Two-year Follow-up of a Patient with Oligodontia Treated with Implant- and Tooth-Supported Fixed Partial Dentures: A Case Report

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Dental implants have become an accepted treatment modality for aging patients with either completely or partially edentulous arches. However, growing patients with congenitally missing primary and/or permanent teeth often need dental implant treatment, even before puberty, for optimum functional and/or psychosocial development. From a developmental perspective, dental implants cannot accompany the physiologic differentiation of the alveolar bone because of the difference in anchorage between an osseointegrated dental implant and a tooth in bone. Nevertheless, reports in the literature suggest that dental implants can be used successfully in partially and completely edentulous arches affected by congenital disorders such as ectodermal dysplasia. In this case report, a multidisciplinary team approach, which included an orthodontist, an oral surgeon, and prosthodontists, in the treatment of a patient with oligodontia is discussed. The orthodontic and prosthodontic treatment sequence, growth analysis from age 14 to 18 years, and successful therapy of an implant associated with late failure is presented. INT J ORAL MAXILLOFAC IMPLANTS 2003;18:905–911

Key words: *dental implant, fixed partial denture, oligodontia, treatment failure*

Following the introduction of osseointegration into restorative dentistry in the early 1960s,[1] completely edentulous mandibular arches in elderly patients received primary emphasis regarding the restoration of oral function. Following excellent long-term results in the treatment of completely edentulous arches,[2] implant-supported fixed partial dentures (FPDs)[3] and overdentures[4,5] became common treatment modalities. Dental implants are now widely used to restore lost function and esthetic compromise associated with missing teeth and related structures in the adult population. With the increased predictability of dental implants, the same treatment modalities have come under consideration for growing patients.

Congenitally missing primary and permanent teeth in the maxilla and mandible accompanied by hypoplasia of the alveolar bone are frequently described oral abnormalities.[6] In addition to loss of function and esthetic compromise, psychosocial development is an important concern in the oral rehabilition of growing patients. Although oligodontia (the absence of 6 or more teeth) is a rare congenital disorder,[7] treatment for this abnormality can be a challenge. Removable partial or complete dentures have been proposed as the treatment of choice for the affected growing patient.[8] However, a number of clinical reports have indicated that the use of dental implants before completion of alveolar growth and development could be beneficial in these patients.

The basic concern in the early 1990s for the use of dental implants in the rehabilitation of growing patients was the probable negative influence of ankylotic anchorage of dental implants, which is

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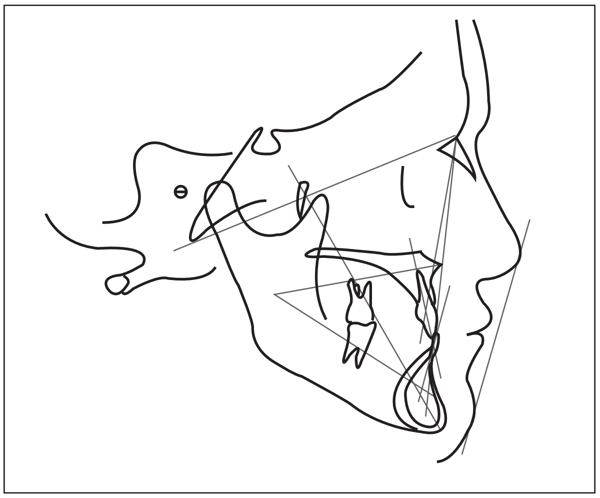

Fig 1 Cephalometric tracing of the patient at 14 years of age. SNA angle = 76 degrees; SNB angle = 80 degrees; lower face height = 41 degrees; facial axis = 97 degrees; 1-NA = 22 degrees; 1-NB = 16 degrees.

similar to ankylotic teeth, on general growth and development of the dentoalveolar process.[9] Both experimentally[10,11] and clinically,[12,13] it has been demonstrated that functional ankylosis of dental implants, defined as *osseointegration*,[14] could result in the burying of dental implants because of the development of the dentoalveolar process induced by the continual eruption of the adjacent natural teeth. Although outcomes of the aforementioned studies were limited to either only a few missing permanent teeth or single-tooth gaps, it is quite surprising that significant bone growth around implants placed between the mental foramina in the edentulous mandible has been seen in growing patients with ectodermal dysplasia.[15,16] However, a 12-year growth analysis of a patient with ectodermal dysplasia treated with dental implants revealed that implants followed mandibular growth displacement.[8] Although these results are limited to case reports, it is suggested that dental implants can be successfully placed anterior to the mental foramina in growing patients.

