e-ISSN:2320-7949
p-ISSN:2322-0090

RESEARCH AND REVIEWS: JOURNAL OF DENTAL SCIENCES

Treatment of Patients With Congenitally Missing Lateral Incisors: Is an Interdisciplinary Task.

Abu-Hussein Muhamad[1], Watted Nezar, Abdulgani Azzaldeen, and Bajali Musa[1].

[1]Department of Pediatric Dentistry, University of Athens, Athens, Greece.
[2]Department of Orthodontics, Arab American University, Jenin, Palestine.
[3]Department of Conservative Dentistry, Al-Quds University, Jerusalem, Palestine.

Research Article

Received: 11/07/2014
Revised : 13/08/2014
Accepted: 15/08/2014

***For Correspondence**

Department of Pediatric Dentistry, University of Athens, Athens, Greece.

Keywords: Congenitally missing teeth, dental implants, interdisciplinary approach

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. Dental implants offer a promising treatment option for placement of congenitally missing teeth. Interdisciplinary approach may be needed in these cases. This article aims to present a case report of replacement of bilaterally congenitally missing maxillary lateral incisors with dental implants.

INTRODUCTION

The successful use of dental implants to replace missing teeth has been one of the most popular, exciting and evolving areas of clinical dentistry [1].

When implants are thought as a treatment option, treatment planning has become more complex for the dental practitioner, and an interdisciplinary team approach is recommended [2,3]. Interdisciplinary approach would involve a preprosthetic and orthodontic treatment and following consultations with an oral surgeon and a restorative dentist, implant treatment was selected as a treatment modality [2].

Congenitally missing permanent teeth can be subdivided into anodontia (total agomphiasis), oligodontia (more than six permanent teeth are missing) and hypodontia (less than six permanent teeth are missing) . The etiology of this selective dysfunction is still unknown but mutations of the genes PAX9 and MSX1 are being discussed . Congenitally absent permanent teeth are often observed in combination with various syndromes. A relatively frequent dysfunction is ectodermal dysplasia that may occur in different forms [1,2].

Polder et al found in their meta-analysis that dental agenesis differs by continent and gender: The prevalence for both sexes from Caucasian populations in North America, Europe and Australia ranged from 3,2 % males and 4,6 % females in North-American to 5,5 % males and 7,6 % females in Australia. The most affected teeth were the mandibular second premolar followed by the upper lateral incisor and the upper second premolar [3].

Högberg et al. impressively describe in their study of 1986 that at the age of 9 years children can realise that they are handicapped. Accordingly psychological help may be necessary, depending on the degree of aplasia.

Missing lateral incisors as well as peg shaped lateral incisors present the clinician with unique and very challenging aesthetic demands [2,3,4]. It is helpful to determine from an early stage which final

treatment modality would be utilised. Treatment options include space closure, re-establishment ofthe space or no treatment at all(4). These cases are best identified and managed at an early age and usually require a multi-disciplinary approach. If implants are utilised it is important to choose an implant system that is versatile so that any restorative requirement can be addressed. In young patients it becomes important to choose a strong implant design and a system that offers a cone connection and horizontal offset. With modern treatment modalities a very satisfactory outcome can now be achieved [2,4,5].

The patient and parents should be counseled about the complexities of this unfortunate anomaly as soon as it is identified. All the available long-term treatment options need to be discussed as well as the considerable cost implications of each [4,5].

Most patients are diagnosed with hypodontia between the ages of 6 – 12 years. The general dentist is well positioned to manage the case and to make necessary referrals at the appropriate stages of development. Regular consultation visits are thus highly recommended and routine maintenance and restoration of the dentition is important as part of the overall management of the patients [6].

Regardless of the type of replacement therapy, multiple disciplines will most likely be involved in managing the patient with congenitally missing teeth. Multidisciplinary treatment considerations require excellent communication to obtain the result necessary for restorative excellence. A thorough diagnosis and treatment plan must precede orthodontic therapy.The orthodontist must understand critical parameters of root alignment and symmetrical distribution of edentulous spaces. Diagnostic wax-ups at the end of orthodontic treatment can be decisive in determining final tooth position, and consultation with the surgeon who will place the implants is critical [7,8].

Indications and Contraindications

The following factors have to be evaluated in a patient with congenitally missing lateral incisors so as to proceed to space opening or closing procedures.

