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Dental implants in growing children:-A multidisciplinary approach

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Abstract
The absence of teeth due to congenital hypodontia or trauma is the most frequent cause of loss of teeth in young children, this leads to loss of masticatory functions, inadequate normal alveolar growth , along with unpleasant esthetics that impede the psychosocial development of child. Dental implants would be considered as an ideal treatment option for absence of teeth, but the most deterring factor in placing an implant in children is the impeding growth. In the maxilla and mandible, continuous remodelling is taking place, and therefore growth in one plane cannot occur uniformly. A multidisciplinary approach was incorporated into the treatment plan by several clinicians in children to achieve successful implant treatment. The aim of this review to understand the implant implications in pediatric dentistry.

Keywords: ectodermal dysplasia, hex implant, multidisciplinary approach

Introduction
Pediatric patients frequently experience congenital partial anodontia and traumatic tooth loss. Total anodontia is considered to be a rare condition in which all teeth in the primary and/or permanent dentition have been missing since birth.
Oral rehabilitation is required in such cases, even before the completion of skeletal and dental maturation. Teeth loss causes a loss of function, a lack of normal alveolar growth, and unsightly aesthetics, all of which impede a young child's psychosocial development. Conservative methods such as a Maryland Bridge and resin-bonded restorations are used in cases of multiple missing teeth where as removable prosthesis are used to treat single tooth loss in young children. However, these treatments are ineffective and have their own set of disadvantages, including increased caries rates, periodontal complications, and residual alveolar resorption [1]. Partial prothesis depends on the conformity of the child however, new prosthesis must be reconstructed often to compensate for craniofacial growth. A number of authors have published about the use of implants in children.
Dental implants for young children are a relatively new treatment option. There are two main issues to be concerned about: (i), if implants are present during several years of facial development, they may become embedded, relocated, or displaced as the jaw grows. (ii) The effect of prosthesis on growth is the second source of concern.
To compensate for growth changes, design changes must be incorporated into such prostheses [2]. The preservation of bone may be the most important reason for using dental implants in a growing patient from a physiologic standpoint. Because there is little alveolar bone in the case of congenital partial anodontia, the placement of a dental implant alters the load mechanism on the bone and slows its resorption. As a result, these advantages must be weighed against the lack of long-term in vivo evidence-based studies in children that support dental implants [3].
The goal of this paper is to analyse the implications of growth and growth assessment in growing childrens, as well as recommendations for multi-disciplinary treatment plan formulation.

Growth considerations
When it comes to placing an implant in children and adolescents, growth is a critical consideration. Although the use of serial cephalometric radiographs taken 6 months apart with superimposed orthodontic tracings is a good quality procedure, there is no accurate predictor for determining when growth has ceased. If no changes occur over a one-year period, one may conclude that growth is complete [4].

Maxillary Growth
The maxilla proceed its growth in two ways: through apposition and through superficial remodelling [5] Soft tissue growth occurs when the maxilla is moved forward and downward, allowing space within the upper and posterior sutural connections to open up, allowing new bone to grow on both sides of the suture [6] At puberty, sutural growth speeds up, and it is the first of the three dimensions to be completed in adolescence [7]

Table 1: Represents maxillary growth in three dimension

Transverse Growth	Sagittal Growth	Vertical Growth
Early implant placement can cause a diastema with adjacent teeth due to transverse growth. When the implant was placed in the anterior maxillary area as early as 9 years old, there were no reported problems [8] According to Moorrees et al., a decrease in incisor-canine circumference between the ages of 13 and 18 was linked to a decrease in arch length [9] BIshara et al., In both the maxillary and mandibular arches, the tooth size-arch length difference increases substantially from early adolescence to mid-adulthood [10]	The anterior surface of the maxilla undergoes resorption, which causes it to move downward and forward. Early implant placement can result in the loss of labial cortical bone which is needed for the implant [11] An implant in the lateral area therefore can prevent the lateral drift, causing an asymmetric arch, while an implant in the anterior region can become more lingually positioned over time [12]	Sutural lowering allows the maxilla to grow vertically [13] Resorption on the nasal surface and deposition on the palatal and alveolar surfaces cause development in the orbits, as well as an increase in the size of the nasal cavity and maxillary sinuses. The face's vertical growth is the last to be completed. Vertical growth in adults is nearly complete in girls by 17–18 years, and even later in boys, and is influenced by the facial growth type (long face or short face). As a result, an implant placed too early in puberty may end up in the nasal floor after the permanent teeth have moved down.

