



Multidisciplinary Management of Oligodontia in the Adolescent

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Multidisciplinary Management of Oligodontia in the Adolescent

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Learning Objectives: After reading this article the individual will learn: (1) the definition, prevalence, etiology, and system connection of oligodontia, and (2) a multidisciplinary treatment approach for an adolescent patient with oligodontia.

About the Authors



Dr. Forlano is a general dentist with Fellowship and Diplomate awards in 3 dental disciplines: general dentistry through the AGD, orthodontics through the International Association for Orthodontics, and implantology through the International Congress of Oral Implantologists, enabling him to take a self-contained approach to treating multidisciplinary cases. He is a clinical instructor at New York University's implantology program. He maintains a private practice in East Islip, NY, dedicated to comprehensive care of the entire masticatory system. He can be reached via email at drforlano@drforlano.com.



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Figure 1. A 12-year-old female presented with 8 missing adult teeth. A diagnosis of nonsyndromal oligodontia was made.

DEFINITIONS AND PREVALENCE

Tooth agenesis is the congenital absence of one or more teeth at birth, excluding the third molars. Under the umbrella of tooth agenesis are hypodontia, oligodontia, and anodontia. *Hypodontia* is the genetic condition of missing one to 6 adult teeth at birth. *Oligodontia* is the genetic condition of missing more than 6 adult teeth at birth. *Anodontia* is the condition of missing all of the adult teeth at birth. Tooth agenesis is one of the most common developmental problems in children. The literature reports prevalence rates of hypodontia from 3.4% to 11%, which is considered common.¹⁻⁶ Oligodontia, on the other hand, is relatively rare, with prevalence rates ranging from 0.084% to 0.17%.^{7,8}

Oligodontia can be associated with syndromes such as ectodermal dysplasia, Down syndrome, cleidocranial dysplasia, Treacher Collins syndrome, and median cleft face syndrome. Nordgarden et al report that 57% of patients with oligodontia were classified as those with ectodermal dysplasias.⁸ Kumasaka et al report 63% of children with Down syndrome are affected with oligodontia.⁹ Oligodontia can also be associated with nonsyndromal conditions such as cleft palate and cleft lip, or merely be isolated genetic mutations. Mutations of 3 genes in humans are traced to oligodontia. These genes are AXIN2, MSX1, and PAX9.¹⁰

Etiology

The congenital absence of teeth results from disturbances during the initial stages of tooth formation: initiation and proliferation.¹¹ *Initiation* is the first stage of tooth development, beginning in the early weeks of embryonic development where there is a microscopic distinction between the vestibular lamina and the dental lamina. It involves the physiological process of induction of the ectodermal tissues by the developing mesenchyme. For deciduous teeth, initiation begins between the sixth and eighth week. For permanent teeth, initiation begins in the twentieth week. If teeth

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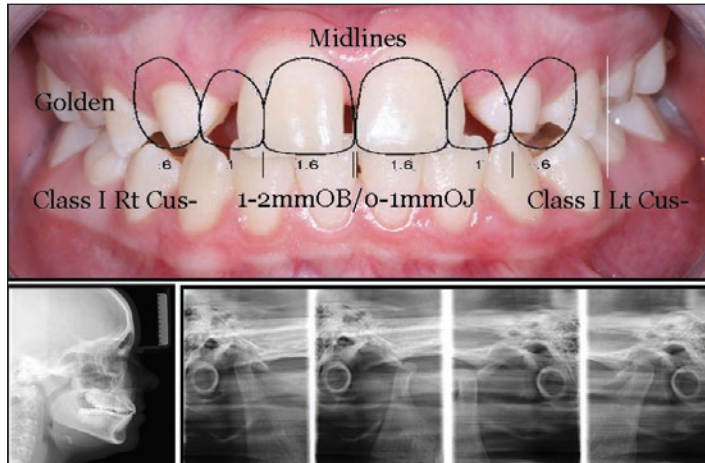


Figure 2. Planning tools included a golden proportion grid superimposed on an image in occlusion, cephalometric, and transcranial images.

do not start to develop at or near these times, they will not develop at all, resulting in tooth agenesis. *Proliferation* is the interaction between the oral ectoderm and the underlying ectomesenchyme, causing the separate tooth buds to proliferate bilaterally from the midline into their respective positions in the dental arches. Interference with proliferation will also lead to tooth agenesis.

