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Management of Congenitally Missing Lateral Incisors with Orthodontics and Single-Tooth Implants (A Case Report: After One Year Clinical Follow-Up)

Authors

**Abu-Hussein Muhamad¹, Abdulgani Azzaldeen², Watted Nezar³,
Zahalka Mohammed⁴**

¹University of Naples Federic II, Naples, Italy, Department of Pediatric Dentistry, University of Athens, Athens, Greece

²Department of Conservative Dentistry, Al-Quds University, Jerusalem, Palestine

³Clinics and policlinics for Dental, Oral and Maxillofacial Diseases of the Bavarian Julius-Maximilian-University Wuerzburg, Germany

⁴Postgraduate Student, Programm of Implantology, Goethe Dental School, Frankfurt/Germany
Corresponding Author

Dr.Abu-Hussein Muhamad

123Argus Street, Athens, Greece

Email: abuhusseinmuhamad@gmail.com

Abstract

Congenitally missing teeth are frequently presented to the dentist. Interdisciplinary approach may be needed for the proper treatment plan. The available treatment modalities to replace congenitally missing teeth include prosthodontic fixed and removable prostheses, resin bonded retainers, orthodontic movement of maxillary canine to the lateral incisor site and single tooth implants.

Careful treatment planning, space management, augmentation of bone and attention to the details of implant surgical and pros-thetic techniques are important factors when treating anterior maxilla, especially in the replacement of missing teeth. This case report addresses the fundamental considerations related to replacement of a congenitally missing lateral incisor by a team approach.

Key words: Dental implant, lateral incisor, case report.

INTRODUCTION

Hypodontia is defined as the developmental absence of one or more teeth either in the primary or permanent teeth, excluding third molars. Patients with hypodontia especially

developmentally missing incisors may present in varying degrees of severity prompting them to seek treatment for improvement in dental / facial aesthetics and function. Patients commonly complain of „gaps in their front teeth“, non-

eruption of permanent incisors following exfoliation of deciduous incisors, disharmony of front tooth size or an unattractive smile. It is quite a common problem often initially seen by the GDP and usually referred to the orthodontist for management^[1,2]

Missing incisors can have a major impact on dental and facial aesthetics and often may affect the self-esteem and social well being of the individual. Usually this condition can be detected at an early age through early diagnosis by the GDP. Hypodontia is often associated with other dental anomalies and early and/or interceptive management can reduce the development of more severe malocclusion and preserve dental structures necessary for restorative procedures^[1,2,3,4,5]

The prevalence of hypodontia in the primary dentition is about 0.5% and range from 3.5-6.5% in the permanent dentition in Caucasians, with females outnumbering males by a ratio of 3:2. Maxillary lateral incisors are more commonly missing than mandibular incisors in Caucasians. However, mandibular incisors were found to be the most commonly absent teeth in Chinese and Japanese populations and was more prevalent than missing maxillary lateral incisors. Similar findings have been reported in local Malaysian children where the prevalence of missing mandibular incisors was the highest among developmentally missing teeth (32-49%).^[5,6,7,8,9]

Environmental factors which cause arrested tooth development may include factors that cause failure of tooth bud cell proliferation from the dental lamina. This may be due to infection (eg. rubella, osteomyelitis), trauma in the dental region such as fractures, surgical procedures on the jaw

and extraction of the preceding primary tooth, drugs (eg. thalidomide), chemotherapy or radiotherapy at a young age.^[1,2,6,9,10]

Hypodontia usually has a genetic basis and often a high proportion of affected individuals have a family history of hypodontia or associated dental anomalies. Mutation in transcription factors MSX1, PAX9 and AXIN 2 have been identified in families with an autosomal dominant oligodontia. Normally, teeth which are „end of series“ are more commonly absent, i.e. lateral incisors, second premolars and third molars. Hypodontia is also often seen in patients presenting with syndromes such as ectodermal dysplasia, Down's syndrome and hemifacial microsomia and in non-syndromic conditions such as cleft lip and palate. However, familial hypodontia is complex and multifactorial; influenced by a combination of gene function, environmental interaction and developmental timing.^[6,9]

This interdisciplinary approach may involve preprosthodontic orthodontic treatment following consultations with an oral surgeon or a periodontist and a restorative dentist to ensure that orthodontic alignment will facilitate the surgical, implant and restorative treatment.^[9]

For patients with congenitally missing lateral incisors, who have over-retained primary lateral incisors or canines, keeping the primary tooth as long as possible should be considered to preserve the supporting alveolar bone for future implants.^[2]

When planning for the placement of a single-tooth implant, the orthodontist must ensure adequate space between the crowns and roots. Both the quantity and quality of alveolar bone must be assessed before implant placement is

considered. To accommodate a standard implant there should be a minimum of 10 mm of in-ciso-gingival bone and a minimum of 6.0 mm of facial-lingual bone. ^[2,9] In cases where there is insufficient alveolar bone for implant placement, ridge augmentation may be necessary in addition to orthodontic repositioning of adjacent teeth. ^[3] Adequate space for the implant is also required between the adjacent roots. The average dental implant fixture is 3.75 mm wide, and 1 to 2 mm of space is necessary between the fixture and the adjacent roots ^[3,9] Typically, between 6 and 8 mm of bone between the central and canine roots is recommended. Creating adequate space between the roots must be specifically addressed since the central and canine roots may be brought into closer proximity when the teeth are initially aligned orthodontically ^[2,9] To create adequate space for the implant, further orthodontic treatment may be necessary to move the roots further apart. Space for the coronal restoration must also be assessed. The average implant platform, which is 4.0 mm wide, requires a space of 1.0 mm mesially and distally between the platform and the adjacent tooth to facilitate proper healing and the development of a papilla postoperatively; thus, a minimum of 6 mm of space for the lateral crown is required. ^[4,5]

CASE REPORT

This case was a 18-year-old female (Figures 1a,b,c) who had congenital missing of lateral incisors and her chief complaint was missing of the lateral tooth and the diastema.



