J. Jofré, A. Werner

Center for Advanced Prosthodontics and Implant Dentistry. Pediatric Dentistry, School of Dentistry, University of Concepción, Concepción, Chile

e-mail: jjofre@udec.cl

Use of mini implants to replace a missing tooth in a growing patient: a six-year follow up case report

ABSTRACT

Background *Loss of anterior permanent teeth can have a detrimental effect on children's quality of life and the therapeutic approaches are always a challenge. From a physiologic and psychological standpoint, the use of dental implants has several advantages in replacing missing teeth. However, several studies have shown that conventional implants are not indicated in patients that are still growing, since they interfere with the sagittal and transversal growth of the maxilla. Recent literature has suggested that Mini Dental Implants (MDIs) can be successfully applied in growing patients, without interfering with the normal craniofacial growth process.*

Case report *This report describes the replacement of missing teeth in a 10-year-old patient by a mini implant of 1.8 mm diameter. After a six-year follow-up period, the mini implant did not follow the regular growth process of the maxilla, resulting in functional and aesthetic complications. Removal of the mini implant entailed some difficulties.*

Keywords *Child; Mini dental implant; Single-tooth; Tooth avulsion.*

Introduction

Tooth loss during adolescence could negatively affect the patient's daily social relationships and quality of life [Stanford, 2007; Bateman et al., 2010; Levin et al., 2006; Giannetti et al., 2010]. Numerous benefits of using root-form titanium dental implants for teeth replacement in adults have been widely documented. From the psychological standpoint, the impact of dental implant treatment on self-esteem and confidence could have considerable influence in personality development during adolescence. Additionally, children have excellent blood supply and osseous healing [Percinoto et al., 2001] thus improving the prognosis of this treatment option which may be beneficial to preserve alveolar bone as has been described for adults. However, the use of implants in growing patients is controversial.

Human [Thilander et al., 1999; Brugnolo et al., 1996; Westwood and Duncan, 1996] and animal [Odman et al., 1991; Sennerby et al., 1993; Thilander et al., 1992] studies have suggested that implants in growing skeletons can behave as ankylosed teeth, unable to follow the changes related with the normal growth of the alveolar process [Thilander et al.,1994; Iseri and Solow, 1996] caused by the continuous eruption of adjacent teeth [Odman et al., 1991; Thilander et al., 1992].

The major complication reported with the use of the conventional dental implant in immature subjects, was the vertical discrepancy of the implant crown with the final occlusal plane [Thilander et al., 1994; Thilander et al., 1999; Thilander et al., 2001], leading to several aesthetic complications, since ankylosis results in restriction to follow the sagittal growth.

A two-year case report [Giannetti et al., 2010] showed a successful implant prosthetic rehabilitation in a growing patient using mini implants, stating that this procedure did not interfere with the sagittal and transversal growth of the maxillary bones.

The purpose of the present case report was to present the clinical result after a six-year follow-up of a mini implant used for replacement of a missing tooth in a 10-year-old patient.

Case report

A 10 year-old boy patient, who had lost his permanent maxillary left central incisor due to a traumatism two years prior, asked for treatment at the School of Dentistry, of the University of Concepcion, Chile.

Initial orthopantomography and lateral teleradiography were taken (Fig. 1). An orthodontic treatment was planned to start two years later, after the eruption of the permanent canines.

In the meanwhile, the child's parents asked for a fixed provisional solution to replace the missing tooth. The possibility of using a provisional implant was evaluated to retain a temporary crown during the patient's growing period. A machined surface, mini dental implant (MDI) was considered to reduce the rate of implant ankylosis affecting the normal development of this edentulous area.

FIG. 1 A Orthopantomography showing the missing maxillary left central incisor.

FIG. 1 B Teleradiography presenting a Class II skeletal jaw relationship with a Legan's angle of 23°.

FIG. 2 Severe implant deformation after removal.

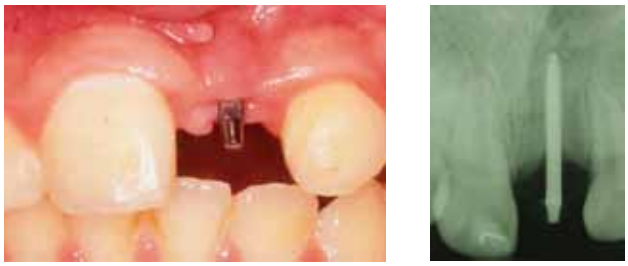

FIG. 3 Clinical and radiographic evaluation one month after mini implant insertion.

FIG. 4 Vertical discrepancy between implant and the adjacent teeth can be clearly observed at the six-year follow up.

After explaining associated risks and signing the informed consent, the use of an MDI was indicated to stabilise a temporary crown.

By using a flapless procedure, a 1.8 mm diameter and 14 mm length mini transitional implant (MTI Transitional Implants, Dentatus, NY, USA) was inserted in the area of 1.1.