In the present case report, the oral rehabilitation, growth analysis, and treatment outcome of a late implant failure in a male patient with oligodontia treated with dental implants is presented.

PATIENT HISTORY

A 14-year-old male patient with oligodontia of the permanent teeth and partially retained and/or ankylosed primary teeth was scheduled to receive implant- and tooth-supported FPDs by a multidisciplinary team that included an orthodontist, an oral surgeon, and prosthodontists. Clinical and radiographic examination revealed that the following permanent teeth were existing and completely erupted into the oral cavity with normal-sized pulp chambers and pulp canals: 17, 16, 14, 13, 11, 21, 24, 26, and 27 (2, 3, 5, 6, 8, 9, 12, 14, 15) in the maxilla and 36, 34, 33, 44, and 46 (19, 21, 22, 28, 30) in the mandible. The other permanent teeth were congenitally missing. Except for the permanent molar teeth in the mandibular and maxillary arches, other permanent tooth crowns were immature, demonstrating a conical shape. However, the roots of all existing permanent teeth were well developed in length and shape and firmly established in their dentoalveolar sockets. Existing primary teeth were 55, 63, and 65 (1, 8, 10) in the maxilla and 75, 72, 71, 81, 82, and 83 (11, 14, 15, 16, 17, 18) in the mandible. The patient's history indicated that there were no missing primary teeth, and the others had been exfoliated in their normal sequence. The crowns of the ankylosed primary teeth (55, 65, 75 [1, 10, 11]) persisted infraocclusally, with almost completely resorbed roots. However, the retained primary teeth (63, 72, 71, 81, 82, 83 [8, 14, 15, 16, 17, 18]) demonstrated partial resorption of their roots.

This developmental defect resulted in disarrangement of the existing permanent teeth, with multiple diastemas. Furthermore, a severely decreased vertical dimension of occlusion, related to inappropriate occlusal contacts of the permanent and primary teeth, caused prognathism, which seriously affected the patient's lower facial expression. The cephalometric analysis revealed a Class III malocclusion, with a retrognathic maxilla, well-developed mandible, reduced lower anterior face height, and upright positioned incisors (Fig 1).

After clinical and radiographic evaluation of the patient, the proposed treatment plan comprised fixed orthodontic treatment and prosthodontic rehabilitation of the mandibular and maxillary arches. Considering the psychosocial compromise of the patient, it was decided to delay the treatment sequence during the developmental growth of the patient. Since the patient strongly rejected the use of an extraoral appliance, fixed intraoral treatment was performed and treatment priority was devoted to achieving appropriate spacing and arrangement of the existing permanent teeth. In the maxillary arch, after leveling and alignment, a protraction utility arch was used to protrude the central incisors. In the mandibular arch, segmented arches were applied for alignment (Figs 2a to 2c). Because of unstable orthodontic anchorage related to the limited number of permanent teeth, orthodontic

Figs 2a to 2c Fixed orthodontic appliance in *(above left)* the maxillary arch and *(above right)* the mandibular arch. *(Right)* Panoramic radiograph of the patient.

treatment was compromised, with tooth positioning that could enable prosthodontic rehabilitation.

According to the planned treatment, the primary teeth were removed from both arches. To improve the cosmetic appearance of the conical anterior permanent teeth in the maxillary arch, a tooth-supported FPD was planned, since the existing permanent teeth would provide enough support. In the mandibular arch, 3 dental implants were placed to support a FPD in the edentulous region that would result following removal of primary teeth between the mental foramina. Tooth-supported FPDs were used to restore function in the right and left posterior edentulous segments.