Mandibular Growth

In contrast to the maxilla, the mandible's growth depends on both endochondral and periosteum activities. Because it contains hyperplasia, hypertrophy, and endochondral replacement, the cartilaginous tissue that covers the condyle of the mandible in the temporomandibular joint differs from that of the epiphyseal disc or synchondrosis [5] All other areas of the mandible are formed and grow by direct apposition to the surface and remodeling.

Table 2: Represents mandibular growth in three dimensions.

Transverse Growth	Saggital Growth	Vertical Growth
Because the symphysis closes in the first year of life, transverse growth in the mandible is completed very early, and only minor changes occur after that through remodelling. Resorption of the bone lingually and deposition buccally occurs posteriorly, resulting in remodelling. If the implant is placed too soon, this pattern of bone growth may cause the implant to be lingually positioned [14]. To accommodate the permanent molars, the mandibular length is limited posterior to the primary second molars.	The mandible, which is more closely associated with cranial structures, grows at a different rate than the maxilla. This is more in the sagittal plane, which is in charge of transforming the child's convex facial profile into a straighter adult profile. The mandible's sagittal growth is caused by endochondral growth in the condyle, which lengthens the mandible but has no effect on its shape [14].	The mandible appears to be displaced downward and forward from the cranium as a result of apposition at the dentoalveolar complex and rotation of the condyle. The dentoalveolar compensatory mechanism maintains the vertical dimension. This happens when the eruption goes off without a hitch and there are no functional issues.[15]

Classification system when considering implants in the growing child [16].

Group I: Children with one congenital missing tooth having adjacent permanent teeth

Group II: Children with multiple missing teeth, with permanent teeth adjacent to edentulous sites

Group III: Children with ectodermal dysplasia

Multi-Discliplinary treatment Approach

Several clinicians have had success with implant treatment in children after incorporating a multidisciplinary approach into their treatment plan.

Pedodontic consideration

Disabilities can have an emotional impact on children, parents, and caregivers, which, when combined with caregivers' inadequate knowledge of what to do and when, can lead to misleading and incomplete information being given to parents and children. Hence, pedodontist must be thorough with current knowledge and proper guidance and counselling should be given to the parents to assist in behaviour change in the child so that this would make it easier for the child to cope positively. Furthermore, information that elicits emotions must be repeated numerous times since psychological factors limit the message received by the recipient, for example the parents and this can lead to misunderstandings and anxiety.

Children with aplasia must be identified as being at risk of developing dental disease, and any symptom of caries or periodontal disease must be considered. Individually adapted preventive dental care programmes therefore

have to be designed for each child with aplasia, depending on the degree of aplasia, psychological developmental stage and possible incipient signs of dental disease. When providing dental care to children with aplasia, it is critical to provide thorough information prior to the intervention [17].

Orthodontic Consideration

Orthodontists should evaluate the completion of the more active growth stage, as well as body height measurements. During the first treatment planning, the face growth pattern should ideally be examined as well. Aplasia cases present potential problems during orthodontic treatment. With a decreased number of permanent teeth, the anchorage may not be as strong as usual and the forces should therefore be adjusted to the situation.

Surgical considerations

The oral surgeon must ensure that adequate bone of suitable quality is present at the implant sites. These patients with significant aplasia may be treated surgically using a variety of procedures, such as autotransplantation, implants, and orthognathic surgery. Autotransplantation may be utilised with a good prognosis when the aplasia is primarily in one jaw and teeth from the other jaw can be used, as in individuals with asymmetrical aplasia. The position of the implants dictates the functional and aesthetically pleasing outcome of the prosthetic treatment. It is vital to carefully plan the placement of the various implants in collaboration with the prosthodontist.