Profile

Patients with concave profile type usually have an edge-to-edge or a negative overjet and present midfacedeficiency and/or mandibular prognathism. If upright maxillary incisors need to be protruded, or tipped labially, to correct anterior crossbites or to gain upper lip support, space opening is indicated as this will improve the midface deficiency [2,4].

Occlusion

Class III malocclusion is regarded as an inarguable indication for space opening and prosthetic restorations for the missing lateral incisors as this can camouflage the existing malocclusion. This will effect also in the possible midface discrepancy that usually co-exists in this type of malocclusion [2]. Where the skeletal discrepancy is not severe, the space opening procedure may produce a stable Class I incisor relationship at the end of treatment, if sufficient overbite is present. Orthodontic space opening is also indicated when there is no significant malocclusion or normal intercuspation of the posterior teeth, as it will maintain an Angle Class I occlusal type.1 Finally, when pronounced spacing is present in the maxilla, space opening is the treatment of choice [2,3,9,10].

Advantages

Space opening for missing maxillary incisors favors an ideal intercuspation of canines through first premolars and as a result this is marked as an advantage both functionally and occlusally. These teeth are maintained in their natural position within the dental arch with their natural morphology.

In addition, if the treatment plan includes a single tooth implant implant, the natural teeth remain totally untouched. Finally, the orthodontic treatment is generally shorter in contrast with orthodontic space closure [2,3,9,10].

Disadvantages

The major disadvantage of this treatment option is that it commits the patient to a lifelong prosthesis in the most visible area of the mouth where tooth shade and transparency, gingival color,

contour and margin levels are critical and difficult to control, particularly in the long term. Furthermore, the overall treatment is not complete when the orthodontic treatment ends. This means, particularly in adolescent patients, that the patient needs long-term retention of the spaces with temporary retainers until all skeletal growth is complete and tooth eruption has ceased, so he or she is eligible for permanent restoration. In addition, all the additional expenses for the permanent restoration and its lifelong maintenance are marked as a disadvantage [2,9,10,11].

This paper describes the therapeutic use of osseointegrated implants to replacε congenitally missing upper lateral incisors. Highlighting the importance of the Orthodontic/Restorative interface.

Case Report

The initial clinical exam revealed diastema, congenitally missing maxillary lateral incisors with the canines located in the lateral incisor positions, and the primary maxillary canines still located in their original positions.These aspects created not only esthetics deficiencies but also maloclussion. Therefore, a multidisciplinary treatment was suggested to restore both esthetics and function [2,6,12,13,14,15,16].

Phase 1: Planning

All dental professionals involved in the treatment (orthodontist, periodontist, master ceramist, and operative dentist) evaluated the clinical case individually to decide which noninvasive procedures were indicated. Next, the four professionals discussed the prognosis and limitations of the case. The master ceramist performed a diagnostic wax-up to provide a model of the multidisciplinary treatment. After patient approval, the conservative treatment was then split into three restorative phase orthodontic, surgical, and restorative [12,13,14,15,16].

Phase 2: Orthodontics (Figs1to 8)

Dental implants have become a common method for restoring missing teeth. However, especially upper lateral incisor implants are esthetically challenging. The orthodontic improvement of the procedure and the final attendance result of these patients can be accomplished best by positioning the remaining natural dentition in the anatomically correct location. This treatment should be closely coordinated with the implant placement and the restorative team . In cases of extensive dento-alveolar and skeletal malformations, occlusion and facial proportions additionally must be improved by orthognatic surgery and sometimes even by esthetic plastic surgery [2,9,16,17].

The orthodontic treatment used the following parameters for evaluation: sagittal relationship between the dental arches; posterior occlusion; location, shape, and size of the canines; amount of remaining interdental space; and profile and facial skeletal pattern of the patient [5,6,7,8,11].

After orthodontic treatment was finalized, the orthodontic brackets were removed and a removable appliance was used to replace the missing maxillary lateral incisors [5,6,7,8,9,11,13,14].

Phase 3: Surgical (Figs 9 to 20)

A more recent option for treating congenitally missing lateral incisors, and one that currently is recommended often, is the single-tooth implant. Over the past several years, the predictability and longterm success rates of implants have made them an obvious restorative choice,5 especially when teeth adjacent to the space are healthy, of normal size and shape, and unrestored. Furthermore, placement of an implant may provide a functional stimulus to help preserve bone and prevent resorption. However, when choosing the single-tooth implant as a restorative option, several factors must be taken into account such as growth considerations, space requirements, and site development [2,3,15].

