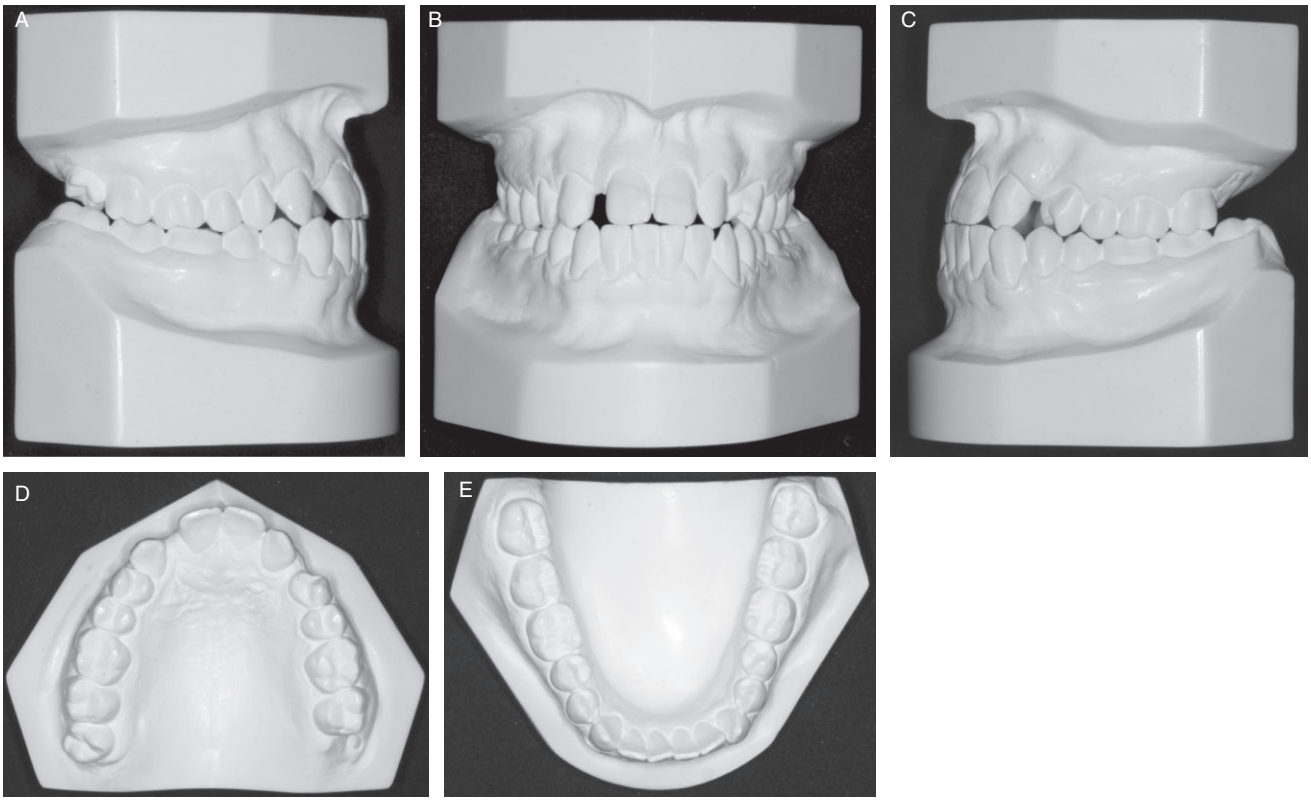

FIGURE 2. Pretreatment dental casts.

presented a Class I relationship, but there was a Class II on the left side because of the mesial eruption of the maxillary canine. Anteriorly, maxillary and mandibular incisors were on an edge-to-edge relationship. Occlusal photographs evaluation revealed good maxillary and mandibular arch forms and rotated maxillary first premolars. There was mild crowding (1 mm) on the mandibular arch (Figures 1 and 2). The cephalometric evaluation confirmed the clinical findings of a moderate skeletal Class III (ANB = 0°) and a slightly excessive vertical dimension (SN-GoGn = 35°). The maxillary incisors were labially inclined (U1-SN = 110°), and the mandibular incisors showed appropriate labiolingual inclination (IMPA = 90°). Soft tissue evaluation demonstrated good lower lip position and retropositioned upper lip to the S-line (Figure 1). The panoramic radiograph confirmed the absence of both maxillary lateral incisors. There was overall adequate alveolar bone level and all third molars, except the maxillary right, were fully erupted (Figure 3).