Prosthodontic considerations

When treating children and adolescents the same prosthodontic materials and methods are used as when treating adults, but therapy planning and treatment must be adapted to the young and growing patient. The prosthodontist's function in the multidisciplinary team is primarily to be responsible for the following areas of concern: 1. Early evaluation of final treatment 2. Appropriate abutment tooth placement 3. Considerations for aesthetic appeal 4. Prosthetic treatments on a temporary basis.

Valle et al., used a multidisciplinary treatment approach to successfully treat a child with hypodontia. The paediatric dentist kept the primary second molars until the child was 17 years old, then combined them with orthodontic treatment to create enough space for endosseous implants to be placed. External hex implants with a 4.1 mm rectangular platform were placed with immediate load after the primary teeth were extracted [18].

Montanari et al., recommended a dental multidisciplinary team consisting of a paediatric dentist, an orthodontist, a prosthodontist, and an oral and maxillofacial surgeon. They used an implant-supported overdenture to perform oral rehabilitation in a child with hypohidrotic ED. At the age of two, the child received an upper conventional denture and a lower implant-supported overdenture. In the anterior aspect of the mandibular jaw, two tapered screw endosseus implants were placed. The mandibular implant-supported overdenture was well received by the patient, who reported excellent masticatory and aesthetic improvements after three years of follow-up [19]

Implant placement in growing children with Ectodermal Dysplasia and Oligodontia

As per the 1988 National Institute of Health consensus Development Conference on Dental Implants in Bethesda, pediatric patients with ED may benefit from dental implants [20].

According to review of literature presented by *Kramer et al.,* they recommended implant placement in paediatric patients with extended syndromal hypodontia, such as those seen in the emergency room [21]. The anterior mandible appears to be the best location for insertion; insertions in the maxilla should be avoided, or at the very least should not cross the midline. The Institute of Jonkoping treated the first published case of implant placement in a boy with hypohydrotic ED and anodontia of the mandible, and the case has been followed for more than 20 years. The overdenture worked well until the patient was 19 years old, when two more implants were placed and a mandibular fixed implant supported prosthesis was provided [22].

Smith et al placed an implant in mandibular anterior region in a 5yr old patient with ectodermal dysplasia, the outcome of treatment was successful.[23] With similar instance *Guckes et al*., placed an implant in 3yr old child with ED in both maxilla and mandible, implant was stable despite growth [24]. According to the study conducted by *Bergendal et al.*, dental implant in children upto 16 years with ED and anodontia in the lower jaw, showed the apparent small size of the jaw and preoperative condition were the main risk factors rather than ED [25]. A retrospective study carried out by *Finnema et al.,* in 13 oligodontia patient showed a survival rate of 90%, 8 years after prosthesis placement [26].

Conclusion

Dental implants in young children adolescents may be a possibility, still there are very limited study in the literature to provide a conclusive evidence. Evaluation of proper growth assesment in a child is necessary before placing an implant. If the treatment objectives favour implant placement before skeletal maturation, the child's parents must be told about the advantages and risks of the procedure. However, the implant procedure can only be justified if the expected benefits outweigh the procedure's disadvantages.

References

1. Agarwal N, Kumar D, Anand A, Bahetwar SK. Dental implants in children: A multidisciplinary perspective for long-term success. Natl J Maxillofac Surg,2016:7(2):122-126.