During the six-year follow-up, the provisional crown was lost six times (once in the 3th, 4th and 5th year and three times in the 6th year). The crown was immediately re-cemented and refilled with acrylic by an external dentist.Due to the high frequency of provisional loss, caused by lack of retention, the mini-implant was removed.

High level of forces, near 50 Ncm, was necessary to remove the osseointegrated provisional mini-implant, causing severe deformation during the process (Fig. 2).

Comparing the baseline clinical and radiographic situation (Fig. 3) with the six-year recall (Fig. 4) a high vertical discrepancy between the implant and the adjacent teeth can be clearly observed, making impossible to achieve an adequate retention of the crown.

Discussion

Several studies have suggested that implants in growing skeletons can act as ankylosed teeth unable to follow normal growth of the alveolar process, caused by the continuous eruption of adjacent teeth.

The ankylosis phenomenon around an implant can be explained by the active bone healing process in the immediate vicinity of the implant surface, which has been described as a functional ankylosis [Giannetti et al., 2010; Schulte, 1967; Schroeder et al., 1981]. However, at some distance from the implants surface the tissues develop normally [Heij et al., 2006].

The growth arrest phenomenon is not seen in edentulous areas, where no implant is placed, or after decoronation of ankylosed teeth. This observation suggests that the implant-retained crown acts as a barrier interrupting the interdental fibres of adjacent teeth in the edentulous zone. The use of mini dental implants has been suggested to replace anterior missing teeth in growing patients. It may be assumed that using an extremely thin implant, fibres interference between adjacent teeth would be minimum, allowing a normal growth of the alveolar process.

Mini implants have shown successful clinical results mainly as anchor for overdentures [Griffitts et al., 2005; Jofre et al., 2010a; Jofre et al., 2010b; Sendax, 1996; el Attar et al., 1999; Bulard andand Vance, 2005; Shatkin et al., 2007], but the use of this type of very small diameter implant in children could have advantages as implant placement in narrow sites, minimally invasive surgeries avoiding bone graft or complex surgical procedures, and they also can be immediately loaded [Velasco Ortega, 2004; Christensen,

2006; Cho et al., 2007; LaBarre et al., 2008].

Giannetti et al. [2010], in a two-year case report, showed a successful implant prosthetic rehabilitation in a growing patient using mini implants, stating that this procedure did not interfere with the sagittal and transversal growth of the maxillary bones.

Authors indicate that mini-implants can simply be unscrewed with small torque wrench, enabling a conservative approach. However, this result did not agree with reports published in the literature showing that mini implants can osseointegrate as conventional implants, especially with modified surface treatments [Simon andand Caputo, 2002; Balkin et al., 2001]. This was confirmed in our case report, even when using a non-surface treated mini implant, high force level was required for its removal, causing severe complications.

At a six-year clinical and radiographic recall, high vertical discrepancy between the implant and the adjacent teeth was observed, meaning that the mini implant did not follow the vertical changes induced by the teeth.

Alternative approaches for replacing missing upper incisor in growing individuals should be considered, which include autotransplantation [Keightley et al., 2010], resin-bonded bridges [Creugers and De Kanter, 2000], and closing the space with an orthodontic appliance [Czochrowska et al., 2003].

Conclusion

This case report confirm the potential risks involved in placing implants in growing patients, even when using mini dental implants. Alternative approaches for replacing missing upper incisor in growing individuals should be considered.

