

Multidisciplinary Treatment Approach with one Piece Implants for Congenitally Missing Maxillary Lateral Incisors: A Case Report

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Abstract - Congenitally missing lateral incisors are a common clinical occurrence. Dental Implants have become a primary treatment option for replacement of these teeth. Many times in prosthodontic treatment planning a multidisciplinary approach is needed for a comprehensive outcome. Prosthodontic treatment planning is needed prior to the patient's consultation and following treatment acceptance; the prosthodontist may need to coordinate treatment needs with other specialists, including an orthodontist and an implant surgeon. This article describes multidisciplinary management of a case presenting with spaced maxillary anteriors due to the congenitally missing lateral incisors. Treatment consisted of initial orthodontic space management to obtain adequate space for missing lateral incisors. Single piece, narrow diameter implants were placed in edentulous spaces on both sides. Aesthetic crown lengthening procedure was performed with all anterior teeth along with tissues surrounding the implants. Metal-ceramic crowns were given as definitive restorations, resulting into an acceptable aesthetic outcome.

KEY WORDS: Aesthetic crown lengthening, orthodontic treatment, one piece implants, single tooth implants, congenitally missing lateral incisors, mini-implants

INTRODUCTION

Patients seeking replacement for congenitally missing lateral incisors are commonly seen in clinical practice as this tooth is commonly affected by anodontia. Treatment alternatives for such patients include conventional fixed bridges, resin-bonded bridges, removable partial dentures, single-tooth implants, auto-transplantation and orthodontic repositioning of canines to close the edentulous spaces¹. While dental implants have expanded restorative treatment options, an multidisciplinary approach is often recommended²⁻⁴. Participating clinicians (orthodontist, periodontist, oral surgeon, prosthodontist) should determine the patient's treatment plan collaboratively and communicate throughout the course of treatment⁵.

In patients with congenitally missing lateral incisors, the centrals and canines often erupt in less than optimal positions encroaching into the space of missing laterals. Richardson and Russell have discussed orthodontic treatment protocols for congenitally missing lateral incisors when planning their replacement with implant restorations⁶. In cases where there is insufficient alveolar bone for implant placement, ridge augmentation may be required along with orthodontic repositioning of adjacent teeth to afford quantity and quality of the supporting bone⁷. The average recommended dental implant diameter for lateral incisor replacement is 3.75 mm with provision of minimum 1.5 mm distance from the adjacent roots⁷. This necessitates that there should be a minimum of 10 mm bone height, and 6 mm of facio-lingual

and 6-8 mm mesiodistal bone width^{4,6,8}. With the evolution of dental implant designs, a multitude of ridge augmentation procedures were also developed to provide adequate volume of alveolar bone for implant placement⁹. Often however, patients are reluctant to undergo ridge augmentation procedures citing financial or time constraints and health concerns. In such situations, narrow diameter implants or mini-implants with judicious management of surrounding hard and soft tissues may be considered a valid treatment alternative. This article describes management of a patient with congenitally missing maxillary lateral incisors. The treatment comprised initial orthodontic space management and implant placement, followed by aesthetic crown lengthening and restorations with metal-ceramic crowns resulting in the desirable aesthetic outcome.

Case report:

An 18-year-old girl presented to the Department of Orthodontics with a chief complaint of spacing in her upper anterior teeth. Intraoral examination revealed spaced maxillary anteriors due to bilaterally missing permanent lateral incisors. An over-retained primary lateral incisor was present on right side. An intraoral periapical (IOPA) radiograph of right lateral incisor region revealed 1-2 mm of spacing on both sides of the over-retained right primary lateral incisor (Fig. 1A). The IOPA radiograph on left lateral incisor region revealed 2-3 mm of spacing between the left canine and the left central incisor and between the left and the right central incisors (Fig. 1B). There was no significant medical and family history. The treatment plan was discussed amongst the orthodontist, periodontist and prosthodontist. On the basis of clinical and radiographic examination the patient was classified as Class III (substan-

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Figure 1a. Pre-treatment IOPA radiograph of right lateral incisor region



Figure 1b. Pre-treatment IOPA radiograph of left lateral incisor region



Figure 2. Intraoral view after completion of the Orthodontic treatment



Figure 3a. Post-Orthodontic IOPA showing space created for right lateral incisor



Figure 3b. Post-Orthodontic IOPA showing space created for left lateral incisor

tially compromised) according to Prosthodontic Diagnostic Index (PDI) Resources for partial edentulous patients¹⁰. Though the clinical and radiographic findings were suggestive of Class II (Moderately compromised) PDI, aesthetic challenge raised the classification from Class II to Class III. The use of PDI dictates the prosthodontic patient classification based on the clinical difficulties and challenges.