Because an implant acts essentially like an ankylosed tooth, any vertical alveolar growth and eruption of teeth would cause a discrepancy between the gingival margin of the natural tooth and the implant.Therefore, implant placement should occur only after growth has been completed, and it has been suggested that neither chronological age nor hand-wrist radiographs are reliable enough to make that determination. Instead it would be best to compare superimposed cephalometric radiographs taken at 1-year intervals until no growth changes are detected [16,17]. Also, the amount of space between the roots is critical to successful implant placement, and orthodontic intervention usually is necessary to achieve not only the amount of interradicular space needed, but also the proper rootarigulation.Because orthodontic

treatment usually occurs at an early age, several years of maintenance therapy may be required until the appropriate age for implant placement. It is also important to maintain proper spacing for ideal tooth proportions of the final restoration In addition to the tooth width requirements for mesiodistal spacing, the alveolar width in a buccolingual direction must be adequate for implant placement. Often an additional surgical appointment is necessary to graft or augment the alveolar ridge before an implant can be placed. It has been suggested in the literature that by allowing or guiding the eruption of the canines into the lateral position and orthodontically moving them to their natural position, the necessary amount of buccolingual alveolar thickness for implant placement can be achieved naturally, without the need to perform any ridge augmentation [17,18].

Although not completely understood, it has been shown that very little, if any, resorptive change in alveolar bone width is observed when space is opened orthodontically compared with the decrease in alveolar ridge width after extraction of maxillary anterior teeth. However, a disadvantage of orthodontic canine distalization for implant site development is the potential for loss of arch length when the canines are allowed to eruptmesially [9,17,18,19].

When agenesis of maxillary lateral incisors is diagnosed in a young patient, usually primary maxillary lateral incisors are retained. In such cases, it may be necessary to selectively extract the primary lateral incisors to encourage the permanent canine to erupt mesially, adjacent to the central incisor.

The canine will influence the thickness of the edentulous alveolar ridge due to its large buccolingual width; otherwise the osseous ridge will not fully develop due to the absence of the lateral incisor [2,4,18].

As the canine is moved distally to open space for the lateral incisor implant and crown, the root movement creates an increased and adequate alveolar ridge which allows proper implant placement. However, the time of implant placement should be relative close to the orthodontic treatment. This procedure is called “Implant site development”. If inadequate alveolar ridge is present, ridge augmentation may be necessary using bone grafts [19].

Adequate implant space: The amount of space needed for the implant and crown is generally determined by the contralateral lateral incisor. However, if both lateral incisors are missing or the contralateral one is peg-shaped, the amount of space should be determined by one of the methods below:

- The golden proportion or a recurrent esthetic proportion
- The Bolton analysis
- A diagnostic wax-up
- Mean values

The small size of the maxillary lateral from 5,5-8,0 mm requires careful planning for an implant to be placed. Is important that orthodontic movement has distanced not only thecrowns, but the roots of the adjacent teeth too. Generally, the adequate coronal space should be no less than 6,3mm whereas the interradicular space no less than 5.7mm. «At least, 1,5 mm between of the implant and adjacent roots is desirable as it is cited that narrower distances between them are more likely to show a reduction in bone height over time. In addition, fixed retention is suggested rather than removable appliances to prevent relapse. crowns, but the roots of the adjacent teeth too [2,9,10,11]. Generally, the adequate coronal space should be no less than 6,3mm whereas the interradicular space no less than 5.7mm. «At least, 1,5 mm between of the implant and adjacent roots is desirable as it is cited that narrower distances between them are more likely to show a reduction in bone height over time. In addition, fixed retention is suggested rather than removable appliances to prevent relapse.

Generally, implants must not be placed until the patients have completed their facial growth and the majority of their tooth eruption(2,6,8,11). As the face grows and the mandibular rami lengthen, teeth must erupt to remain in occlusion. However, the implant behaves like an ankylosed tooth and will not follow the changes of the alveolar processes due to the eruption of adjacent teeth. This may result in clinical infra occlusion of the implant supported
crown and cause a discrepancy in the occlusalplane and between the gingival margins of the implant and the adjacent natural teeth. Thus, evaluation of the completion of facial growth by cephalometric radiographs must be done and subsequently, the patient should be informed for the optimal time of implant placement. However, even mature adults can exhibit major vertical steps afteranterior restorations with implants to the same extend as adolescents [4,5,7,17].

e-ISSN:2320-7949
p-ISSN:2322-0090

Phase 4: Restorative (Figs 21 to 39)

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 [4,7,8,11]. 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 [2,7,9,13,17,18].