FIGURE 3. Pretreatment panoramic radiograph.

TREATMENT OBJECTIVES

The treatment objectives for this patient were to open spaces for prosthetic substitution of the congenitally missing maxillary lateral incisors, to maintain the appropriate molar relationship, and to establish adequate canine relationship on both sides, thus obtaining a better functional occlusion, and also to

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achieve normal overbite and overjet. The esthetic objectives were to improve the harmony of his smile and the upper lip support, consequently improving his facial profile.

TREATMENT ALTERNATIVES

Two treatment plans were presented to this patient: (1) space closure on the maxillary arch, extraction of the mandibular second premolars and orthognathic surgery to advance the maxilla, (2) flaring of the maxillary central incisors, derotation of the maxillary first premolars, and interproximal enamel reduction (IPR) on the maxillary canines and premolars to obtain adequate spaces for prosthetic substitution of the missing maxillary lateral incisors; IPR on the mandibular arch to resolve the mild anterior crowding, and to compensate for the maxillary IPR and thus to maintain the good posterior occlusion; placement of miniscrews between the four second premolars and first molars to provide maximum anchorage while closing the spaces obtained with both maxillary and mandibular IPR. The first option would address the patient's midface deficiency and improve his concave profile. It would also contemplate reshaping of the maxillary canines with enamel grinding and composite build-ups to try to mimic the normal shape of a maxillary lateral incisor. The patient rejected this treatment alternative because he did not feel any need to significantly change his facial appearance. He also did not want to extract teeth and face the risks and the high costs related to an orthognathic surgery. Therefore, orthodontic treatment was performed to open spaces for implant placement and prosthetic substitution of the congenitally missing maxillary lateral incisors.

TREATMENT PROGRESS

After the patient declined the treatment alternative involving orthognathic surgery, an interdisciplinary consultation was scheduled with the orthodontist, a prosthodontist, and a periodontist. The three specialists evaluated the patient together and discussed the prosthetic options to substitute both missing maxillary lateral incisors. After evaluating the patient's facial profile, his smile line height, the anatomy and color of his maxillary central incisors and canines, and the thickness and height of the attached gingiva, the interdisciplinary team decided that opening spaces for implant-supported crowns was the best orthodontic-restorative alternative for this patient. They also came to an agreement that 6.5 mm were the minimum amount of space required to insert implants with 3.5 mm of diameter. The patient was informed of the advantages and disadvantages of all treatment alternatives and he signed an informed consent authorizing the second treatment option.

Ceramic edgewise brackets (0.022×0.028-in, DENTISPLY GAC International, Bohemia, NY, USA) were bonded on both arches. Initial leveling and alignment was performed with 0.014-inch and 0.018-inch heat-activated nickel-titanium wires and finished on 0.018-inch stainless steel wires. Titanium miniscrews (S.I.N., São Paulo, Brazil) were placed between the second premolars and the first molars on all four quadrants. The majority of the space required for implant placement was obtained with the first and second molars distalization after all third molars were extracted, with the derotation and distalization of the maxillary first premolar and with the distal movement of the maxillary left canine until touching the first bicuspids. All of these movements were anchored on the miniscrews.