Systemic Connection

The genes that control the development of teeth also have important functions in other organs. Therefore, it is plausible that a genetic mutation resulting in tooth agenesis may also cause abnormalities in other organs. Tooth agenesis may be a risk marker for certain cancers. Lammi et al reported a possible molecular association between hypodontia and colon cancer.¹² Gerber et al presented a correlation of hypodontia with malignancy of dysplastic and cancerous epithelium of the human esophagus.¹³ Furthermore, Chalothorn made a correlation of familial, nonsyndromal hypodontia with ovarian cancer, concluding that women with epithelial ovarian cancer are 8.1 times more likely to have hypodontia.¹⁴

TREATMENT CONSIDERATIONS

Multidisciplinary Approach

The treatment of oligodontia in children is complex and should be undertaken by a clinician skilled in pediatric dentistry, orthodontics, oral surgery, and prosthodontics.¹⁵ A multidisciplinary approach is necessary. Early treatment decisions will affect the patient's dental health for a lifetime; therefore, correct decisions must be made at the appropriate time. The total treatment time of several years creates a challenge when considering temporization, space maintenance, and bone volume maintenance.

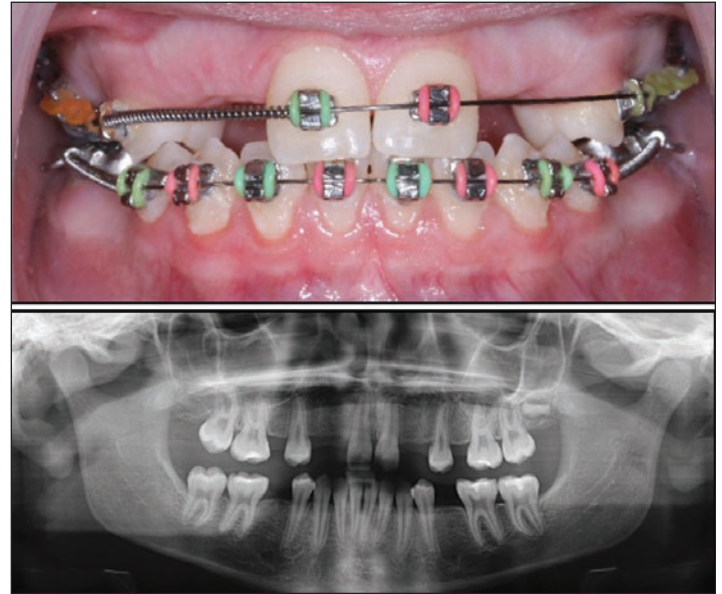


Figure 3. The remaining teeth and spaces were aligned into a Class I relationship for future implant restorations.

Treatment considerations include facial growth, available bone, and the adolescent psyche.

Facial Growth

The diagnosis of tooth agenesis should confirm or negate the association with a syndrome, as this will be critical to predicting facial growth. There are 3 basic facial types: short or *brachycephalic*, normal or *mesocephalic*, and long or *dolicocephalic*. These are characterized by several morphological features, making them, in their own right, facial syndromes. Assessment includes cephalometric analysis and craniometric measurements.

Growth of the maxilla and mandible occurs on 3 planes: horizontal, sagittal, and vertical. Three-dimensional growth patterns will vary with the different facial types. Short facial types, or deep bites, tend to grow horizontally with a forward rotational growth of the mandible. Long facial types, or skeletal open bites, are vertical growers with backward rotational growth of the mandible. Oligodontia can occur in any of these types, making management complex.