DISCUSSION

For patients with congenitally missing lateral incisors, in addition to over-retained primary teeth, permanent canines may erupt or drift mesially into the edentulous space. If the space is to be opened orthodontically for ideal prosthesis, the canines will need to be moved distally, which may result in development of the alveolar ridge in the canine region [2,7,20]. In cases where the occlusion and esthetics of the canine in the lateral position are acceptable, closure of the lateral space by the mesially positioned canine may be the simplest alternative treatment option.However, in all the above congenital missing cases we considered space opening followed by fixed prosthesis would be more acceptable on aesthetic point of view [19,20,21].

Esthetics as well as occlusion must be considered in the final orthodontic positioning of the teeth adjacent to the edentulous space. To satisfy the "golden proportion" principle of esthetics, the space for the maxillary lateral incisor should be approximately two-thirds of the width of the central incisor.

However, if the patient is missing only one maxillary lateral incisor, the space required to achieve symmetrical esthetics and occlusion is primarily dictated by the width of the contralateral incisor [22].

The optimal time for placement of fixed prosthesis is after the growth of the maxilla, mandible and alveolus is complete. If fixed prosthesis/implant are placed before growth is complete, the surrounding alveolar bone may continue to develop vertically and adjacent teeth may continue to erupt. Thus a discrepancy between the gingival margins of the prosthesis and the natural teeth is created and the prosthesis appears to became submerged. This creates a functional as well as an esthetic problem [23].

In this case, alveolar bone was available in maxillary lateral incisor areas in the mesiodistal and coronoapical dimen-sion; however, there was deficiency in orofacial dimension. The patient was refused to have bone augmentation procedures using either autogenic or synthetic bone grafts because of financial and patient related factors [24]. Therefore, implants with 3 mm diameter were used to compensate for horizontal alveolar bone deficiency. However, to avoid labial fenestration, the implants had to be placed off axis in labial direction. The relationship of the position between the implant and the proposed restoration should be based on the position of the implant shoulder, since it will influence the final hard and soft tissue response [25]. The malposition of the implant shoulder in the coronoapical direction causes soft tissue recession. In this case, location of the implant shoulders was in coronoapical and mesiodistal dimension in comfort zone. However, in the orofacial dimension the implant shoulders were in danger zone [25]. The angulation of implants in labial direction was compensated using angled abutments that were prepared for better emergence profile of the ceramic crowns. Many authors have also concluded that angled abutments may be considered a suitable restorative option when implants are not placed in ideal axial positions. Nevertheless, forces applied off axis may be expected to overload the bone surrounding single-tooth implants, as shown by Papavasiliou et al using finite element analysis. Hence, the segmental osteotomy may provide an alternative treatment to reposition the severely malposed implants [26,27,28].

e-ISSN:2320-7949
p-ISSN:2322-0090

Dental implants can be restored with cemented or screw-retained FDPs. In most esthetic areas, the implant shoulder is located subgingivally, resulting in a deep interproximal margin. This shoulder location makes seating of the restoration and removal of cement difficult. Therefore, screw retained restorations are mostly preferred in these cases. But, in the present case, because of the angulation of the implants, cemented restorations had to be chosen, although off axis implant placement can sometimes be compensated with angled abutments that still allow screw retention. Besides, after preparation of the angled abutments, the retention areas of the crowns were significantly reduced. For this reason, crowns were luted with adhesive resin cement. Cement remnants were removed easily because the implant shoulders were not deeply located [27,28].

