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Optimal Aesthetic Solution for Hypodontia in Frontal Maxilla with Interdisciplinary Approach.

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ABSTRACT

Tooth agenesis is one of the most common developmental dental anomalies in humans. The aim of this study is to offer a solution in cases of anterior agenesis, dental restoration with osseointegrated implants as the most conservative treatment. The main reason for this is to avoid preparation of the adjacent teeth. This is particularly very important element in planning the therapeutic approach since most of the patients are in young age. Following orthodontic treatment, the most common problems relate to less than ideal locations of teeth adjacent to the edentulous area and relapse of the orthodontic treatment outcomes. The problems created by the proximity of the roots of teeth to an edentulous area as a consequence of orthodontic treatment are difficult to manage. A case of a 22-year old patient with missing of lateral incisors in maxilla with previously completed orthodontic treatment is presented. The clinincal and paraclinical examination showed that the available edentulous spaces were marginally acceptable for implant supported restorations. Bilateral single-tooth implant supported metal-ceramic prosthetic crowns were constructed six months after osseointegration.

Keywords: lateral incisors, agenesis, orthodontic treatment, dental implants, crowns

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INTRODUCTION

The most common missing teeth in the population of European ancestry are the wisdom teeth (25-35%), followed with the lower second premolars (3%) and permanent upper lateral incisors (2%)[1]. Interdisciplinary cooperation between orthodontists, oral surgeons and prosthodontists became especially apparent and important when treating tooth-bounded gaps resulting from hypodontia [2, 3].

Agenesis of lateral incisors usually is treated with one of the following options: simple isolated orthodontic treatment, in which the canines are positioned in the place of lateral incisors; multidisciplinary orthodontic-prosthetic approach with fixed crowns which restore the empty spaces; and multidisciplinary orthodontic-implantologic-prosthetic option, in which after creating a sufficient bone segment in maxilla for implant treatment, single prosthetic crowns are fabricated and then fixed to the implants [4].

To make the final decision, if a patient is suitable for the orthodontic approach and to anticipate if additional restorations may be necessary, the authors strongly suggest a carefully executed treatment plan. This treatment plan should include full radiographic work-up, cephalometric analysis, full esthetic work-up (esthetic evaluation form), model analysis for Angle classification and Bolton discrepancies, model set-up, including the recontoured canine to predict the esthetic and functional result, as well as the amount of reduction (width, labial convexity, incisal and lingual eminence), which are necessary to achieve the desired results [5]. If carefully planned and executed, the orthodontic approach is the most conservative approach. Long-term esthetic results, superior esthetic outcome compared with implants and Maryland bridge, psychological comfort that the patient has no missing teeth are the main advantages, while the disadvantages of the orthodontic treatment refer to the possibility of a new restorative treatment and bleaching of the canine if it appears too dark [6].

Another approach to congenitally missing lateral incisors is the restorative approach. The restorative approach may be categorized as (1) resin-bonded bridge, (2) conventional bridge, and (3) cantilever bridge. The advantages of restorative approach are the occlusal and esthetic adjustments that can be done within the restoration (full-coverage fixed partial dentures) and the fast approach if no orthodontic treatment needed. However, the restorative approach is the least conservative one, additional orthodontic treatment may be needed, it has to be changed over lifetime and additional preparation of the adjacent teeth may be necessary [7].

The third recommended approach is the implant supported one. Several criteria have to be considered before placing a single tooth implant in adolescents: time of implant placement, development of a proper implant site, enough space coronally and apically, sufficient height of gingival and space retention before implant placement.

Advantages of orthodontic-implantological treatment are: ideal intercuspidation of canines with physiological occlusion and function, better physiognomy and aesthetics in frontal region because the teeth are maintaining the proper position in the dental arch and the permanent teeth are maintaining their natural shape and form and orthodontic treatment is significantly shorter [8, 9]. Disadvantages are: complete physiological osseal jaw growth must be definitive; during the time of implant osseointegration, a retaining of the space between central incisors and canines must be effective to prevent the inclination of adjusting teeth; a final couture of soft and hard tissue around the implants cannot be always predictable in aesthetic aspect; and finally, financial cost is always higher compared to the other approaches [10, 11].