References

› Balkin BE, Steflik DE, Naval F. Mini-dental implant insertion with the auto-advance technique for ongoing applications. J Oral Implantol 2001; 27: 32-7.
› Bateman G, Barclay CW, Saunders WP. Dental dilemmas: Endodontics or dental implants? Dent Update 2010; 37: 579-82, 85-6, 89-90 passim.
› Brugnolo E, Mazzocco C, Cordioll G, Majzoub Z. Clinical and radiographic findings following placement of single-tooth implants in young patients--case reports. Int J Periodontics Restorative Dent 1996; 16: 421-33.
› Bulard RA, Vance JB. Multi-clinic evaluation using mini-dental implants for long-term denture stabilization: A preliminary biometric evaluation. Compend Contin Educ Dent 2005; 26: 892-7.
› Cho SC, Froum S, Tai CH, Cho YS, Elian N, Tarnow DP. Immediate loading of narrowdiameter implants with overdentures in severely atrophic mandibles. Pract Proced Aesthet Dent 2007; 19: 167-74.
› Christensen GJ. The 'mini'-implant has arrived. J Am Dent Assoc 2006; 137: 387-90.
› Creugers NH, De Kanter RJ. Patients' satisfaction in two long-term clinical studies on resin-bonded bridges. J Oral Rehabil 2000; 27: 602-7.
› Czochrowska EM, Skaare AB, Stenvik A, Zachrisson BU. Outcome of orthodontic space closure with a missing maxillary central incisor. Am J Orthod Dentofacial Orthop 2003; 123: 597-603.
› el Attar MS, el Shazly D, Osman S, el Domiati S, Salloum MG. Study of the effect of using mini-transitional implants as temporary abutments in implant overdenture cases. Implant Dent 1999; 8: 152-8.
› Giannetti L, Murri Dello Diago A, Vecci F, Consolo U. Mini-implants in growing patients: A case report. Pediatr Dent 2010; 32: 239-44.
› Griffitts TM, Collins CP, Collins PC. Mini dental implants: An adjunct for retention, stability, and comfort for the edentulous patient. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2005; 100: e81-4.
› Heij DG, Opdebeeck H, van Steenberghe D, Kokich VG, Belser U, Quirynen M. Facial development, continuous tooth eruption, and mesial drift as compromising factors for implant placement. Int J Oral Maxillofac Implants 2006; 21: 867-78.
› Iseri H, Solow B. Continued eruption of maxillary incisors and first molars in girls from 9 to 25 years, studied by the implant method. Eur J Orthod 1996; 18: 245-56.
› Jofre J, Cendoya P, Munoz P. Effect of splinting mini-implants on marginal bone loss: A biomechanical model and clinical randomized study with mandibular overdentures. Int J Oral Maxillofac Implants 2010; 25: 1137-44.a
› Jofre J, Hamada T, Nishimura M, Klattenhoff C. The effect of maximum bite force on marginal bone loss of mini-implants supporting a mandibular overdenture: A randomized controlled trial. Clin Oral Implants Res 2010; 21: 243-9.b
› Keightley AJ, Cross DL, McKerlie RA, Brocklebank L. Autotransplantation of an immature premolar, with the aid of cone beam ct and computer-aided prototyping: A case report. Dent Traumatol 2010; 26: 195-9.
› LaBarre EE, Ahlstrom RH, Noble WH. Narrow diameter implants for mandibular denture retention. J Calif Dent Assoc 2008; 36: 283-6.
› Levin L, Sadet P, Grossmann Y. A retrospective evaluation of 1,387 single-tooth implants: A 6-year follow-up. J Periodontol 2006; 77: 2080-3.
› Odman J, Grondahl K, Lekholm U, Thilander B. The effect of osseointegrated implants on the dento-alveolar development. A clinical and radiographic study in growing pigs. Eur J Orthod 1991; 13: 279-86.
› Percinoto C, Vieira AE, Barbieri CM, Melhado FL, Moreira KS. Use of dental implants in children: A literature review. Quintessence Int 2001; 32: 381-3.
› Schroeder A, van der Zypen E, Stich H, Sutter F. The reactions of bone, connective tissue, and epithelium to endosteal implants with titanium-sprayed surfaces. J Maxillofac Surg 1981; 9: 15-25.
› Schulte WC. Ankylosis of the temporomandibular joint. Report of three cases. Oral Surg Oral Med Oral Pathol 1967; 24: 270-83.
› Sendax VI. Mini-implants as adjuncts for transitional prostheses. Dent Implantol Update 1996; 7: 12-5.
› Sennerby L, Odman J, Lekholm U, Thilander B. Tissue reactions towards titanium implants inserted in growing jaws. A histological study in the pig. Clin Oral Implants Res 1993; 4:65-75.
› Shatkin TE, Shatkin S, Oppenheimer BD, Oppenheimer AJ. Mini dental implants for longterm fixed and removable prosthetics: A retrospective analysis of 2514 implants placed over a five-year period. Compend Contin Educ Dent 2007; 28: 92-9; quiz 100-1.
› Simon H, Caputo AA. Removal torque of immediately loaded transitional endosseous implants in human subjects. Int J Oral Maxillofac Implants 2002; 17: 839-45.
› Stanford CM. Dental implants. A role in geriatric dentistry for the general practice? J Am Dent Assoc 2007; 138 Suppl: 34S-40S.
› Thilander B, Odman J, Grondahl K, Friberg B. Osseointegrated implants in adolescents. Analternative in replacing missing teeth? Eur J Orthod 1994; 16: 84-95.
› Thilander B, Odman J, Grondahl K, Lekholm U. Aspects on osseointegrated implants inserted in growing jaws. A biometric and radiographic study in the young pig. Eur J Orthod 1992; 14: 99-109.
› Thilander B, Odman J, Jemt T. Single implants in the upper incisor region and their relationship to the adjacent teeth. An 8-year follow-up study. Clin Oral Implants Res 1999;10: 346-55.
› Thilander B, Odman J, Lekholm U. Orthodontic aspects of the use of oral implants in adolescents: A 10-year follow-up study. Eur J Orthod 2001; 23: 715-31.
› Velasco Ortega E SEJ, Linares Gancedo D, Medel Soteras R, Poyato Ferrera M. La carga inmediata de implantes transicionales en sobredentaduras mandibulares en adultos mayores. Av Periodoncia 2004; 16: 107 -13.
› Westwood RM, Duncan JM. Implants in adolescents: A literature review and case reports. Int J Oral Maxillofac Implants 1996; 11: 750-5.