IPR was performed on maxillary premolars and canines to obtain the remaining amount of space required for implant placement and on the mandibular arch to compensate for the maxillary IPR as well as to maintain the adequate buccal occlusion the patient already presented before treatment. The miniscrews were removed after all required spaces were obtained. The maxillary central incisors were tied together with a steel ligature, and a temporary crown was used to maintain the spaces until the implants were placed and fully osseointegrated (Figure 4). The treatment proceeded with the installation of rectangular stainless steel arch wires (0.017×0.025-inch and 0.019×0.025-inch

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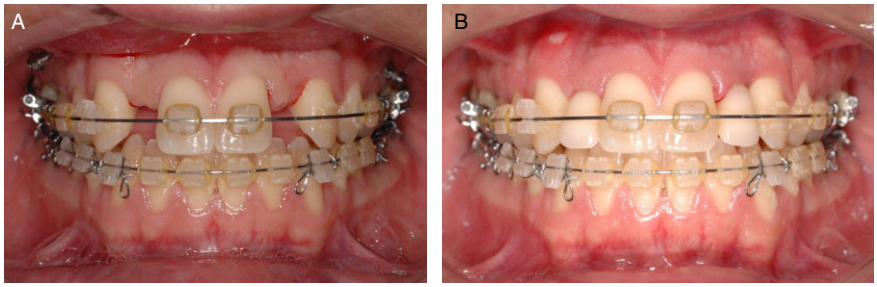

FIGURE 4. Progress orthodontic photographs after space opening and with temporary crowns.

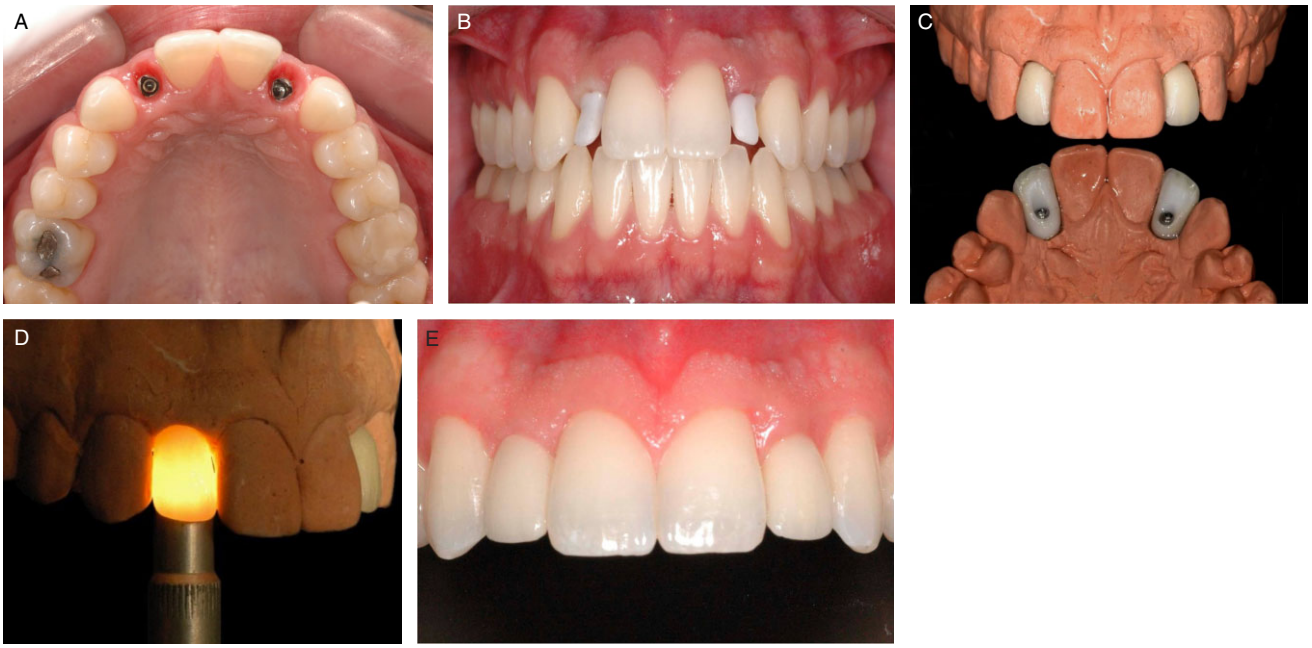

FIGURE 5. Progress prosthodontic photographs: A, Good periodontal health surrounding the implants. B, Zirconia abutments proof. C, All-ceramic crowns adapted to the working models. D, Adequate translucency of the restorative materials used. E, Final prosthetic result.

subsequentially) to correct the torque, improve arch coordination, and refine the occlusion.