Figure 1: Pre-operative radiograph

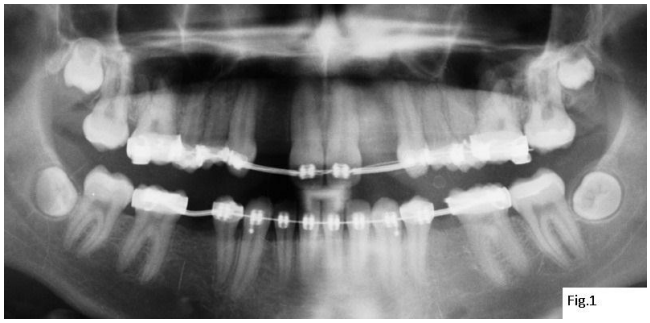
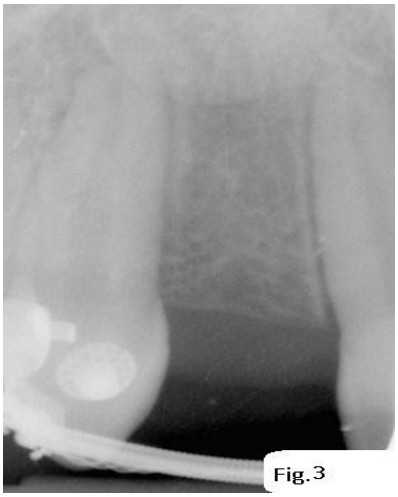


Figure 2: Pre-operative view

Figure 3: Preoperative radiograph of the congenitally missing right lateral incisor



e-ISSN:2320-7949
p-ISSN:2322-0090

Figure 4: Preoperative radiograph of the congenitally missing left lateral incisor

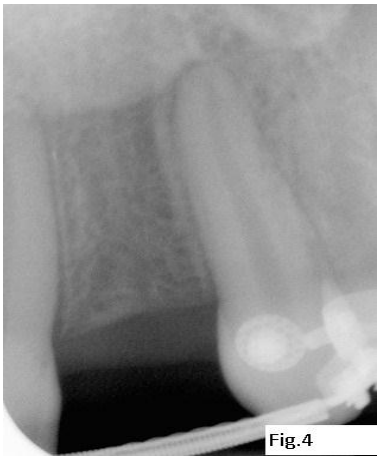


Figure 5: View of right preoperative site

Figure 6: View of left preoperative site

Figure 7: Preoperative smile

e-ISSN:2320-7949
p-ISSN:2322-0090

Figure 8: View of preoperative sites after the removal of orthodontic braces

Figure 9: Initial incision

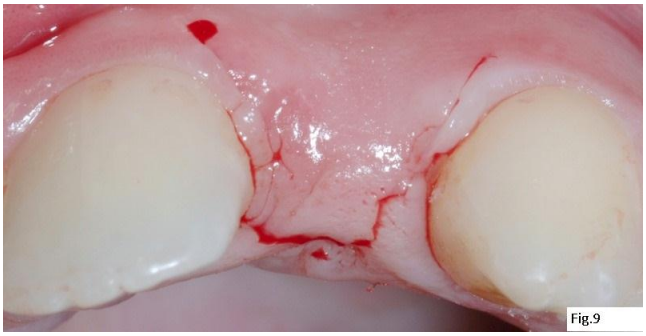


Figure 10: Osteotomy being prepared for the right lateral incisor implant with 2.0mm pilot bur rotating at 1100RPM with external irrigation

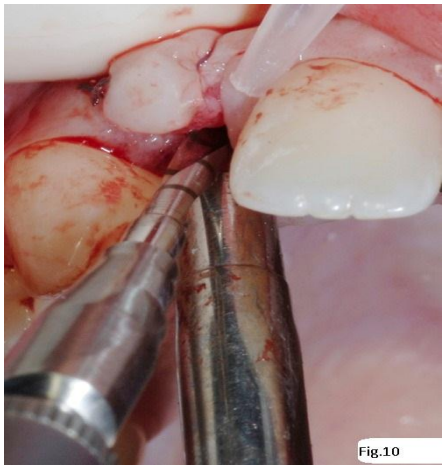


Figure 11: Parallel pins seated in pilot osteotomies indicating their trajectories