The right primary maxillary lateral incisor was extracted leaving the total edentulous space of 7 mm between the right central incisor and the canine. A fixed pre-adjusted edgewise appliance (0.018 inch-MBT) was used to manage the interdental spaces in such a way that both the central incisors were approximated together (mesially) and both the canines were retracted distally to obtain adequate space of 6 mm on each side (at mid-coronal level) for restoring the lateral incisors. After completion of the orthodontic treatment, braces of the two central incisors were consolidated with a ligature wire for retention purpose (Fig. 2). The canines, premolars and the first molars on either side were also consolidated for the same purpose.

Post-orthodontic radiographs along with bone sounding by Wilson caliper¹¹ and palpation of the proposed implant sites at the crestal level revealed approximately 5 mm of space between the roots of left central incisor and the canine and 7 mm of space in between their right side counterparts (Fig. 3 A, B). This width of bone was inadequate for placing a conventional 3.3 and 3.75 mm diameter implants on left and right sides respectively. Patient refused to undergo horizontal bone augmentation

procedure citing economic reason and unwillingness for additional surgery. Hence a decision was made to place a 2.4 mm wide and 11.5 mm long mini-implant (Hi-tec, Israel) on the left side and a 3.3 mm wide and 11.5 mm long single-piece implant (Adin, Israel) on the right side. A surgical template was fabricated using a vacuum thermoformed sheet (Easy Vac Gasket, 3A Medes, Korea) over the cast duplicated from the diagnostic wax up of the edentulous site. The adapted sheet was modified according to guidelines given by Sarment and Misch and used to guide implant positioning during surgery and highlight the proposed gingival margin^{12,13}. After placement of implants primary stability of the implant was measured with the torque-wrench and found to be above 55 N-Cm for both the implants, which was adequate for the immediate loading. The full thickness soft tissue flap was sutured back in place. Patient was recalled after a week for suture removal and the surgical site was irrigated with the diluted (0.12%) form of the glutaraldehyde solution (Sekucid; Paragerm Lab, Carros, France) (Fig. 4).

Aesthetic crown lengthening was required in the anterior region as the gingival margins of the central incisors and the canines were shifted incisally (2-3 mm) during course of the orthodontic treatment, giving them appearance of short clinical crowns. Two weeks after the suture removal, aesthetic crown lengthening was carried out in maxillary anterior region including peri-implant tissues surrounding lateral incisor implants (Fig. 5). The patient was recalled after two weeks to assess healing of gingival margins and the peri-implant tissues (Fig. 6). Temporary crowns were fabricated using tooth



Figure 4. One-piece lesser diameter implants placed for both lateral incisors



Figure 5. Aesthetic crown lengthening done with all maxillary anterior teeth along with peri-implant tissues in lateral incisor area



Figure 6. Healing completed 2 weeks after esthetic crown lengthening



Figure 7. Intraoral view six months after definitive restoration of metal-ceramic crowns



Figure 8. Post-treatment OPG showing osseointegrated single piece implants

coloured auto-polymerizing acrylic resin (Dental Products of India, Mumbai, India). Sequential alterations of the tissue surfaces of the temporary crowns were obtained (at the interval of 4 weeks) to achieve the peri-implant tissue contour for desired esthetics¹⁴⁻¹⁶. At four months follow up, the decision to fabricate a definitive prosthesis was made. The final impression was made with the polyvinyl-siloxane impression material (Exaflex; GC America, Chicago, IL) by blocking-out the braces and the gingival undercut areas developed due to the braces with the modeling wax. The blocked-out wax was removed and another impression was made with an irreversible hydrocolloid impression (Dentalgin; Prime dental products, Mumbai, India). Both impressions were poured with a type IV gypsum material (Ultrarock; Kalabhai Karson, Mumbai, India). A cast retrieved from the polyvinyl-siloxane impression material was used to fabricate the wax-patterns and the metal copings. After metal try-in, the cast retrieved from the irreversible hydrocolloid was used (as a guideline) for the ceramic build-up because the facial contours of the teeth on the cast retrieved from the polyvinyl impression material was altered due to the wax block-out. The metal ceramic crowns were cemented with the glassionomer cement (GC Fusi I; GC America, Chicago, IL). The patient was recalled after one month to remove the braces. The patient received postoperative instructions and recall appointments were scheduled. Clinical as well as radiographical (Orthopantomogram) examinations revealed satisfactory results during the recall visit 6 months after cementation of the definitive restorations (Fig. 7 and 8). The patient was pleased with the final esthetic outcome (Fig. 9).