At this stage of treatment, the patient was referred to the periodontist for implant placement. The implants used in this patients presented narrow 3.5 mm diameter platform (Replace Select Tapered NP, Nobel Biocare Brasil, São Paulo, Brazil) The implants were inserted after full-flaps were raised, and the prosthodontist inserted immediate temporary crowns over the implants in infraocclusion. Care was taken to avoid any functional contact over these crowns, both in maximum intercuspation and during the mandibular functional movements. The patient was instructed to avoid biting with his front teeth during the osseointegration period.

During the finishing stages of the orthodontic treatment, intermaxillary elastics were used to refine intercuspation. After debonding, the patient received a maxillary wrap-around and a mandibular spring retainer to be worn at night for at least the next 24 months.

Three months after the removal of the orthodontic appliances, the patient initiated the final prosthetic work. He performed an external bleaching during 4 weeks, and after the desired color of the teeth color was achieved, the prosthodontist inserted zirconia custom-made implant abutments (Procera, Nobel Biocare Brasil) and the final porcelain crowns (Figure 5). After the final porcelain crowns were inserted a

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full-coverage maxillary splint (Michigan type) was made for protection during the night.

TREATMENT RESULTS

The final results showed an overall improvement of the occlusion with a more adequate intercuspation of molars and premolars. Ideal canine relationship was achieved on both sides, and proper overbite and overjet were obtained (Figures 6 and 7). The distal movement of the maxillary premolars and canines, and the flaring of the maxillary central incisors provided the required space for implant-supported prosthetic substitution of the congenitally missing lateral incisors. The facial treatment objectives were also achieved. The flaring of his maxillary central incisors improved the upper lip support and helped to better camouflage the moderate skeletal Class III (Figure 6). The orthodontic-restorative treatment resolved

FIGURE 6. Post-treatment photographs.

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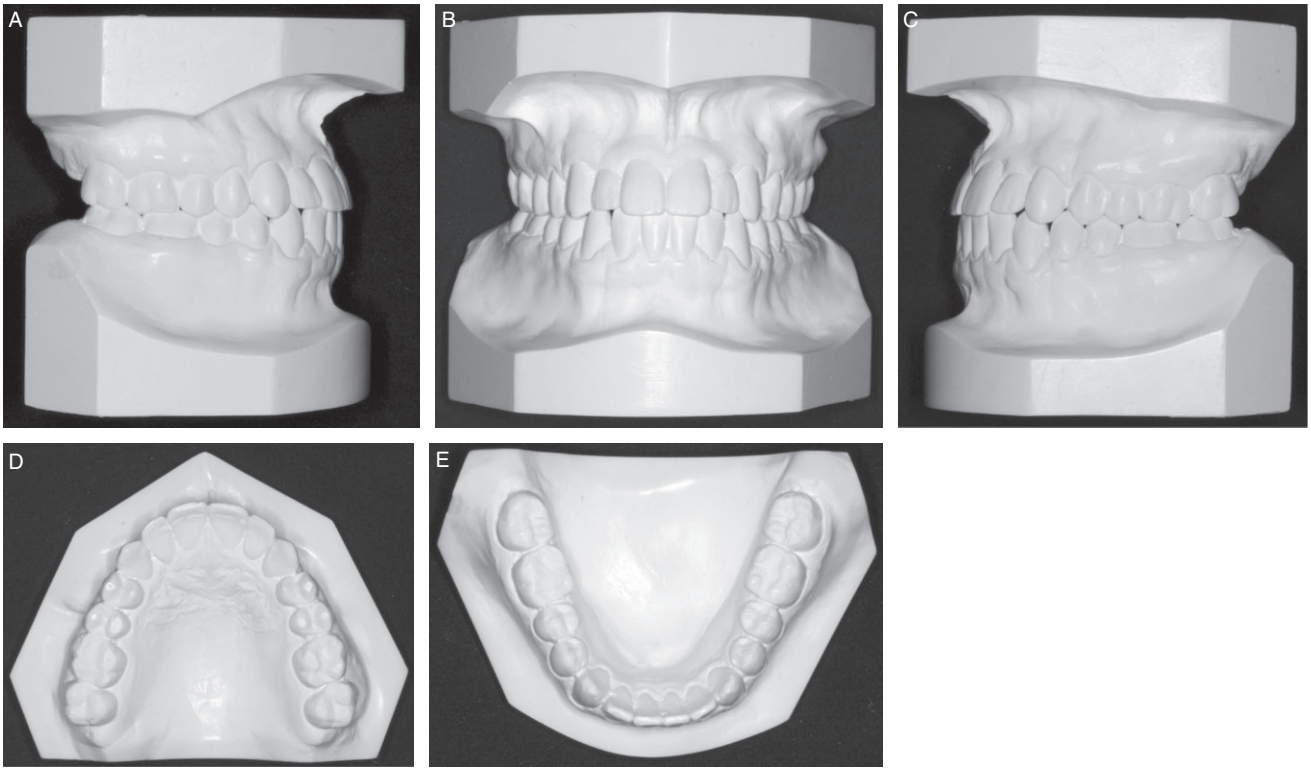