2. Oesterle LJ, Cronin RJ Jr, Ranly D. Maxillary implants and the growing patient. Int J Oral Maxillofac Implants,1993:8:377-87.
3. Cronin RJ Jr, Oesterle LJ. Implants use in growing patients. Dent Clin North Am,1998:42:1-35.
4. Brahmin JS. Dental Implants in Children. Oral Maxillofacial Surg Clin N Am,2005:17:375-81.
5. Albrektsson T et al. State of the art in oral implants. J Clin Periodontol,1991:18:474-81.
6. Albrektsson T, Zarb G, Worthington P, Eriksson AR. The long-term efficacy of currently used dental implants: a review and proposed criteria of success. Int J Oral Maxillofac Implants,1986:1(1):11-25.
7. Björk A, Skieller V. Growth of the maxilla in three dimensions as revealed radiographically by the implant method. *Br J Orthod*,1977:4:53-64.
8. 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.
9. Moorrees CF, Lebret LM, Kent RL. Changes in the natural dentition after second molar emergence 13-18 years. *Int Assoc Dent Res*,1979:58:276.
10. Bishara SE, Jakobsen JR, Treder JE, Stasi MJ. Changes in the maxillary and mandibular tooth size-arch length relationship from early adolescence to early adulthood. A longitudinal study. *Am J Orthod Dentofacial Orthop*,1989:95:46-59.
11. Bjork A, Skeiller V. *Postnatal growth and development of the maxillary complex.* Ann Arbor, MI: University of Michigan Press; 1976. pp. 62–99. (Monograph 6, Craniofacial Growth Series).
12. 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.
13. Cronin RJ, Jr, Oesterle LJ. Implant use in growing patients. Treatment planning concerns. *Dent Clin North Am*,1998:42:1-34.
14. Op Heij DG, Opdebeeck H, van Steenberghe D, Kokich VG, Belser U, Quirynen M. Age as compromising factor for implant insertion. *Periodontol 2000.*,2003:33:172-84.
15. Solow B. The dentoalveolar compensatory mechanism: Background and clinical implications. *Br J Orthod*,1980:7:145-61.
16. Sharma AB, Vargervik K. Using implants for the growing child. J Calif Dent Assoc,2006:34:719-24.
17. Bergendal B, Bergendal T, Hallonsten AL, Koch G, Kurol J, Kvint S. A multidisciplinary approach to oral rehabilitation with osseointegrated implants in children and adolescents with multiple aplasia. Eur J Orthod,1996:18:119-29.
18. Valle AL, Lorenzoni FC, Martins LM, Valle CV, Henriques JF, Almeida AL, et al. A multidisciplinary approach for the management of hypodontia: Case report. *J Appl Oral Sci*,2011:19:544-8.
19. Montanari M, Battelli F, Callea M, Corinaldesi G, Sapigni L, Marchetti C, et al. Oral rehabilitation with implant-supported overdenture in a child with hypohidrotic ectodermal dysplasia. *Ann Oral Maxillofac Surg*,2013:1:26.
20. Mehrali MC, Baraoidan M, Cranin AN. Use of endosseous implants in treatment of adolescent trauma patients. NY State Dent J,1994:60:25-9.
21. Kramer FJ, Baethge G, Tschernitschek H. Implants in children with ectodermal dysplasia: A case report and literature review. Clin Oral Iml Res,2007:18:140-6.
22. Bergendal B. When should we extract deciduous teeth and place implants in young individuals with tooth agenesis?. J Oral Rehabil,2008:35(1):55-63.
23. Smith RA, Vargervik K, Kearns G, Bosch C, Koumjian J. Placement of an endosseous implants in a growing child with ectodermal dysplasia. Oral Surg Oral Med Oral Pathol,1993:75:669-73.
24. Guckes AD, Brahim JS, McCarthy GR, Rudy SF, Cooper LF. Using endosseous dental implants for patient with ectodermal dysplasia. J Am Dent Assoc,1991:122:59-62.
25. Bergendal B, Ekman A, Nilsson P. Implant failure in young children with ectodermal dysplasia: A retrospective evaluation of use and outcome of dental implant treatment in children in Sweden. Int J Oral Maxillofac Implants,2008:23:520-4.
26. Finnema KJ, Roghoebar GM, Meijer HJ, Vissin KA. Oral rehabilitation with dental Implants in oligodontia patients. Int J Prosthodont,2005:8:203-9.