The Role of Complete Overdentures in Esthetic Rehabilitation of the Adolescent Oligodontia Patient. A Case Report

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ABSTRACT

Statement of the Problem: Dental agenesis is a common developmental anomaly among human populations. It presents with varying degrees of severity. Oligodontia present in the permanent dentition may have significant esthetic, psychosocial, as well as functional implications.

Case Presentation: A case of oligodontia in an adolescent patient treated with conventional overdentures is presented in this article. A thorough medical and dental history were taken. Comprehensive clinical and radiographic examinations were made. Diagnostic casts were mounted. The prosthetic denture teeth were set and followed by esthetic and phonetic evaluation. Following approval by the patient, the overdentures were processed in heat cure resin using the conventional techniques.

Results: Good esthetic results were achieved. Patient was satisfied with the final prostheses.

Conclusion: Simple prosthodontic solutions can be utilized to aid patients with dental agenesis. These have great implications for the patient's self image.

CLINICAL SIGNIFICANCE

Oligodontias are common. The literature frequently addresses esthetic rehabilitation using fixed prostheses and dental implants. This case report illustrates the value of removable prosthodontic procedures as one approach to fulfilling the requirements of esthetic rehabilitation of a young oligodontia patient.

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INTRODUCTION

Dental agenesis is a common developmental anomaly among human populations. The prevalence of dental agenesis in North America as reported in a meta-analysis study in 2004 was 3.9%.[1] Dental agenesis presents with varying degrees of severity. Oligodontia is a rare anomaly affecting approximately 0.1% to 0.3% of the population.[1] It refers to the congenital absence of six or more teeth excluding the third molars.[2]

Moreover, it can present as an isolated trait or as a part of a syndrome. Among these syndromes are ectodermal dysplasias or incontinentia pigmenti.

Microdontia and conical crowns may be additional features.[3–6]

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Reduction in the crown size is more severe when the number of missing teeth increases.[7] Some studies also reported the presence of taurodontism of the first and second molars.[8,9]

The etiology of oligodontia can be genetic or environmental as a result of a traumatic injury to the jaws during tooth development, infection, as well as radiation or chemotherapy during cancer treatment. Genes that have been associated with tooth agenesis are *MSX1*,[10] *PAX9*[11,12] as well as *AXIN2* mutations.[13] Mutations in the *EDA* gene have also been reported in some cases of non-syndromic oligodontia patients.[14]

Oligodontias are mostly evidenced by the permanent dentition and the desire for treatment is displayed in adolescence.

Restorative and prosthetic treatment options include overdentures, cast metal ceramic restorations, porcelain jacket crowns, and adhesive restorations either solely or in combinations.

Treatment of the adolescent patient requires special considerations. Beyond the psychological features of the younger patient and the concerns of the parents, facial growth is a prominent concern. Any treatment should reflect the needs of the growing patient. Adhesive restorations to close diastemas may require replacement. Fixed prostheses will impose the need to remove tooth structure that can lead to pulp exposure in young patients. Moreover, the potential for jaw growth in this patient population contraindicates the use of fixed prostheses as jaw growth can lead to altered occlusion and poor esthetics. On the other hand, small, conical tapered teeth are not conducive to retentive crown preparation. Removable prostheses may affect tooth position or require replacement. Orthodontics may be required and dental implant therapy is also affected by the differential removal of teeth versus the relative immobility of the implant. Endosseous implants placed in young patients act as ankylosed teeth resulting in infraocclusion of the restorations[15,16] or if the implants are fixed together can cause jaw growth disturbances. The placement of implants in the growing maxilla should be avoided until early adulthood.[17] On the other hand, the lack of teeth in these patients is often associated with a developmental failure of alveolar bone, resulting in an apparent atrophy of the ridge. Finnema and colleagues reported an overall implant survival rate of 86% and 96% for the maxilla and mandible, respectively, in oligodontia patients (grown patients).[18]

OVERDENTURE THERAPY FOR THE ADOLESCENT PATIENT

Overdentures supported by natural teeth or implants have been described in the literature in the treatment of patients with oligodontia.[19–22] This choice is simple as well as reversible. It can provide means for restoring ideal occlusion, increasing the vertical dimension and thus dramatically improving facial esthetics, in addition to restoring the self image of those patients.[22]

On the other hand, the overdentures cover the teeth as well as the gingival margins. This will isolate the supporting teeth from normal salivary contact, which aids in remineralization. This can potentially increase caries rate, gingivitis as well as periodontal breakdown.[23–25]

Daily applications of fluoride pastes to the intaglio surface of the overdenture are recommended to reduce the risk of dental caries. Periodic recalls every 3–4 months are imperative to monitor hygiene and growth.