Three sandblasted/acid-etched, solid-screw, Synocta Esthetic Plus ITI dental implants (Straumann, Waldenburg, Switzerland), 4.1×12 mm each, were placed immediately into the fresh extraction sockets of primary teeth 72, 81, and 82 (14, 16, 17) (Fig 3). During the implant osteotomies, autogenous bone was harvested from the anterior chin to graft the cervical region of the extraction sites of primary teeth 73 and 83 (13 and 18). This procedure was necessary to fill the small gaps around the implant necks after placement. The surgical area was closed using 4/0 propylene sutures after the appropriate closure screws were connected. Meanwhile, all other primary teeth were removed.

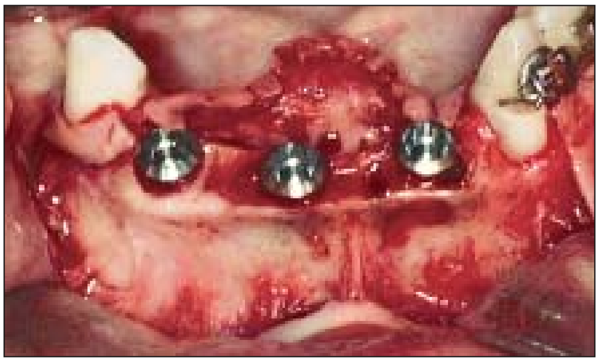

Fig 3 Placement of the implants.

After an uneventful healing period of 6 weeks, solid abutments (4 mm high) were connected and torqued to 35 Ncm using a manual torque device (Straumann) to support a 5-unit FPD. Impressions for casts, facebow transfer, and centric and lateral relation records were made. Subsequently, the above-described implant- and tooth-supported FPDs were fabricated. The tooth-supported FPDs were cemented with zinc polycarboxylate cement,

Fig 4 Implant- and tooth-supported FPDs in maxillary and mandibular arches in centric occlusion.

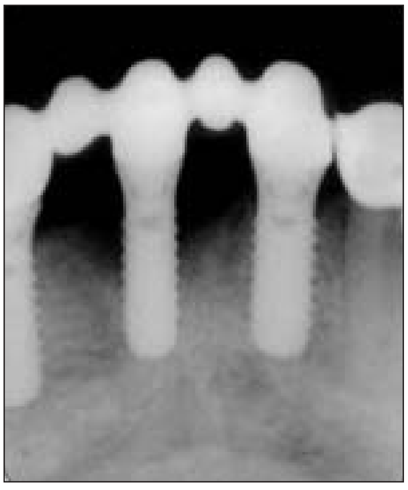

Fig 5a *(Left)* Periapical radiograph. Note the cratering and bone loss.

Fig 5b *(Right)* Periapical radiograph demonstrating subsequent bone fill of the defect.

and temporary cement was used for the implant-supported FPD. The patient then began the standard follow-up (Fig 4).

At the first follow-up examination, 3 months after delivery of the prostheses, the patient demonstrated a localized purulent swelling on the facial aspect of the implant placed in the region of the mandibular primary right central incisor. Dental plaque accumulation accompanied the suppuration. Peri-implant probing depth around the implant was 5 to 7 mm, with bleeding. No mobility was detected following removal of the FPD. However, a large, crater-shaped radiolucent area in the cervical region of the implant involving the first 4 threads was identified in the periapical radiograph (Fig 5a). The peri-implant lesion was classified as a late failure.

The lesion was treated according to the Cumulative Interceptive Supportive Therapy (CIST) approach,[17] which involves instruction in more effective oral hygiene practices and antiseptic and antibiotic therapy. In the CIST modality for this patient, systemic ornidazole (Biteral; Hoffman-La Roche, Basel, Switzerland) was prescribed, 500 mg twice a day, for 10 days before and following local curettage of the granulation tissue around the cervical region of the implant with plastic instruments. During the surgical approach, the surgical site was rinsed with sterile saline solution (0.9%) for approximately 15 minutes. After removal of the sutures, 0.2% chlorhexidine gluconate irrigation was performed daily for 5 weeks. Positive treatment results were achieved 6 weeks later. Infection was controlled successfully, resulting in absence of suppuration and reduced edema. There was radiographic evidence of restoration of lost cervical bone (Fig 5b). However, shrinkage of the attached gingiva exposed the polished transmucosal portion of the ITI dental implant (Fig 6).