FIGURE 7. Post-treatment dental casts.

FIGURE 8. Post-treatment panoramic radiograph.

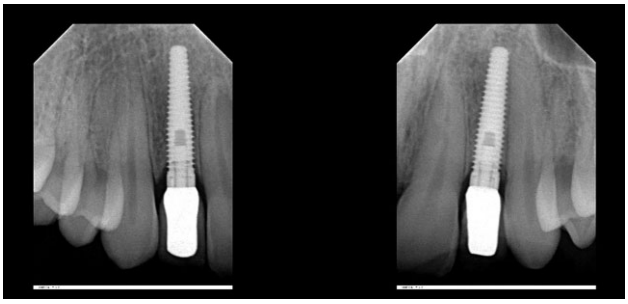

FIGURE 9. Periapical radiographs 3.5 years post-treatment.

the patient's chief complaints, substituting the missing lateral incisors and improving the esthetics of his smile as well as his facial profile without the need of an orthognathic surgery.

Post-treatment cephalometric analysis revealed no skeletal changes on both sagittal and vertical dimensions. Conversely, moderate dental modifications were registered. These changes were reflected in his more protrusive post-treatment upper lip position, whereas his lower lip position remained basically unchanged (Figure 6).

The post-treatment radiographs revealed proper root parallelism, adequate implant placement, and the maintenance of a good overall alveolar bone height (Figure 8 and 9). The final cephalometric radiograph and superimpositions confirmed that the space obtained for implant placement and both overbite and overjet correction were achieved with dentoalveolar movements).

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FIGURE 10. Facial and intraoral photographs 3.5 years post-treatment.

The patient was pleased that the results were obtained without the need of an orthognathic surgery and he was especially satisfied with the improvement in his smile esthetics. The results of this interdisciplinary treatment remain stable 3.5 years after the overall interdisciplinary treatment was completed (Figure 10).

DISCUSSION

Agenesis of maxillary lateral incisors often compromises smile esthetics, thus most patients presenting this problem need and seek orthodontic treatment. The frequency of missing maxillary lateral incisors varies among different populations ranging from 1% to 3% for congenitally absent maxillary laterals[9] with the bilateral absence being more prevalent than the unilateral.[10] Therefore, this is a relatively common clinical situation in the orthodontic practice, and it imposes an important and sometimes difficult decision for the orthodontist. The clinician must decide between opening spaces for future prosthetic work or closing the spaces anteriorly. The purpose of this paper was to illustrate a case in which spaces were opened bilaterally

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in an adult Class III patient for implant-supported restorations. A reflection about the circumstances that led the interdisciplinary team to choose this treatment alternative was also presented.