Clinical observations from case reports revealed no evidence of growth restrictions induced by the overdenture treatment. The overdentures present no impediment to the eruption of the permanent dentition.[26]A long-term follow-up

study of pediatric patients treated with overdentures for 2–25 years reported no Temporomandibular joint-related complication (TMJ) although the vertical dimension has been increased.[27]

The aim of this case report is to review the current concepts regarding the treatment of the adolescent prosthodontic patient and to reinforce the potential merit of overdentures as either interim or definitive prostheses for this patient.

CASE REPORT

A 16-year-old female presented to the Graduate Prosthodontic Clinic at the University of North Carolina seeking comprehensive esthetic dental rehabilitation. A review of the patient's past medical history revealed that there was no knowledge of an existing syndrome associated with missing teeth, but both parents were congenitally missing lateral incisor teeth. The patient did not have clinical signs or genetic markers of ectodermal dysplasia. Genetic evaluation revealed no mutation of genes known to be associated with hypodontia or anodontia (e.g., *MSX1*, *PAX9*, and *AXIN2*).

The past dental history included the absence of dental caries and no treatment of the existing condition. A previous consultation with orthodontic specialists led to no treatment plan due to the acknowledgement of limited funds for eventual implant and fixed prosthodontic treatment.

Figure 1. A, *Frontal facial view of the patient.* B, *Profile view demonstrating reduced vertical dimension of occlusion.*

The clinical examination of this patient revealed a notable reduction of the lower third of facial height with associated profile changes including a marked nasolabial angle and procumbent lip contours (Figure 1). Facial symmetry was good and maintained on mandibular opening. The patient's maximal interocclusal space upon opening was 48–50 mm. No clicking or crepitus of the TMJs was observed. The muscles of mastication were not sensitive to palpation. The patient denied any facial or neck muscle pain.

The intraoral examination was marked by the conical malformation of the incisor teeth and microdontia of the bicuspid and molar teeth. Oral hygiene was good and there was a generalized absence of plaque and no bleeding on probing of the periodontal tissues. Teeth numbers 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, J, 14, and 15 were present in the maxilla (Figure 2). The palatal throat form was Class I House classification and the palatal form was U-shaped. Teeth numbers 19, 20, 21, M, 22, Q, 27, R, 28, 29, and 30 were present in the mandible (Figure 3). The patient had a total of 7 congenitally missing teeth excluding the third molars. The lateral border of the tongue was at the level of the

Figure 2. Occlusal view of the maxillary teeth.

Figure 3. Occlusal view of the mandibular teeth.

mandibular occlusal tables and the lingual frenum was attached 6–8 mm below the lingual gingival border. There were no soft tissue masses, swellings, or lesions present on the gingival, buccal or labial mucosa, tongue or alveolar mucosa. The patient presented with underdeveloped alveolar ridges in the anterior mandibular region. At maximal intercuspation, all anterior teeth interdigitated with 100% vertical overbite and –1 mm horizontal overjet (Figure 4). Angle's classification was class III (Figure 5).

Figure 4. Maximal intercuspal position (frontal view).

Radiographic evidence of osseous lesions was absent and good bone density was noted. The retained deciduous teeth J, M, Q, and R were noted to possess good root morphology with less than 50% resorption (Figure 6). This also revealed the absence of permanent successors. Previous orthodontic diagnostic radiography also recorded the vertical maxillary insufficiency and rotation of the mandible with attendant cephalometric findings.

A clinical diagnosis of oligodontia with maxillary and mandibular insufficiency and loss of vertical dimension of occlusion was made and confirmed by panoramic radiography. Despite the marked anatomic variation from normal, oral health status was good (no caries or periodontal disease) and the secondary diagnosis was marked esthetic discrepancy. The only symptom was severe esthetic dissatisfaction.