The case described here suffers from aplasia of the upper lateral incisors. After the orthodontic treatment, the gaps were kept open, implant-supported restorations were placed later on. As the orthodontist, oral surgeon, prosthodontist and dental technician had been working together consistently, the outcome of aesthetics will be considered really satisfactory.

Case report

Twenty-two-year-old male patient referred to our clinic with bilateral missing of lateral maxillary incisors. Taking into consideration all the conditions and after a consult with orthodontist, a multidisciplinary approach was planned. All the necessary examination methods mentioned above were performed. The

orthodontic treatment included fixed orthodontic appliances in order to move the canines distally, to ensure contact between the central incisors and to maintain the space between central incisors and canines (Figure 1). After completed orthodontic treatment, all the necessary measurements were made for the implant phase. Therefore, two endooseal dental implants were inserted in the missing teeth regions (12 and 22) following the standard surgical and implant protocols and principles (Figures 2 and 3). Single tooth implant-supported metal-ceramic crowns were constructed and fixed six months after definitive implant osseointegration (Figures 4 and 5). The patient was evaluated by an orthodontist, an oral surgeon and a proshtodontist; the aeshtetic and functional results were considered as very satisfactory.

Figure 1. Clinical and radiological condition after completed orthodontic treatment. The retainer placed on the central incisors is also visible here.

Figure 2. Intraoperative view of implant placement

Figure 3. X-ray image, six months after implant placement

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Figure 4. Definitive position of fixed single tooth abatments

Figure 5. Definitive position of fabricated and fixed single-tooth metal-ceramic crowns over the implants

DISCUSSION

The maxillary anterior buccal crestal bone thickness can be very thin and deficient in vertical and buccolingual dimensions, much less than 2 mm. In fact, similar to findings in cadaver and clinical studies, a recent cone-beam study [12] revealed that facial bone thickness of 2 mm at levels 1, 2, 3, 4, and 5 mm from the bone crest was present in 0%, 1.5%, 2.0%, 3.0%, and 2.5% of patients, respectively. After removal of teeth, blood supply to this predominantly thin facial bone overlying maxillary anterior teeth can be disrupted, leading to detrimental bone loss or soft-tissue recession [13, 14]. Therefore, atraumatic procedures, use of alternative implant sites with adequate bone volume, and delayed placement of implants are recommended until enough bone volume is generated at the implant site by performing bone grafting, socket preservation techniques, or orthodontic bone regeneration.

The orthodontic extrusion of nonrestorable or periodontally compromised teeth increases the hard and soft tissue volume in the future implant site [14] and may eliminate the vertical bone volume deficiencies. Alveolar ridge augmentation techniques are more predictable in restoring the width of an alveolar ridge than its height [15]; nonetheless, orthodontic extrusion is one of the most reliable means of gaining vertical bone augmentation. This is particularly true in the maxillary anterior region, where vertical bone augmentation is difficult. Good plaque control, the existence of at least one-third to one-fourth of the apical attachment, and a sufficient stabilization period are necessary for a successful forced eruption. [16] The orthodontic extrusion is done at a rate of 1 mm per week, and a stabilization period of 1 month for each millimeter extruded has been recommended. When a periodontally compromised tooth is extruded, torquing and tipping of the tooth toward an angular bone defect increase the alveolar bone volume in the future implant site. With this strategy, some improvement of the interproximal papillary height can be expected.

With congenitally missing teeth, adjacent or opposing teeth may tip, drift, or overerupt, leaving edentulous spaces that are not favorable to replacement of missing teeth. Collectively, this affects the space and bone volume required for implant placement or the implant- supported restoration. The staged orthodontic treatment and some orthodontic strategies, such as the orthodontic extrusion, delayed orthodontic space opening, and the orthodontic implant site- switching technique, can preserve or augment the future implant site.