Furthermore, most individuals with oligodontia demonstrate a Class III tendency, despite the facial type or growth pattern. With oligodontia, it is also common to see a deficiency in the lower face height.¹⁶

Teeth Versus Implants During Jaw Growth

Movement of the developing teeth, including mesial drift and continuous eruption, is coincidental with the growth of the

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jaws; however, osseointegrated dental implants do not move with jaw growth and are prone to becoming submerged. Hence, it is well accepted to postpone implant placement until craniofacial and skeletal growth is complete,¹⁷ especially in cases of oligodontia. In fact, an implant placed in the anterior maxilla at age 7 years will be located 10 mm more apically than the adjacent teeth 9 years later.¹⁸ Growth indicators important to the successful timing of implant placement in oligodontia patients include cervical vertebrae analysis, hand-wrist bone age, superimposed cephalometrics, and endocrinology reports.

The Adolescent Psyche

Another consideration in treating oligodontia in children is managing the adolescent psyche. This can be the most challenging for the dental clinician, as most dentists have no formal training in this area. Adolescence is a transitional stage of physiological and psychological development, usually occurring between the ages of 10 and 20 years, somewhere between puberty and legal adulthood. Adolescents become more emotional, become conscious of their appearance, begin to have an interest in sexual relationships, and increase time spent with their peers during this period.¹⁹

Missing teeth in the aesthetic zone can negatively impact their self-confidence and lead to awkward or embarrassing situations, as well as making them vulnerable to bullying.

Compliance with dental treatment in adolescence has its challenges as teens increase their independence from parents. Conflict between adolescents and their parents, and authority figures in general, increases at this time.²⁰ The dentist can be taken as an authority figure, hence thwarting compliance. As with all courses of dental treatment, compliance is essential. A doctor-patient understanding is essential for a smooth course of treatment, let alone a course of treatment that can take several years. The longer the total treatment time, the greater the chance of a problem, such as a lost retainer, a broken temporary, unexpected growth variations, etc, making management of oligodontia during adolescence even more challenging.

CASE REPORT

Diagnosis and Treatment Plan

A 12-year-old female presented for general dental treatment

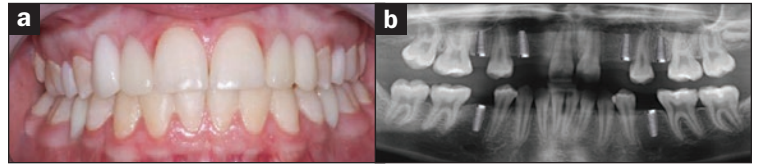


Figure 4. Removable partial dentures satisfied the adolescent's aesthetic needs, maintained the mesial-distal spaces, and retained the orthodontic results.

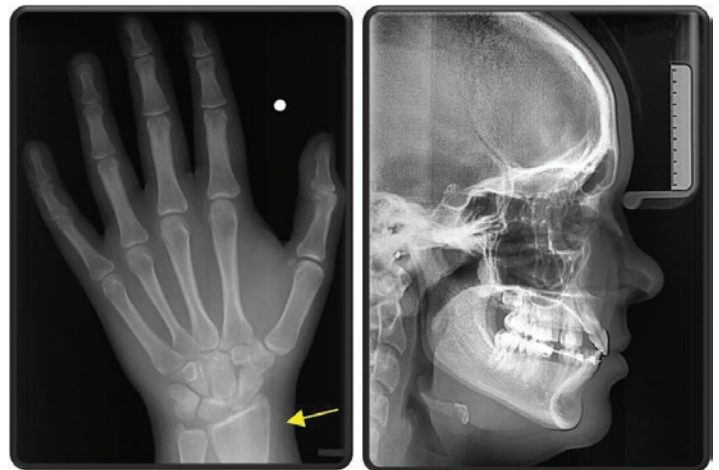


Figure 5. The epiphysis of the radius has formed a union with the diaphysis (Ru) indicating skeletal growth completion at age 16 years, 7 months.