A final cephalogram obtained at age 18 revealed that the maxillary incisors were protruded 7 mm and the lower anterior face height had increased 2 degrees, both of which resulted in an improved facial profile (Fig 7a). In contrast to the expected normal mandibular growth process observed from superimposition of the initial (age 14) and final (age 18) tracings, cephalometric analysis showed a clockwise rotation of the mandible. The implants accompanied the mandibular rotation, without any anteroposterior or vertical alveolar changes (Fig 7b).

Fig 6 Note the appearance of the cervical transmucosal polished region of ITI dental implant after completion of the CIST treatment.

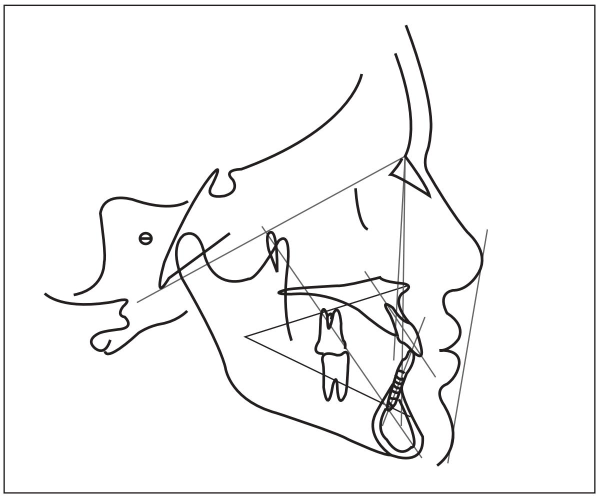

Fig 7a Cephalometric tracing at 18 years of age. SNA angle = 76 degrees; SNB angle = 80 degrees; lower face height = 43 degrees; facial axis = 96 degrees; 1-NA = 37 degrees; 1-NB = 20 degrees.

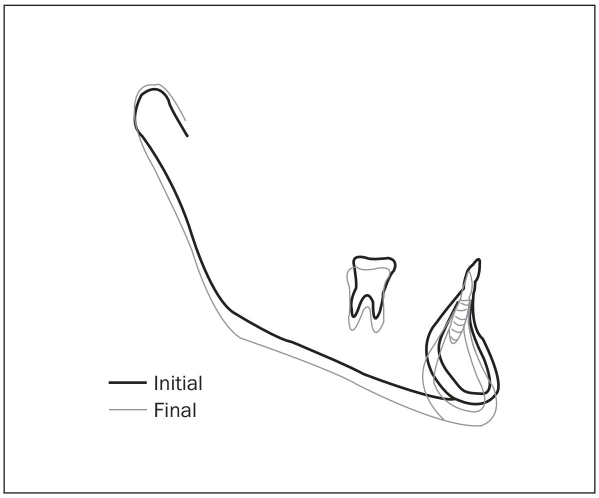

Fig 7b Superimposition of the initial and final mandibular cephalograms.

DISCUSSION

Currently, it is not unusual to restore function and esthetics in growing patients with implant-supported prostheses. An osseointegrated implant behaves like an ankylosed primary tooth, with the same lack of alveolar growth and dental eruption.[18] Therefore, dental implants in growing patients could impair the local development of bone where they are placed. However, Bjork[19] noted that the mandibular growth pattern is generally characterized by upward and forward curving growth in the condyles, with no growth occurring at the anterior aspect of the mandible. Another important issue is the social development of these patients. Congenitally missing teeth can create dental and facial disfigurement, which can lead to social withdrawal, especially in the adolescent years.[13] Therefore, the patient in this case received dental implants in the mandibular anterior region while he was still growing. The implants in the anterior mandibular edentulous region did not become submerged, and the normal growth of the mandible was not impaired by the placement of implants in the mandibular anterior region.