Fig.1 a-c; Pretreatment photographs.

The treatment plan was:

- **Initial therapy (SRP)**
- **Orthodontic therapy for alignment and achievement of sufficient space**
- **Surgery: ridge augmentation and implant placement**
- **Prosthesis**
- **SPT (supportive periodontal therapy)**

First the space required for implant placement was achieved by orthodontic therapy (Figures 2). To

place the implant in a proper position, a bone graft was placed labially to create an adequate ridge width because the tomography showed that the ridge width was insufficient for implant placement.

The donor site was the external oblique ridge site and the lateral aspect of the ascending ramus.



Fig 2; wax-up

A. Surgery (Figures 3a-d,4a-c,5a-c)

Lateral ridge augmentation was carried out using autogenous bone by using a trephine bur and an envelope flap (Trephine Bur Bone Harvest) [6,9]. The implant was placed after 6 months.

Blocks of grafts from oblique ridge and the lateral aspect of the ascending ramus were harvested and used to create an adequate ridge width anatomy and the collected bone was used as space filler. Six months later, one implant with a diameter of 3.8 mm and a length of 10 mm was placed. Six months later, the second stage surgery and aesthetic surgery for leveling of gingival margins were performed and the final restoration was placed.



Fig 3a; minor expansion



Fig 3b; wide-based flaps are done



Fig 3c; 3.0-mm fixtures are placed



Fig 3d; Intraoral view of the patient after implants



Fig 4a; retainer post-ortho



Fig 4b; Good periodontal health surrounding the implants

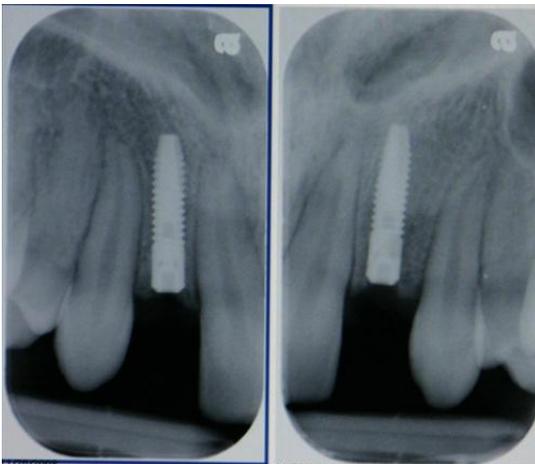


Fig 4c; Periapical radiographs 3months post-treatment



Fig 5a;3 months later uncovering



Fig 5b; Progress prosthodontic photographs: Good periodontal health surrounding the implants



Fig 5c; retainer post-ortho after 3 mnths

B. Restorative (Figures 6a-d)

Six weeks after surgery the patient returned for the restorative phase of treatment. The healing abutment on the implant was then modified to create a better emergence profile (1,2,%). This was achieved with air abrasion of the healing abutment, application of metal primer, bonding agent and flowable composite. The desired effect was achieved in that the soft tissue moved in a bucco-apical direction creating a more labial emergence profile. A harmonious gingival contour with the adjacent teeth was established. It was suggested from the outset that a crown lengthening procedure on the peg shaped lateral would create a longer crown length and a more symmetrical gingival contour in relation to the contra-lateral incisor [4,7,8,9,11]. The patient decided to keep treatment simple and avoid further surgery and cost [2].

An open tray NC impression coping was connected to the implant and verified radiographically. The 12,22 was minimally prepared for a full coverage veneer. A polyether impression compound was used to take the final impression, taking great care to record the soft tissue emergence profile.

A customised final abutment was cast accordingly and torqued to 35 Ncm. The porcelain fused to metal crown was cemented with Tempbond. The Emax full coverage veneer was luted with transparent Rely-X veneer cement, and the upper Hawley retainer adjusted to fit.



Fig 6a,b,c Patient's smile after one year clinical follow-up



Fig 6d; Periapical radiographs after one year clinical follow-up

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 laterals²² with the bilateral absence being more prevalent than the unilateral^[9,10] 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 in an adult Class II 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^[6,9,11]

tooth-supported restorations^[5,7,9] 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 criteria⁸ 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.^[7,13,14] 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^[15,16]. 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^[17,18] 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.^[9,18,19,10]

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]

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.^[22,23] 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 interradicular 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 interradicular and intercoronal space would be sufficient for placing 3.5 mm diameter implants.^[21,22,23]

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.^[21,22,23]

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

Congenitally missing lateral incisor presents challenging treatment planning for the dentist as they are usually associated with other malocclusions and abnormalities. Selecting the appropriate treatment option depends on the malocclusion, the anterior relationship, specific space requirements and the conditions of the adjacent teeth. In order to obtain the best aesthetic and functional result, a multidisciplinary team approach involving the orthodontist, implantologist and prosthodontist is required.

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