Figure 6. Mesial-distal prosthetic space for teeth Nos. 4 and 13 was compromised. A custom, self-activated, molar distalizing appliance with prosthetic teeth Nos. 6, 7, 10, and 11 was fabricated to regain the lost space.

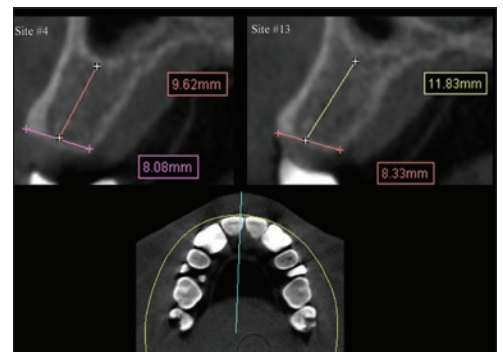


Figure 7. CBCT images of site Nos. 4 and 13 proved ample available bone height and width, but the actual implant diameter selection was based upon prosthetic mesial-distal tooth width.

(Figure 1). Medical history was unremarkable. Dental history included what the parents described as “routine checkups and a few fillings.” Upon examination, 8 adult teeth (Nos. 4, 6, 7, 10, 11, 13, 20, and 29) and 4 third molars were found to be missing. Six deciduous teeth were retained. Endocrinology reports were negative. No systemic problems were discovered. A diagnosis of

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nonsyndromal oligodontia of the adult dentition was made. Vertical deficiency, a Class III tendency, and deviant tooth morphology—which are commonly seen in oligodontia cases—were not present.

There are 2 schools of thought when it comes to multidisciplinary treatment planning. One is to begin with the end result in mind and provide a plan to achieve that result. The other is to list the problems and provide individual solutions. The former approach was undertaken. The planned end result was a 28-tooth Class I dental occlusion with the correct vertical dimension of occlusion, aligned skeletal and dental midlines, a normal overbite and overjet, and an aesthetically pleasing smile. The multidisciplinary treatment plan included removal of the deciduous teeth, alignment of the adult dentition, transitional removable partial dentures until craniofacial growth was complete, and ultimately, dental implant-supported restorations in site Nos. 4, 6, 7, 10, 11, 13, 20, and 29.

Diagnostic data and planning tools included a golden proportion grid superimposed upon an image of the teeth in maximum intercuspation, and cephalometric and transcranial images (Figure 2). These along with other diagnostic tools were used to plan a Class I occlusal relationship.

Extractions and Orthodontics

Treatment began with atraumatic removal of the deciduous teeth. Light-force differential straight arch orthodontics was initiated utilizing Tip-Edge brackets (TP Orthodontics). Differential tooth movement is comprised of simultaneous tipping of the crowns toward their desired positions, followed by uprighting of the roots to achieve the final axial inclinations. All movements were achieved with only 2 to 3 ounces of force. A Class I molar relationship was obtained bilaterally. The dental midlines were aligned. The spaces for the missing teeth, and ultimately the dental implants, were provided and maintained according to average mesial-distal tooth sizes (Figure 3).

Interim Prosthesis

All-acrylic, removable partial dentures were fabricated to serve as the interim prostheses. The maxillary prosthesis was fabricated to replace the maxillary second bicuspids, cupids, and lateral incisors bilaterally. The mandibular prosthesis was fabricated to replace the mandibular second bicuspids bilaterally. Along with a lingual