DISCUSSION

Although adjacent teeth may have to be repositioned orthodontically to create adequate space for an implant, implants do not necessitate “altering” or “contouring” parts of the natural dentition and are therefore the most conservative of the prosthodontic options for replacing missing lateral incisors. The multidisciplinary approach is required to ensure orthodontic alignment that will facilitate the implant restorative treatment. Once the permanent central incisor and canine have been positioned orthodontically to create



Figure 9. Post-treatment photograph of the patient

adequate mesio-distal space between the crowns and the roots of the teeth, orthodontic retention is necessary to maintain this space and the position of the teeth¹⁷. The length of time in retention prior to implant placement will depend on the orthodontic treatment that was completed. In the presented case we planned to achieve the post-orthodontic retention with the original appliances consolidated to keep both central incisors together as well as the teeth posterior to canines together (on each side) until placement of the definitive prosthetic restorations. Following removal of the fixed appliances, conventional types of orthodontic retainers (Hawley retainers) also can be used to maintain the space until the implant is placed and restored¹⁸. Overall plaque control of the patient is an important factor to be considered for the long term success of the implants. We found the poor plaque control of the patient and hence reinforced the oral hygiene instructions.

Conventional fixed prostheses are no longer primarily indicated in patients with non carious or non restored adjacent

anterior teeth¹⁹. Replacement of an anterior single tooth by an endosteal implant supported prosthesis has become a widely practiced clinical procedure^{20,21}. Surgical placement of implants is dictated by availability of bone and anatomical limiting structures²². In conjunction with the evolution of dental implants, a multitude of surgical techniques have been developed to enhance the alveolar bone volume for implant placement⁹. The choice of placing smaller diameter (2.4 and 3.3 mm) single piece implants in this patient was made after a systematic review of the risk versus benefit of bone augmentation procedure^{23,24}. Various authors^{14,25-27} have established that the use of smaller diameter or mini implants as an alternative to the conventional implantation procedure in specific situations where overload factors are carefully assessed and minimized. Shatkin *et al*²⁸ studied the overall survival rate of mini-implants supported fixed (total 1278) and removable prostheses (total 1236) with a mean follow up period of 2.9 years and found to be 94.2%. Laboratory study aimed to provide comparative data on the mechanical performance of a number of narrow commercially marketed implants. Allum *et al*²⁹ studied the comparative data on the mechanical performance of a number of commercially marketed implants (4.1 mm, 3.3 mm, 2.8 mm and 2.4 mm) and found that implants with less than 3 mm diameter were yielding poorer results significantly representing a risk of fracture in clinical practice. The authors recommended the standardized fatigue testing for all commercially available narrow diameter implants.

The choice of placing a mini-implant in this patient was made after a systematic review of the risk versus benefit of bone augmentation procedure^{23,24}. In this case the patient was unwilling to undergo a bone augmentation procedure and our assessment of the implant site revealed that it was possible to minimize overload on the implant, therefore, we decided to place smaller diameter implants. After orthodontic treatment there was still limited inter-radicular space in the region of left lateral incisor necessitating the selection of a 2.4 mm diameter mini-implant. The diagnostic data for this case was obtained by taking conventional radiographs, employing bone mapping and comparing it to the diagnostic cast. Though in our case bone sounding and IOPA radiographs have been used, the cone beam computer tomography (CBCT) should always be considered for treatment planning in such compromised clinical situations. Achieving the desirable aesthetic outcome with single piece implants is challenging. Excision of tissue prior to crown placement is the integral part of restorative therapy with one-piece mini-implants to achieve the desired aesthetics. Sequential alteration of the tissue surfaces of the temporary crown can obtain the desired peri-implant tissue contour for better esthetics¹⁴⁻¹⁶. In this case we have followed the same principle. Though the single piece implants are not always the first treatment of choice in most situations, the financial constraints, need for bone augmentation and multiple surgical interventions for two-piece implant resulted in the patient opting for this treatment option.