e-ISSN:2320-7949
p-ISSN:2322-0090

Figure 12: Osteotomy being enlarged with an olive green 2.5mm hand reamer

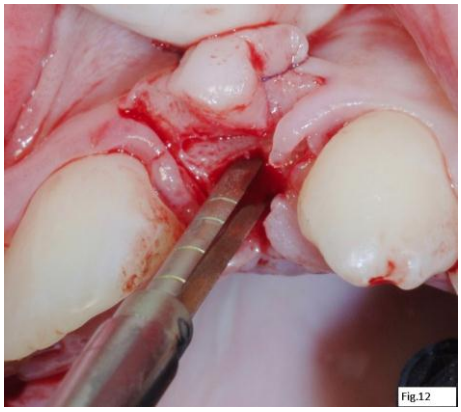


Figure 13: Ridge being split by the use of sliver 4.5mm Expanding Chisel

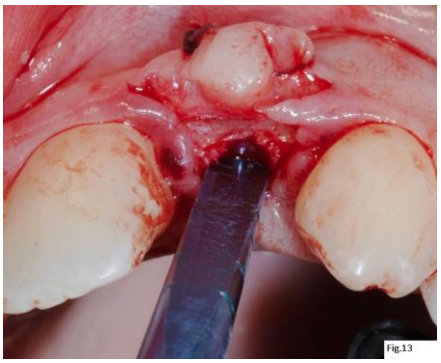


Figure 14: Osteotomy being enlarged with a blue 3.5mm hand reamer

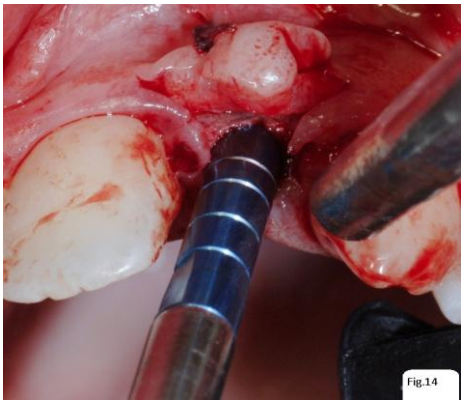
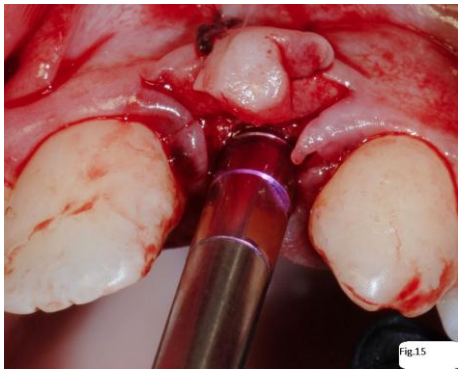


Figure 15: Osteotomy being enlarged with a red 4.0mm hand reamer



e-ISSN:2320-7949
p-ISSN:2322-0090

Figure 16: Osteotomy being prepared with a silver 4.5mm bone expander.

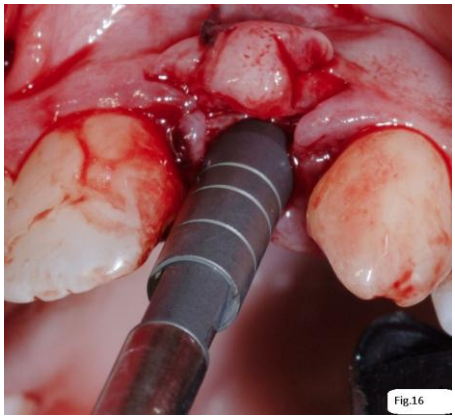


Figure 17: A 4.5mm x 8.0mm HA coated implant being inserted into the osteotomy with an implant inserter

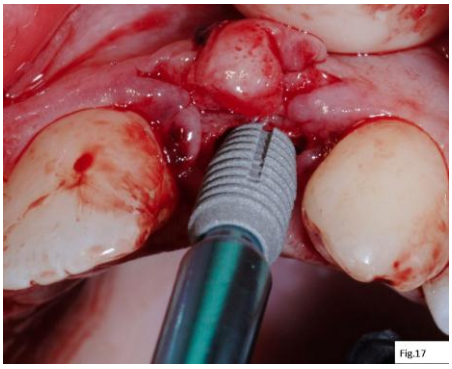


Figure 18: Cut polyethylene healing plug being inserted into the well of the implant

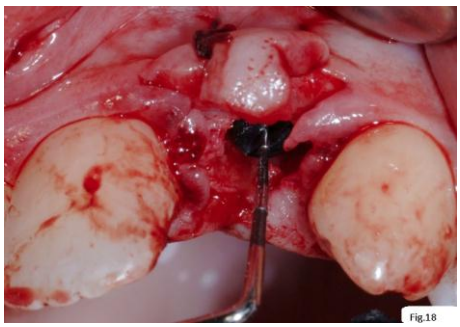
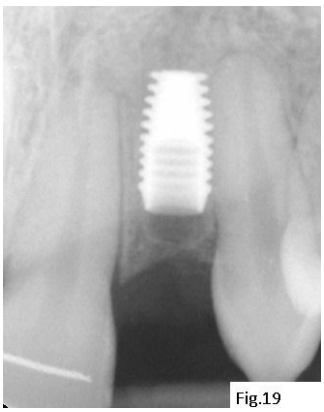