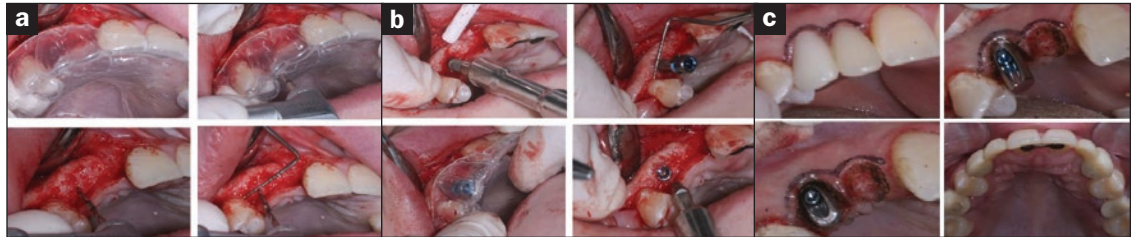


Figure 8a. The implant in site No. 6 was plotted with a surgical guide fabricated from the diagnostic wax-up.

Figure 8b. A 3.2-mm root-form implant was placed based upon the mesial-distal prosthetic space.

Figure 8c. The patient was transitioned from a removable temporary to a fixed temporary utilizing a stock abutment and a diode laser to sculpt the soft tissue.

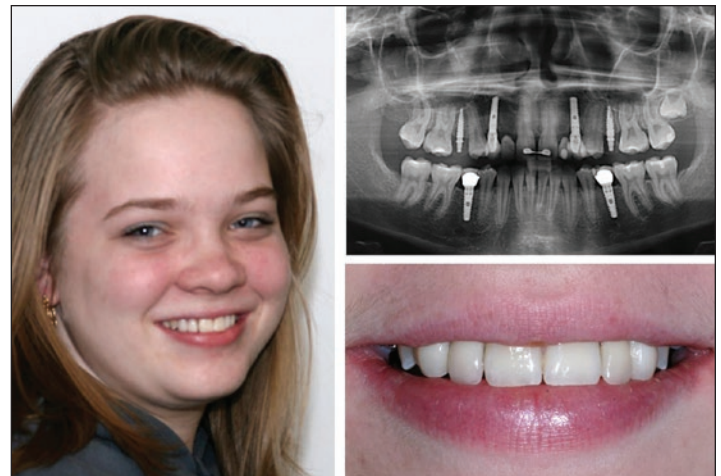


Figure 9. A multidisciplinary approach resulted in achievement of the preoperative goals: an aesthetically pleasing 28-tooth, Class I occlusion.

bonded retainer from teeth Nos. 8 and 9, these interim prostheses also served as orthodontic retainers and space maintainers. These were worn for approximately 5 years.

The interim treatment goals were obtained and demonstrated via the images in Figure 4. Psychological factors must be taken into consideration when treating a patient of this age. Partial edentulism can adversely affect the adolescence psyche,¹⁹ whereas proper aesthetics can positively affect a teen's confidence and maturation.

Growth Assessment

Growth assessment was made through hand-wrist radiographs, cervical vertebrae analysis, superimposed cephalometric tracings, and endocrinology reports. At age 16 years and 7 months, hand-wrist radiographs revealed fusion of the epiphysis of the radius with the diaphysis, cervical vertebrae analysis demonstrated mature vertebrae, and superimposition of cephalometric tracings one year apart showed no change, all signifying cessation of skeletal growth (Figure 5).

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Implant Restoration

CBCT images (iCAT) were obtained to assess available bone for the dental implants. During the course of treatment, space was lost in site Nos. 4 and 13 due to mesial migration of the maxillary first molars. This was corrected with a custom, fixed appliance (DynaFlex Laboratory) that utilized the implants in site Nos. 6 and 11, as well as a Nance Button on the palate as anchorage to distalize the maxillary molars (Figure 6). Acrylic prosthetic teeth Nos. 6, 7, 10, and 11 were built into this appliance to fulfill the aesthetic requirements and to keep this 16-year-old patient socially active and free from embarrassment.