ADDRESS FOR CORRESPONDENCE

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REFERENCES

1. Rupp RP, Dillehay JK, Squire CF. Orthodontics, prosthodontics, and periodontics: a multidisciplinary approach. *Gen Dent* 1997; **45**(3):286-9.
2. Schweizer CM, Schlegel AK, Rudzki-Janson I. Endosseous dental implants in orthodontic therapy. *Int Dent J* 1996; **46**(2):61-8.
3. Phillips K, Kois J. Aesthetic peri-implant site development. The restorative connection. *Dent Clin North Am* 1998; **42**(1):57-70.
4. Dialogue. The role of the orthodontist on the maxillary anterior implant team. *Am Assoc Orthodont* 1998; **10**(2).
5. Kokich VG, Spear FM. Guidelines for managing the orthodontic-restorative patient. *Semin Orthod* 1997; **3**(1):3-20.
6. Richardson G, Russell KA. Congenitally Missing Maxillary Lateral Incisors and Orthodontic Treatment Considerations for the Single-Tooth Implant. *J Can Dent Assoc* 2001; **67**:25-8.
7. Shroff B, Siegel SM, Feldman S, Siegel SC. Combined orthodontic and prosthetic therapy. Special considerations. *Dent Clin North Am* 1996; **40**(4):911-43.
8. Spear FM, Mathews DM, Kokich VG. Interdisciplinary management of single-tooth implants. *Semin Orthod* 1997; **3**(1):45-72.
9. Patil PG. Implants or pontics. *J Am Dent Assoc* 2010; **141**: 14-15.
10. McGarry TJ, Nimmo A, Skiba JF, Ahlstrom RH, Smith CR, Koumjian JH, *et al*. Classification system for partial edentulism. *J Prosthodont* 2002; **11**:181-193.
11. Wilson DJ. Ridge mapping for determination of alveolar ridge width. *Int J Oral Maxillofac Implants* 1989; **4**:41-3.
12. Preston JD. A systematic approach to the control of esthetic form. *J Prosthet Dent* 1976; **35**:393-402.
13. Samment DP, Misch CE. Diagnostic casts and surgical guides. In: Misch CE. *Dental Implant Prosthetics*. St Louis: Elsevier-Mosby; 2005. p. 142-156.
14. Gupta A, Sahegal R, Tagore M, Patil PG, Kothari B, Puri S. Achieving desired esthetic outcome for a single tooth implant restoration with tissue excess using a multidisciplinary treatment approach- A clinical report. *J Prosthodont* 2011; **20**:228-32.
15. Spyropoulou PE, Razzoog M, Sierralta M. Restoring implants in the esthetic zone after sculpting and capturing the periimplant tissues in rest position: a clinical report. *J Prosthet Dent* 2009; **102**:345-7.
16. Lapinski RL, O'Calahan D, Horowitz I, Rosenblum M. Improving the emergence profile of an anterior implant restoration using a custom healing cap and a "double cast" abutment. *J N J Dent Assoc*. 2007; **78**:42-3.
17. Ong MA, Wang HL, Smith FN. Interrelationship between periodontics and adult orthodontics. *J Clin Periodontol* 1998; **25**(4):271-7.
18. Hess D, Buser D, Dietschi D, Grossen G, Schonenberger A, Belzer UC. Esthetic single-tooth replacement with implants: a team approach. *Quintessence Int* 1998; **29**(2):77-86.
19. Salinas TJ, Block MS, Sadan A. Fixed partial denture or single-tooth implant restoration? Statistical considerations for sequencing and treatment. *J Oral Maxillofac Surg*. 2004; **62** (9 Suppl 2):2-16.
20. Garg AK, Finley J, Dorado LS. Single-tooth implant-supported restorations in the anterior maxilla. *Pract Periodontics Aesthet Dent*. 1997; **9**:903-10.
21. Lewis S. Anterior single-tooth implant restorations. *Int J Periodontics Restorative Dent*. 1995; **15**:30-41.
22. Buser D, Martin W, Belser UC. Optimizing esthetics for implant restorations in the anterior maxilla: anatomic and surgical considerations. *Int J Oral Maxillofac Implants*. 2004; **19** Suppl:43-61.
23. Balaji SM. Management of deficient anterior maxillary alveolus with mandibular parasymphseal bone graft for implants. *Implant Dent*. 2002; **11**:363-9.
24. Nkenke E, Radespiel-Tröger M, Wiltfang J, Schultze-Mosgau S, Winkler G, Neukam FW. Morbidity of harvesting of retromolar bone grafts: a prospective study. *Clin Oral Implants Res*. 2002; **13**:514-21.
25. Siddiqui AA, Sosovicka M, Goetz M. Use of mini implants for replacement and immediate loading of 2 single-tooth restorations: a clinical case report. *J Oral Implantol*. 2005; **32**:82-6.
26. Christensen GJ. The 'mini'-implant has arrived. *J Am Dent Assoc*. 2006; **137**:387-90.
27. Flanagan D. Fixed partial dentures and crowns supported by very small diameter dental implants in compromised sites. *Implant Dent* 2008; **17**:182-91.
28. Shatkin TE, Shatkin S, Oppenheimer BD, Oppenheimer AJ. Mini dental implants for long-term fixed and removable prosthetics: a retrospective analysis of 2514 implants placed over a five-year period. *Compend Contin Educ Dent*. 2007; **28**:92.
29. Allum SR, Tomlinson RA, Joshi R. The impact of loads on standard diameter, small diameter and mini implants: a comparative laboratory study. *Clin Oral Implants Res*. 2008; **19**:553-9.