Mandibular superimposition of the initial and final cephalograms revealed normal mandibular growth. The facial profile improved dramatically, as the lower anterior face height had increased because of posterior rotation of the mandible. However, the anteroposterior maxillomandibular relation was only partially corrected, since the patient refused to use an extraoral appliance. Therefore, the maxillary incisors were positioned more labially than the normal limits.

Failures in dental implant treatment can be classified as early or late depending on certain complications, and it is rare not to find the causes.[20] Late failures are usually attributed to peri-implantitis and/or occlusal overload. However, the hypothesis that occlusal overload causes peri-implant bone loss is still being debated,[21–24] and scientific evidence for such a relationship has not been fully established.[25] In several studies,[26–28] marginal bone defects similar to periodontal lesions found around teeth were created around the peri-implant tissues experimentally, through plaque accumulation promoted by various methods.

In this patient, clinical signs and symptoms that were associated with radiographic evidence of saucer-shape destruction around the cervical region of the implant were typical of peri-implantitis.[29] The failure probably should not be considered "late," because the elapsed time for the defect to appear clinically after delivery of the prosthesis was too short. In addition, lack of osseointegration could not be considered, as the patient experienced no sensitivity, and the implant did not appear to rotate at the time of abutment connection, where the bond between implant and bone counters the applied torque of 35 Ncm. Since mucositis may represent a risk for peri-implantitis,[29] it could be that in the present case, local trauma and/or irritation, causing mucositis, might have been responsible for the peri-implantitis.

Although an increasing number of reports have presented the successful regenerative treatment of peri-implantitis defects,[30–32] histologic evidence of re-osseointegration in humans is lacking. Persson and coworkers[33] demonstrated only a dense connective tissue capsule formation in the peri-implantitis defects next to commercially pure titanium surfaces in a dog study. However, the same authors recently demonstrated substantial re-osseointegration next to a sandblasted/acid-etched surface in another dog study.[34] Also, rapid biologic host recovery of the sandblasted/acid-etched surface was shown, with early radiographic signs of loss of osseointegration.[20]

Patients with oligodontia may benefit from the use of dental implants in the mandibular anterior region, with restoration of function and improvement in psychosocial development, without waiting for the completion of growth to initiate treatment.

REFERENCES

1. Brånemark P-I, Zarb GA, Albrektsson T. Tissue-Integrated Prostheses: Osseointegration in Clinical Dentistry. Chicago: Quintessence, 1985:175–186.
2. Adell R, Lekholm U, Rockler B, Brånemark P-I. A 15-year study of osseointegrated implants in the treatment of the edentulous jaw. Int J Oral Surg 1981;6:387–416.
3. Jemt T, Lekholm U, Adell R. Osseointegrated implants in the treatment of partially edentulous patients: A preliminary study on 876 consecutively placed fixtures. Int J Oral Maxillofac Implants 1989;4:211–217.
4. Mericske-Stern R. Clinical evaluation of overdenture restorations supported by osseointegrated titanium implants. A retrospective study. Int J Oral Maxillofac Implants 1990;5:375–383.
5. Batenburg RH, van Oort RP, Reintsema H, Brouwer TJ, Raghoebar GM, Boering G. Overdentures supported by two IMZ implants in the lower jaw. A retrospective study of peri-implant tissues. Clin Oral Implants Res 1994;5:207–212.
6. Levin LS. Dental and oral abnormalities in selected ectodermal dysplasia syndromes. Birth Defects Orig Artic Ser 1988;24:205–227.
7. Schalk van der Wiede Y. Oligodontia. A Clinical, Radiographic and Genetic Evaluation [thesis]. Utrecht: University of Utrecht, 1992.
8. Becktor KR, Becktor JP, Keller EE. Growth analysis of a patient with ectodermal dysplasia treated with endosseous implants: A case report. Int J Oral Maxillofac Implants 2001;16:864–874.
9. Lekholm U. The use of osseointegrated implants in growing jaws [editorial]. Int J Oral Maxillofac Implants 1993;8:243–244.
10. Thilander B, Odman J, Grondhal K, Lekholm U. Aspects of osseointegrated implants inserted in growing jaws. A biometric and radiographic study in the young pig. Eur J Orthod 1992;14:99–109.
11. Odman J, Grondhal 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;13:279–286.
12. 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 Implant Res 1999;10:346–355.
13. Cronin RJ Jr, Oesterle LJ. Implant use in growing patients. Treatment planning concerns. Dent Clin North Am 1998;42:1–34.
14. Schroeder A, Sutter F, Buser D, Krekeler G. Oral Implantology: Basics, ITI Hollow-Cylinder System. New York: Thieme, 1996.
15. Bergendal T, Eckerdal O, Hallonstel AL, Koch G, Kurol J, Kvint S. Osseointegrated implants in the oral rehabilitation of a boy with ectodermal dysplasia: A case report. Int Dent J 1991;41:149–156.
16. Escobar V, Epker BN. Alveolar bone growth in response to endosteal implants in two patients with ectodermal dysplasia. Int J Oral Maxillofac Surg 1998;27:445–447.
17. Lang NP, Wilson TG, Corbet EF. Biological complications with dental implants: Their prevention, diagnosis and treatment. Clin Oral Implants Res 2000;11:146–155.
18. Oesterle LJ, Cronin RJ, Ranly DM. Maxillary implants and the growing patient. Int J Oral Maxillofac Implants 1993;8:377–387.
19. Bjork A. Prediction of mandibular growth rotation. Am J Orthod 1969;55:585–599.
20. Akca K, Iplikcioglu H. One-year follow-up of an implant with early radiographic signs of loss of osseointegration: Case report. Clin Impl Dent Relat Res 2002;4:43–46.
21. Isidor F. Loss of osseointegration caused by occlusal load of oral implants. A clinical and radiographic study in monkeys. Clin Oral Implants Res 1996;7:143–152.
22. Miyata T, Kobayashi Y, Araki H, Motomura Y, Shin K. The influence of controlled occlusal overload on peri-implant tissue: A histologic study in monkeys. Int J Oral Maxillofac Implants 1998;13:667–683.