Treatment Planning Procedures

Any prosthodontic treatment plan minimally requires a clinical record, mounted diagnostic casts, and diagnostic radiographs. Following a comprehensive clinical charting and assessment of the panoramic radiographs, preliminary study casts were made using Penta (3M/ESPE, Seefeld, Germany) and poured in improved dental stone (Microstone, Whip Mix Corp, Louisville, KY, USA). A

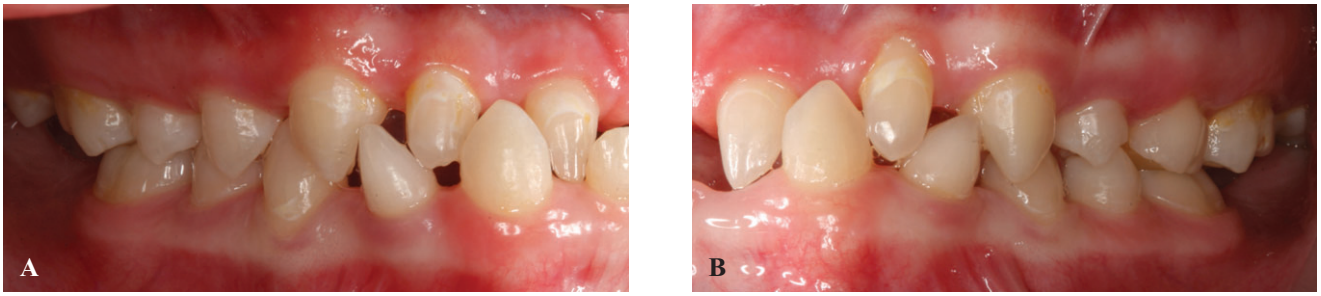

Figure 5. A, *Maximal intercuspal position (lateral view—right side).* B, *Maximal intercuspal position (lateral view—left side).*

Figure 6. Panoramic X-ray.

Figure 7. Lateral view of surveyed mounted diagnostic casts.

facebow index was taken (Springbow, Teledyne Water Pik, Fort Collins, CO, USA) and used to mount the maxillary cast on a Hanau Modular articulator (Hanau, Teledyne Water Pik). Using vinylpolysiloxane, a maxillomandibular recording was made in both maximum intercuspal position and at the centric relation position. These records were used to accurately mount the mandibular cast with mounting plaster (Mounting Plaster, Whip Mix Corp) in a position with the incisal pin at minus 7 (Figure 7). After mounting, the records were clinically confirmed. The mounted study casts confirmed the general symmetry of the maxilla and mandible. The soft tissue undercuts of the maxillary and mandibular alveolus were surveyed. The highlip line was transferred from the patient to the maxillary cast.

Treatment Planning Options

Evaluation of the diagnostic data indicated that many potential treatment options were possible. No treatment was not a viable treatment option because it failed to address the primary clinical symptom of esthetic disappointment and social distress.

The opportunity for fixed prostheses supported by natural tooth roots was briefly considered. The key limitations included the inability to address the maxillary horizontal insufficiency and the marked crown taper that would compromise retentive preparations.

Dental implant therapy was also considered. Both fixed and

removable prosthetic options were considered. Implant supported fixed dentures would provide denture-like esthetics with improved function but at an extremely high cost. The likelihood of surgical phases of tooth extraction, staged bone grafting, and subsequent implant placement were a further deterrent. Implant-based therapy alone did not address the immediate social needs of the patient. Economic realities of dental implants precluded fixed dental implant solutions. Regarding implant supported removable prosthodontic options, the current health of existing teeth, the large amount of interocclusal space currently available for restoration, and cost were arguments that dissuaded removal and replacement of abutment teeth with dental implants.

Removable overdentures are an option for both functional and esthetic dental rehabilitation that require sufficient interocclusal space for a physically robust prosthesis, acceptable residual alveolar ridge morphology for stability, and favorable anatomic features for retention. Review of the mounted diagnostic casts suggested that these prerequisites were present and that the natural teeth could be modified where needed to provide ample space for restorative materials and a path of draw for insertion and retention. In fact, survey of the remaining teeth and alveolar ridges suggested that minimal undercuts could be maintained between existing teeth to provide retention of an acrylic removable overdenture.

Other types of overdenture prostheses were considered. Some designs utilizing tooth supported retentive devices (telescopic crowns, ERA-type attachments, bars) with and without metal frameworks were also considered. After considering the potential to retain an acrylic removable overdenture using tooth undercuts, it was decided to forgo any fixed prosthodontic procedures to provide retentive elements on natural tooth abutments and to eliminate additional cost.

The penultimate step in planning of this patient was to conduct a thorough review of the esthetic and functional limitations that might be presented by the overdenture prosthesis. Discussions focused on four points: (1) esthetic limitations of the overdenture, (2) functional limitations of the overdenture (comfort, confidence, actual loosening of the denture, and phonetic difficulties), (3) biological impact of the overdenture prostheses (denture stomatitis, increased plaque accumulation, denture odor and dental caries, candidal infection), and (4) mechanical failure (fracture, tooth debonding, tooth wear, discoloration). Finally, the likely need for frequent replacement was emphasized.