Once the space was regained, implant-supported PFM crowns were planned using implant planning software (SIMPLANT [Dentsply Sirona Implants]) for site Nos. 4, 6, 11, 13, 20, and 29. For soft-tissue aesthetics, cantilevered 2-unit fixed partial dentures were planned for site Nos. 6, 7, and 10, 11, respectively.²¹

Implant selection was prosthetically driven and based on the planned mesial-distal tooth widths. More times than not, implant diameter selection is guided by buccal-lingual bone width (Figure 7). In cases of oligodontia, mesial-distal tooth width is just as important, if not more so, when determining implant diameter.

Placed in site Nos. 20 and 29 were 3.75-mm diameter MIS Seven fixtures (MIS Implant Technologies). For site Nos. 4 and 13, one-piece, 2.4-mm diameter implants (3M) were placed. Placed in site Nos. 6 and 11 were 3.2-mm wide Legacy3 fixtures (Implant Direct). Site Nos. 6, 7, 10, and 11 received soft-tissue contouring with a diode laser (AMD LASERS) for papillae development and optimal aesthetics of the cantilevered prostheses (Figure 8).

All fixtures received PFM restorations. An aesthetically pleasing, 28-tooth Class I molar and cuspid relationship was achieved with normal overbite, overjet, and dental midlines (Figure 9). Protrusive movements were guided by the natural maxillary central incisors with disocclusion of all other teeth. Lateral movements were guided by group function of the natural first bicuspid and the implant-supported cuspids and second bicuspid with disocclusion of all other teeth.

CONCLUSION

Managing oligodontia in the adolescent is best achieved through a multidisciplinary approach, as several modalities must be incorporated and coordinated throughout time with skeletal growth and the changing adolescent psyche. This case was treated during the course of 5 years, from ages 12 to 17 years. Incorporating several dental disciplines enabled a healthy and sound dentition best suited to face the test of time. ♦

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POST EXAMINATION QUESTIONS

1. **Tooth agenesis includes the following type(s):**
 - a. Hypodontia.
 - b. Oligodontia.
 - c. Anodontia.
 - d. All of the above.
2. **Oligodontia is the genetic condition of missing more than ___ adult teeth at birth:**
 - a. 4.
 - b. 6.
 - c. 8.
 - d. 10.
3. **Prevalence rates of hypodontia range from 3.4% to 11%. Prevalence rates of oligodontia range from 0.084% to 0.17%.**
 - a. The first statement is true, the second is false.
 - b. The first statement is false, the second is true.
 - c. Both statements are true.
 - d. Both statements are false.
4. **Oligodontia can be associated with the following syndrome(s):**
 - a. Down syndrome.
 - b. Cleidocranial dysplasia.
 - c. Treacher Collins syndrome.
 - d. All of the above.
5. **For deciduous teeth, initiation (first stage of tooth development) begins between the sixth and eighth week of embryonic development. For permanent teeth, initiation begins in the twentieth week.**
 - a. The first statement is true, the second is false.
 - b. The first statement is false, the second is true.
 - c. Both statements are true.
 - d. Both statements are false.
6. **Tooth agenesis may be a risk marker for certain cancers.**
 - a. True.
 - b. False.

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- 7. Most individuals with oligodontia demonstrate a Class III tendency. With oligodontia, it is common to see a deficiency in the lower face height.**
 - a. The first statement is true, the second is false.
 - b. The first statement is false, the second is true.
 - c. Both statements are true.
 - d. Both statements are false.

- 8. Short facial types, or deep bites, tend to grow vertically with backward rotational growth of the mandible.**
 - a. True.
 - b. False.

- 9. An implant placed in the anterior maxilla at age 7 years will be located _____ more apically than the adjacent teeth 9 years later.**
 - a. 5 mm.
 - b. 7 mm.
 - c. 10 mm.
 - d. 14 mm.

- 10. Growth indicators important to the successful timing of implant placement in oligodontia patients include:**
 - a. Cervical vertebrae analysis.
 - b. Hand-wrist bone age.
 - c. Superimposed cephalometrics.
 - d. All of the above.



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- 5. a b c d
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