Figure 19: Post-operative radiograph



e-ISSN:2320-7949
p-ISSN:2322-0090

Figure 20: Post-operative radiograph

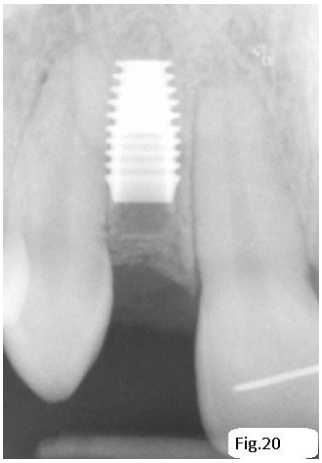


Figure 21: View of the trimmed black polyethylene plug seated in the well of the implant

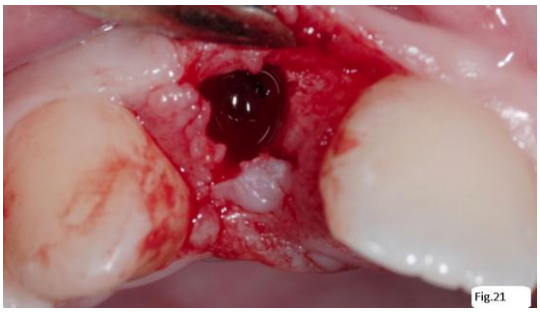


Figure 22: Healing plug being removed with a healing plug removal instrument

Figure 23: plastic 3.0mm impression post being inserted into the 3.0mm well of an integrated implant for the making of an implant level transfer impression

e-ISSN:2320-7949
p-ISSN:2322-0090

Figure24: Healing plug being removed with a healing plug removal instrument

Figure 25: View of green 3.0mm plastic impression posts seated in the well of the implants

Figure 26: View of Integrated Abutment Crowns

Figure 27: View of transitional prostheses prior to their removal for the insertion of Integrated Abutment Crowns

e-ISSN:2320-7949
p-ISSN:2322-0090

Figure 28: Integrated Abutment Crown being inserted.

Figure 29: View immediately after the insertion of right maxillary lateral Integrated Abutment Crown

Figure 30: Integrated Abutment Crown being inserted

Figure 31: Floss being used to confirm the fact that the interproximal contacts are passive and will not interfere with the engagement of the locking taper

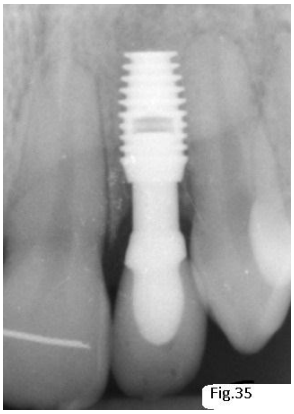
e-ISSN:2320-7949
p-ISSN:2322-0090

Figure 32: Facial view immediately after the insertion of two Integrated Abutment Crowns

Figure 33: Post-operative radiograph after the insertion of the right maxillary lateral Integrated Abutment Crown

Figure 34: Post-operative radiograph after the insertion of the left maxillary lateral Integrated Abutment Crown

Figure 35: View of Integrated Abutment Crown two weeks after being inserted



e-ISSN:2320-7949
p-ISSN:2322-0090

Figure 36: View of Integrated Abutment Crown two weeks after being inserted

Figure 37: View of Integrated Abutment Crowns two weeks after being inserted

Figure 38: Left profile two weeks post insertion of Integrated Abutment Crowns

Figure 39: Right profile two weeks post insertion of Integrated Abutment Crowns

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.