There are some treatment options for replacing missing maxillary lateral incisors with satisfactory results, including canine substitution and reshaping,[6,11] tooth-supported restorations,[5,7] and osseointegrated implants.[12] However, the debate whether opening or closing spaces is the best alternative in these cases remains open in the literature.[6,7] We believe that the orthodontist should not have a universal protocol for every missing maxillary lateral patient but rather carefully individualize his diagnosis taking into consideration all important diagnostic criteria[8] for each patient, balancing the advantages and disadvantages of the different treatment alternatives.

In cases of missing maxillary lateral incisors, it is beneficial to use an interdisciplinary treatment approach to obtain the most predictable outcome.[7] Our interdisciplinary team believes that this is indeed the best approach for these patients. In fact, before initiating any treatment procedure, we have been trying to have a consultation with all specialists involved, discussing the benefits and limitations of all treatment possibilities in front of the patient, as well as the ideal timing of the interventions in order to have the most efficient treatment. The patient presented in this case report said that the interdisciplinary consultation facilitated the understanding of his problems and possible solutions, as well as made him feel more secure about the chances of achieving a satisfactory final result. The interdisciplinary evaluation must consider some factors such as the type and the complexity of the overall malocclusion, the characteristics of the patient's facial profile, the nasolabial angle, the thickness of the lips, the height of smile line, if the absence is unilateral or bilateral, and finally, the shape, size, color, and position of the permanent canines.[4–13]

In the present patient, a careful examination was performed to collect all information needed for achieving the best treatment plan. The extraoral assessment showed a midface deficiency and a moderately concave profile. An idealistic treatment plan contemplating an orthodontic-surgical approach to correct this facial discrepancy was presented to the patient. He received a careful explanation demonstrating that an adequate presurgical orthodontic preparation would include distal movement of the canines and central incisors to close the missing lateral spaces on the maxillary arch and second premolar extractions on the mandibular arch to create room for an appropriate maxillary surgical advancement. The use of the canines as lateral incisors substitutes was considered possible because one of the most important success factors for the patients, a canine color matching the central incisor shade,[14] was favorable. The patient said he understood the reasons for considering this idealistic approach as a treatment option, and despite recognizing that the overall results would be more complete, he did not feel the need to significantly change his facial appearance, neither wanted to have teeth extracted, and most importantly, he would not like to be exposed to the risks and could not afford the additional costs involving an orthognathic surgery. Therefore, he asked if there was any other treatment alternative that could solve his major complaints despite not achieving as many improvements as this first option.

This is a very common situation for those orthodontists who treat adult patients. The lack of residual craniofacial growth and the presence of other problems such as missing teeth, bone loss, old and failing restorations, or abraded teeth restorations further complicate the treatment planning of these individuals.[15] The requirements to achieve the ideal treatment objectives may represent procedures that adults are not willing to go through. The clinician must be prepared to present one or even two treatment alternatives with realistic goals and cautiously explain them to the patient. The treatment planning process of adult orthodontic-periodontic-restorative patients should establish economically, occlusally, periodontally, and restoratively realistic treatment goals for each specific patient.[15,16] Although the final results of this case report were not perfect, they attended all patient's demands. The treatment implemented was financially realistic because it avoided the high costs of an

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orthognathic surgery. It was periodontally realistic because the amount of maxillary central incisors flaring was small, and the amount and thickness of the attached gingiva was adequate to support this change. It was occlusally realistic because adequate canine relationship was achieved on both sides; overbite and overjet were improved, and it was restoratively realistic because modern materials were used to minimize the possible darkening of the soft tissues around the implants.

The choice of treatment involving space closure without orthognathic surgery was not considered because closing anterior spaces in patients with such facial characteristics would increase the profile concavity and maximize the maxillary deficiency.[8] Moreover, this approach would increase the nasolabial angle and further reduce the support for the upper lip,[17] which was considered highly undesirable in this patient. Thus, space opening and subsequent prosthetic substitution was considered the better treatment option because it would increase upper lip support, thus camouflaging his moderate skeletal Class III appearance.