Active Treatment Procedures

No esthetic treatment can be conducted without knowledge of the midline and plane of occlusion, and further esthetic refinement requires knowledge of the high lipline. These features can and should be reflected in the mounted study casts. Defining the plane of occlusion also requires defining the location of the central incisor tooth and both involve the use of stabilized record bases. Therefore, the first steps involved obtaining oral records using a maxillary stabilized record base.

The presence of teeth and the desire to maintain enamel on these teeth without fixed prosthodontic intervention creates some complexity in developing stabilized record bases. For the purpose of transferring information to the articulator, a base plate wax record base was utilized with the advantage of being infinitely thin where required and being thermoplastic to avoid tooth and soft tissue undercuts. The disadvantage of its weakness and instability are noted.

The maxillary record base was placed in the mouth and the midline, high lipline, and lateral border of the ala of the nose was marked and then transferred to the

articulator. Tooth selection was discussed with the patient and a shade appropriate for this young patient and a mold consistent with available interalar distance and required occlusion versus the mandibular ridge was selected from the Ivoclar Blueline tooth collection. Central incisors were next hollow grinded and tentatively located along the indicated incisal edge. The incisors were clinically evaluated for phonetics, physical support of the upper lip, and display (midline, relation to high lipline). After minor modifications intraorally, the remaining anterior teeth were set on the articulator and again evaluated clinically. This process of anterior tooth arrangement in a clinical setting is critical to optimizing overdenture esthetics. It was determined that an ideal anterior overdenture tooth location could be established without ameloplasty of the underlying natural teeth.

The intervening overdenture tooth set up was completed in the dental laboratory, and the following visit was used to evaluate the initial tooth arrangement, to verify the centric relation recording, and to examine the chosen vertical dimension of occlusion in terms of facial esthetics, tongue position, and phonetics. The setting of denture teeth over the existing natural teeth required careful hollow grinding. At the denture try in visit, several small modifications were required to enhance esthetics. Some adjustments were made in the clinical environment and others were carefully annotated. The final adjustment of tooth position was made in the dental laboratory (Figure 8).

The overdenture try-in visit was performed to further refine the tooth arrangement and evaluate phonetics. The patient's acceptance to this wax denture was essential. Without complete assurance from the patient that the esthetic determinants were consistent with her desires, progression can not occur.

Figure 8. Lateral view of teeth try-in.

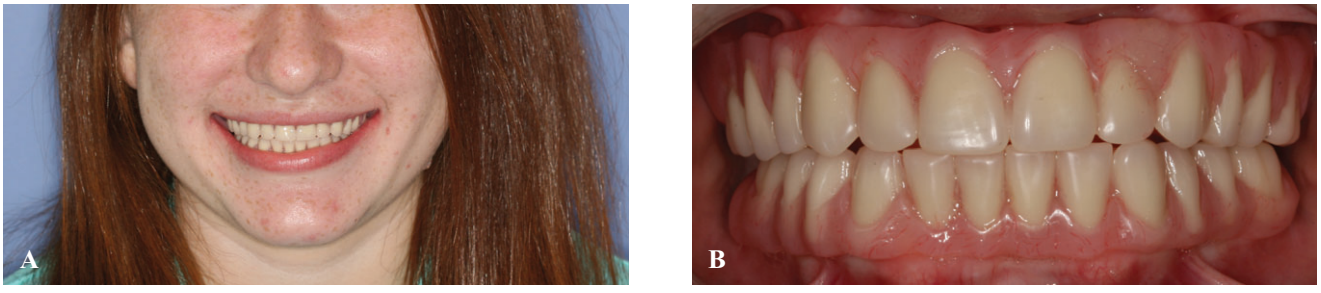

Figure 9. A, *Frontal view of the overdentures in centric relation.* B, *Frontal facial view of the patient with the overdentures.*

The maxillary and mandibular overdentures were processed in heat polymerizing resin (Lucitone 199, Dentsply, York, PA, USA) using conventional technologies and remounted on the articulator to remove processing errors in occlusion. After polishing the prostheses, the patient was seen for delivery of the finished prosthesis (Figure 9).

Follow up Care

Patients with overdentures are at increased risk of dental caries[24]. This patient was advised to regularly clean the prostheses. Fluoride applications to the intaglio surface of the denture were advised. Three- to 6-month hygiene recall visits were scheduled to maintain and reinforce home care performance as well as to assess the need to reline, rebase, or remake prosthesis.

DISCLOSURE

The authors do not have any financial interest in the companies whose materials are included in this article.