When it comes to treatment planning, x-ray imaging, 3D imaging and CT scan are necessary along with Bolton analysis and studio models. Establishing adequate proportion and optimal aestetitics in frontal maxilla are very significant clinical aspects. Objective orthodontic considerations in restorative management with endosseous implants are: short and retrognathic maxilla, prognathic mandible, and shorter lower anterior facial height, which sometimes need orthognathic correction as part of the complete treatment. Dental problems vary and include bimaxillary retroclination of incisors, spacing, centerline discrepancies, microdontia, hypoplastic enamels, ankylosis of the retained primary teeth, overeruptions, and volume deficiencies of alveolar ridges. The mentioned challenges, as well as the bone volume deficiencies, compromise the successful placement of implants. Orthodontic strategies and techniques, such as uprighting mechanics, extrusion/intrusion, delayed space opening, and orthodontic implant site-switching, can be used to create, preserve, or augment the implant site. After orthodontic site development, the final planned position of the teeth should be maintained with a rigid bonded retainer; overlooking this stage may compromise the implant site and require orthodontic retreatment.

Creating a sufficient space for dental implants requires minimal mesio-distal dimension of 5.5 to 8.0 mm and the optimal dimension for clinical crown needs to be at least 6.3 mm. Interradicular dimension should be at least 5.7mm, and there should be a 1.5 mm distance from adjusting roots of natural teeth.

Careful attention has to be paid to the distance of the apical roots between central incisor and canine [17]. A minimum of 5 mm is required generally to provide sufficient space for a 3.5-mm implant. This space has to be provided by an orthodontist, who controls the mesiodistal root angulation when creating space for an implant. During this process of creating space, the mesiodistal space coronally is achieved earlier due to a so-called tipping movement, followed by a change of the mesiodistal angu- lation of the roots. It is crucial not to rely on the appearance of the mesiodistal distance of the coronal aspect, which is achieved earlier than the proper mesiodistal distance of the roots. Not paying attention to this aspect leads to too early removal of the orthodontic appliances and, therefore, insufficient space between the roots. To prevent this mistake, radiographs of this particular area should be made to make sure that sufficient interradicular space is created before removal of orthodontic appliances.

CONCLUSION

The concern for esthetics is an ever-growing demand and goal in today's dental treat- ment plans provided to patients. In the past, function, biology, and structure were more important; esthetics had to follow. Today, it should be the goal to start with the best esthetic outcome in mind and then work out the treatment plan according to it. That does not mean that function, biology, and structure are less important than before; it just means that the esthetic goal should be set first, not at the end of the treatment. As Dawson said, "if know where you are, and if you know where you are (esthetically) going, getting there is easy."

As discussed previously, many instances need a team play of several specialties to reach the optimal esthetic result for individuals. It is important that every member of the team is exactly aware of what he or she has to do; otherwise, the result may become compromised or even disastrous. Such complications may be avoided by systematically designing a multidisciplinary treatment plan in which individual responsibilities are detailed in chronologic order, so that everybody has a clear picture of what to do and what the team players have to do.

Specifically, for missing congenitally lateral incisors there are several treatment options, which all can lead to a good result if patients are properly selected for an ideal treatment. Canine substitution can be a good treatment solution, if certain criteria are met. Nevertheless, team play with a restorative dentist is often required to reach an optimal esthetic outcome. Also, the restorative option can be used to meet a patient's high esthetic demands, if used in the right situation; hence, requiring an interdisciplinary treatment approach

is often necessary to get the best result. Implants are probably the most favorable treatment alternative for many dentists for replacing missing anterior teeth. The implant approach in the anterior region is a delicate situation, which can be challenging esthetically, especially in the long term. In this scenario, it is necessary to work as a team to have ideal conditions before and after implant placement. Autotransplantation can be a good alternative in growing patients. It is not suitable for nongrowing adults. As in all the other treatment options, an interdisciplinary approach between oral surgeon, periodontist, orthodontist, and restorative dentist is crucial. This may be the most important take-home message in today's world: with the high demand for esthetics, it is not possible for a dentist who tries to work alone to achieve an optimal esthetic result, especially in challenging cases. Furthermore, it is imperative to have the best people in every specialty working together to satisfy patients' esthetic needs. More importantly, there should not be a scenario where several specialists are working on a case but one where all these specialists are working together on a case. This ideal equilibrium between all the different specialists defines the interdisciplinary team approach, which will lead to the best esthetic outcome possible.

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