The recent advances in osseointegrated implants associated with modern prosthetic alternatives and the return of the nonextraction trend in orthodontics have increased the popularity of space opening to replace the missing lateral incisors.[7,8,12] Various studies have shown the successful osseointegration and long-term function of single-tooth implant-supported restorations.[18–20] Thus, the interdisciplinary team opted for replacing the missing lateral incisors with implants using modern prosthetic resources. Custom-made zirconia implant abutments associated to all-ceramic restorations were used to achieve better esthetics. These restorative materials minimize possible darkening of the labial gingiva around the implants through the years.[21,22]

Additionally, a careful examination of the alveolus dimensions is important to increase the chances of long-term success with implants. Without the development and eruption of the lateral incisors, the bone thickness and height in this region may be compromised.[23] However, when the permanent canines erupt mesially and occupy the lateral incisors position in the arch, the height and thickness of the alveolus is maintained.[12] As a matter of fact, in early treatment cases, the orthodontist should guide the canines to erupt into the missing lateral incisor space.[24] Although our patient did not receive any previous orthodontic intervention, fortunately, his maxillary canines were mesially enough to have maintained good alveolar bone dimensions. The distal movement of the canines during orthodontic space opening left adequate alveolus height and width for implant placement. The adequate bone height and thickness associated with a proper amount of keratinized gingiva and the zirconia implant abutment increased the chances for a good long-term esthetic result, avoiding the occurrence of cyanotic color of the soft tissue, gingival recession, or abutment exposure,[7,22] as confirmed with the 3.5-year post-treatment records.

In order to obtain long-term stability in cases with anterior implants, they should be placed only after growth is complete,[25] thus avoiding problems such as infraocclusion of the implants crowns.[26,27] If we had to maintain the edentulous space for some years to wait until growth is finished, the roots of central incisors and canines could converge toward each other and to ensure sufficient space for implant placement, at least 6.3 mm of intercoronal space and 5.7 mm of interadicular space would be required.[28] However, timing of implant placement was not an issue in this patient, and the interdisciplinary team agreed that 5.5 mm of both interadicular and intercoronal space would be sufficient for placing 3.5 mm diameter implants.

After evaluating the final aspect of the anterior gingiva, the papilla remained slightly more gingival than ideal. This was probably due to the amount of space created for implant placement. Six and 6.3 mm of space were the maximum obtained with the non-surgical orthodontic approach, and they were below the ideal 6.5 mm of space for adequate soft tissue response around the implants. If more space was created, a better emergence profile could have been achieved for the ceramic crowns, and an ideal papillae shape would have been obtained. However, the tomographic images

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showed that the alveolar bone buccal plates were too thin to support orthodontic lateral expansion of the dental arches.

The surgical implant placement was performed with a full-thickness flap to facilitated adequate implant positioning in such a tight space. A flapless approach associated to at least another 0.5 mm of space on each side may have represented a better final result minimizing the chances of developing the surgical scar noted on the left maxillary lateral incisor. These limitations were explained to the patient prior to the treatment, and he opted to the multidisciplinary treatment presented here because he did not want to extract premolars and neither undergo an orthognathic procedure.

Finally, the substitution of the maxillary wrap around Hawley retainer to a full-coverage maxillary splint after the final porcelain crowns were inserted was implemented to protect the teeth, to prevent arch constriction, and to avoid tooth eruption in relation to the implants.

CONCLUSION

Bilateral congenital maxillary incisors in a moderate skeletal Class III adult patient may be successfully treated combining orthodontics, periodontics, and prosthodontics. The use of miniscrews to improve anchorage control, small diameter implants to minimize space requirements, and modern prosthetic materials to optimize anterior esthetics demonstrated that the interdisciplinary efforts illustrated in this case report resulted in a realistic treatment approach that adequately camouflaged the moderate skeletal Class III and improved function and both dental and facial esthetics.

DISCLOSURE STATEMENT

The authors have no financial interest in the companies whose products were mentioned in this paper.

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