REFERENCES

1. 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;32:217–26.
2. Schalk-van der Weide Y, Beemer FA, Faber JA, Bosman F. Symptomatology of patients with oligodontia. J Oral Rehabil 1994;21:247–61.
3. Garn SM, Lewis AB. The gradient and the pattern of crown-size reduction in simple hypodontia. Angle Orthod 1970;40:51–8.
4. McKeown HF, Robinson DL, Elcock C, et al. Tooth dimensions in hypodontia patients, their unaffected relatives and a control group measured by a new image analysis system. Eur J Orthod 2002;24:131–41.
5. Rune B, Sarnäs KV. Tooth size and tooth formation in children with advanced hypodontia. Angle Orthod 1974;44:316–21.
6. Worsaae N, Jensen BN, Holm B, Holsko J. Treatment of severe hypodontia-oligodontia—an interdisciplinary concept. Int J Oral Maxillofac Surg 2007;36:473–80.
7. Schalk-van der Weide Y, Steen WH, Bosman F. Distribution of missing teeth and tooth morphology in patients with oligodontia. ASDC J Dent Child 1992;59:133–40.
8. Zhu JF, Marcushamer M, King DL, Henry RJ. Supernumerary and congenitally absent teeth: a literature review. J Clin Pediatr Dent 1996;20:87–95.
9. Kirzioğlu Z, Köseler Sentut T, Ozay Ertürk MS, Karayilmaz H. Clinical features of hypodontia and associated dental anomalies: a retrospective study. Oral Dis 2005;11:399–404.
10. Vastardis H, Karimbux N, Guthua SW, et al. A human MSX1 homeodomain missense mutation causes selective tooth agenesis. Nat Genet 1996;13:417–21.
11. Mostowska A, Kobielak A, Trzeciak WH. Molecular basis of non-syndromic tooth agenesis: mutations of MSX1 and PAX9 reflect their role in patterning human dentition. Eur J Oral Sci 2003;111:365–70.
12. Stockton DW, Das P, Goldenberg M, et al. Mutation of PAX9 is associated with oligodontia. Nat Genet 2000;24:18–9.
13. Lammi L, Arte S, Somer M, et al. Mutations in AXIN2 cause familial tooth agenesis and predispose to colorectal cancer. Am J Hum Genet 2004;74:1043–50.
14. Song S, Han D, Qu H, et al. EDA gene mutations underlie non-syndromic oligodontia. J Dent Res 2009;88:126–31.
15. Westwood RM, Duncan JM. Implants in adolescents: a literature review and case reports. Int J Oral Maxillofac Implants 1996;11:750–5.
16. Op Heij DG, Opdebeeck H, van Steenberghe D, Quirynen M. Age as compromising factor for implant insertion. Periodontol 2000 2003;33:172–84.
17. Cronin RJ Jr, Oesterle LJ. Implant use in growing patients. Treatment planning concerns. Dent Clin North Am 1998;42:1–34.
18. Finnema KJ, Raghoebar GM, Meijer HJ, Vissink A. Oral rehabilitation with dental implants in oligodontia patients. Int J Prosthodont 2005;18:203–9.
19. Stephen A, Cengiz SB. The use of overdentures in the management of severe hypodontia associated with microdontia: a case report. J Clin Pediatr Dent 2003;27:219–22.
20. He X, Shu W, Kang Y, et al. Esthetic and functional rehabilitation of a patient with nonsyndromic oligodontia: a case report from China. J Esthet Restor Dent 2007;19:137–42.
21. Johnson A, Winstanley RB. Use of simple overdentures in the treatment of young patients with developmental anomalies. Quintessence Dent Technol 1987;11:27–33.
22. Esposito SJ, Cowper TR. Overdentures in partial anodontia: simple solutions for complex problems. Compendium 1991;12:174–7.
23. Toolson LB, Smith DE. A two-year longitudinal study of overdenture patients. Part 1: incidence and control of caries on overdenture abutments. J Prosthet Dent 1978;40:486–91.
24. Renner RP, Gomes BC, Shakun ML, et al. Four-year longitudinal study of the periodontal health status of overdenture patients. J Prosthet Dent 1984;51:593–8.
25. Mericske-Stern R. Overdentures with roots or implants for elderly patients: a comparison. J Prosthet Dent 1994;72:543–50.

26. Bonilla ED, Guerra L, Luna O. Overdenture prosthesis for oral rehabilitation of hypohidrotic ectodermal dysplasia: a case report. Quintessence Int 1997;28:657–65.

27. Vergo TJ Jr. Prosthodontics for pediatric patients with congenital/developmental orofacial anomalies: a long-term follow-up. J Prosthet Dent 2001;86:342–7.

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