23. Quirynen M, Naert L, van Steenberghe D. Fixture design and overload influence marginal bone loss and fixture success in the Brånemark System. Clin Oral Implants Res 1992;3:104–111.
24. Celleti R, Pameijer CH, Brachetti G, Donath K, Persichetti G, Visani I. Histologic evaluation of osseointegrated implants restored in nonaxial functional occlusion with preangled abutments. Int J Periodontics Restorative Dent 1995;15:563–573.
25. Tonetti M, Schmid J. Pathogenesis of implant failures. Periodontology 2000 1994;4:127–138.
26. Loe H, Theilade E, Jensen SB. Experimental gingivitis in man. J Periodotol 1965;36:177–187.
27. Quirynen M, Listgarten MA. The distribution of bacterial morphotypes around natural teeth and titanium implants ad modum Brånemark. Clin Oral Implants Res 1990;1:8–12.
28. Berglundh T, Lindhe J, Marinello C, Ericsson I, Liljenberg B. Soft tissue reaction to de novo plaque formation at implants and teeth. Clin Oral Implants Res 1992;3:1–8.
29. Mombelli A, Lang NP. The diagnosis and treatment of peri-implantitis. Periodontology 2000 1998;17:63–76.
30. Bragger U. Use of radiographs in evaluating success, stability and failure in implant dentistry. Periodontology 2000 1998;17:77–88.
31. Hammerle CHF, Fourmousis I, Winkler JR, Weigel C, Bragger U, Lang NP. Successful bone fill in late peri-implant defects using guided tissue regeneration. A short communication. J Periodontol 1995;66:303–308.
32. Jovanovic SA. The management of peri-implant breakdown around functioning osseointegrated dental implants. J Periodontol 1993;64:1176–1183.
33. Persson LG, Ericsson I, Berglundh T, Lindhe J. Guided bone regeneration in the treatment of peri-implantitis. Clin Oral Implants Res 1996;7:366–372.
34. Persson LG, Berglundh T, Sennerby L, Lindhe J. Reosseointegration after treatment of peri-implantitis at different implant surfaces. An experimental study in dog. Clin Oral Implants Res 2001;12:595–603.