REFERENCES

1. Graber LW. Congenital absence of teeth: a review with emphasis on inheritance patterns. J Am Dent Assoc. 1978;96: 266-75.
2. Kinzer GA, Kokich VO. Managing congenitally missing lateral incisors. Part I: canine substitution. J Esthet Restor Dent. 2005;17:5-10
3. Polder BJ, Van't Hof MA, Van der Linden FP, Kuijpers-Jagtman AM A meta-analysis of the prevalence of dental agenesis of permanent teeth. Community Dent Oral Epidemiol. 2004,32: 217–226
4. Högberg G, Lagerheim B, Sennerstam R The 9-year crisis reflected at a rehabilitation center, at a child health care center and at a child and adolescent psychiatric center. Lakartidningen. 1986, 83: 2038–2042

5. Kokich OV, GA Kinzer and J Janakievski. Congenitally missing maxillary lateral incisors: Restorative replacement. American J Orthodont Dentofacial Orthop. 2011;139(4):435-445.
6. Krassnig M, and S Fickl. Congenitally missing lateral incisors- A comparison between restorative, implant, and orthodontic approaches. Dent Clin N Am. 2001;1:283-299.
7. Garg AK. Treatment of congenitally missing lateral incisors: Orthodontics, Bone grafts, and Osseointegrated implants. Dental Implantology Today. 2002,13(2): 9.
8. Garib DG, NLM Zanella and S Peck. Associated Dental Anomalies: Case report. J Appl Oral Sci. 2005;13(4): 431-436
9. Graber TM, RL Vanarsdall and KW Vig, 2005. Orthodontics: Current Principles and Techniques. 4th ed. St Louis, Mo: CV Mosby.
10. Kennedy DB. Orthodontic management of missing teeth. J Can Dent Assoc. 1999;65: 548–550
11. Balshi TJ Osseointegration and orthodontics: Modern treatment for congenitally missing teeth. Int J Periodontics Restorative Dent. 1993;13: 494–505
12. Misch CE, M Sharawy, J Lemons and KW Judy. Rational for application of immediate load in implant dentistry: Part II. Implant Dent. 2004;13: 310-321.
13. Strong SM. Replacement of congenitally missing lateral incisors with implant crowns. Gen Dent. 2008;56(6): 516-9.
14. Winkle S, KG Boberick, S Braid, R Wood and MJ Cari. Implant replacement of congenitally missing lateral incisors: a case report. J Oral Implantol. 2008;34(2):115-8.
15. Hahn J. Single-stage, immediate loading, and flapless surgery. J Oral Implantol. 2000;26(3):193-8.
16. Belser UC, Bernard JP, Buser D. Implant-supported restorations in the anterior region: Prosthetic considerations. Pract Periodontics Aesthet Dent. 1996;8: 875–883
17. Jemt T. Regeneration of gingival papillae after single-implant treatment. Int J Periodontics Restorative Dent. 1997;17: 326-33.
18. Bergendal B, Bergendal T, Hallonsten AL, Koch G, Kurol J, Kvint S A multidisciplinary approach to oral rehabilitation with osseointegration implants in children and adolescents with multiple aplasia. Eur J Orthod. 1996;18: 119–129
19. Bukhary SM, Gill DS, Tredwin CJ, Moles DR The influence of varying maxillary lateral incisor dimensions on perceived smile aesthetics. Br Dent J .2007;203: 687–693
20. Romanos GE. Present status of immediate loading of oral implants. J Oral Implantol. 2004;30: 189-197.
21. Dueled E, Gotfredsen K, Damsgaard MT, Hede B. Professional and patient-based evaluation of oral rehabilitation in patients with tooth agenesis. Clin Oral Implants Res. 2009;20:729-36.
22. Olsen TM, Kokich VG Sr. Postorthodontic root approximation after opening space for maxillary lateral incisor implants. Am J Orthod Dentofacial Orthop. 2010;137:158-9.
23. Small BW. The use of cast gold pinledge retainers with pontics as an esthetic and functional restorative option in the maxillary anterior. Gen Dent. 2004;52:18-20.
24. Winkler S, KG Boberick, S Braid, R Wood and MJ Cari, Implant replacement of congenitally missing lateral incisors: a case report. J Oral Implantol. 2008;34(2):115-8.
25. Wheeler, S.L., Implant complications in the esthetic zone. J Oral Maxillofac. Surg; Suppl 1,2007; 65: 93-102.
26. Gumus, H.O., N. Hersek, I. Tuluoglu and F. Tasar, . Management of Congenitally Missing Lateral Incisors with Orthodontics and Single-Tooth Implants: Two case Reports. Dental Res J. 2008, 5(1): 37-40.
27. Kinzer GA, Kokich VO. Managing congenitally missing lateral incisors. Part II: tooth-supported restorations. J Esthet Restor Dent. 2005;17:76-84.
28. Kinzer GA, Kokich VO. Managing congenitally missing lateral incisors. Part III: single-tooth implants. J Esthet Restor Dent. 2005;17:202-10.