

DENTAL IMPLANT PATIENTS WITH ECTODERMAL DYSPLASIA: CURRENT APPROACHES

Mustafa Erhan Sari^{1*}, Ibrahim Duran², Sevgin Ibis³

1. DDS, PhD, Assistant Professor, Department of Pediatric Dentistry, Faculty of Dentistry, Ondokuz Mayıs University, Samsun, Turkey.
2. DDS, PhD, Assistant Professor, Department of Prosthetic Dentistry, Faculty of Dentistry, Ondokuz Mayıs University, Samsun, Turkey.
3. PhD, Department of Pediatric Dentistry, Faculty of Dentistry, Ondokuz Mayıs University, Samsun, Turkey.

Abstract

In cases of ectodermal dysplasia (ED); anodontia, hypodontia, conic teeth, underdeveloped crests, vertical size loss and presence of cleft lip and palate may occur due to developmental defects in ectoderm-origin organs and tissues. In such patients, alternative rehabilitation methods are required because of insufficient areas for denture retention. Dental implants are one of the alternative methods to enhance retention. In order to plan the best customized implant treatment, a multidisciplinary approach consisting of a pediatric dentist, an orthodontist, a prosthodontist and a maxillofacial surgeon would be helpful. There are two important concerns related to implant application: implants do not have physiological movement and eruption capacity and the effect of denture on growth. The most important reason of implant use in growing children is bone protection. Thus, insufficient bone volume/mass is prevented through implant placement in ED patients who have alveolar crest resorption caused by congenitally absent teeth. Long-term clinical trials supporting the use of dental implants in children. Long term clinical studies are needed supported the use of dental implants in children.

Review (J Int Dent Med Res 2015; 8: (3), pp. 147-150)

Keywords: Ectodermal dysplasia, dental implants.

Received date: 19 October 2015

Accept date: 27 November 2015

Introduction

Partial congenital absence of teeth and traumatic tooth injuries are common in pediatric patients. In such cases, oral rehabilitation should be made before skeletal and dental maturation. Removable partial dentures are a treatment option; however, they are associated with complications such as increased rate of tooth decay, periodontal complications and residual alveolar resorption¹.

In cases of ED that is a hereditary X-linked recessive inherited disease; anodontia, hypodontia, conic teeth, underdeveloped crests,

vertical size loss and presence of cleft lip and palate may occur due to developmental defects in ectoderm-origin organs and tissues. In such patients, alternative rehabilitation methods are required because of insufficient areas for denture retention. Dental implants are one of the alternative methods to enhance retention. Patients with ED do not exhibit a normal growth model, therefore the region to which the implant will be placed should be analyzed well^{2,3}.

Several authors argue the use of implants in children. In order to plan the best customized implant treatment, a multidisciplinary approach consisting of a pediatric dentist, an orthodontist, a prosthodontist and a maxillofacial surgeon would be helpful. All specialists have an important impact on the process with their contributions in their special fields and their knowledge about rehabilitation. The points to be considered as determining the best time for implant placement include the aesthetic expectations of the patient, and the implant treatment and hygiene compliance of both the patient and his/her family.

*Corresponding author:

Dr. Mustafa Erhan Sari,
Department of Pediatric Dentistry,
Faculty of Dentistry, Ondokuz Mayıs University,
55139, Kurupelit, Samsun, Turkey.
Phone: +90 505 2384285
Business Tel: +90 362 3121919
E-mail: dterhansari@hotmail.com

There are two important concerns related to implant application: (i) the first one is that the implants do not have physiological movement and eruption capacity since they do not have periodontal ligaments contrary to natural teeth. Therefore, implant teeth act as impacted or ankylosed teeth due to the adjacent teeth with continued eruption in relation to the growth process. (ii) The second one is the effect of denture on growth. Design changes may be required to compensate the changes in growth. The most important reason of implant use in growing children is bone protection. Thus, insufficient bone volume/mass is prevented through implant placement in ED patients who have alveolar crest resorption caused by congenitally absent teeth⁴.

Therefore, these advantages should be discussed with long-term clinical trials supporting the use of dental implants in children.

Growth Determination

Growth determination is of significance for implant planning in children and adolescents. Semi-annual cephalometric radiograph is a quality method; however, it is not a completely reliable method to demonstrate the completion of growth and development⁵. Calcification of ulnar sesamoid bone of the thumb starts during the period when pubertal growth spurt accelerates in hand and wrist radiographs. 3. The covering of the middle phalanx of the finger with epiphysis typically occurs in the deceleration period after the growth spurt is completed. When the radius bone is covered with epiphysis, the growth is considered as reached to the adult level. It has been suggested that the changes in the cervical vertebrae with growth and development can be used to determine the skeletal age, and it is a method as reliable and valid as the hand-wrist region⁶. Additionally, a high correlation has been observed between lower canines and skeletal maturation levels. A close association has been established between adductor sesamoid calcification and root mineralization of mandibular canine⁷.

Regions recommended to place implants:

Maxillary anterior region is an important area related to traumatic losses of teeth and

congenital losses of teeth⁸. Vertical and anteroposterior growth changes in this region are important. The vertical growth of the maxilla is greater than the growth in other dimensions. The vertical growth of the maxilla extend over all other directions in this region; repetition of the transmucosal implant connection may be required following the premature implant placement, and this may lead to poor implant denture rate and overloading⁴. According to Krant, 15 years of age in girls and 17 years of age should be waited for implant placement to maxillary anterior region⁹.

The growth in the maxillary posterior region shares similarity with the anterior side. Additively, the transversal growth of the maxilla in the midpalatal suture may result in the exposure of maxillary molar teeth to rotation toward anterior direction. The cases with adjacent natural tooth and the natural tooth-implant combinations are the worst-case clinical scenario. The best timing for maxillary posterior teeth is 15 and 17 years of age in girls and boys, respectively⁴.

Mandibular anterior region is the most ideal area for the implants placed prior to the growth and development. It shows less changes of growth. During the first two years of life, the suture in the symphysis region becomes closed. Implant-supported dentures placed to the anterior mandible should be redesignable in order to allow for a 5-6-mm increase in dental height⁴.

The growth and development of the mandibular posterior region in transversal and anteroposterior dimensions and its anteroposterior rotation raise several concerns related to the treatment. Growth completion should be waited for endosseous implant application in the posterior mandible⁴.

Implant placement recommendations for unaffected patients:

1. If possible, implant placement should be postponed until the age of 15 in girls and 18 in boys.

2. Adequate follow-up should be conducted for the growing patients undergoing implant treatment.

3. Further studies are required in relation to implant placement in growing patients.

4. The most important factors for determining the ideal time of implant placement

are implant location, patient gender and skeletal maturation.

5. Except severe ED cases, it should be recommended to wait for the completion of dental and skeletal development.

Discussion

In children with ED, it is mandatory to achieve oral rehabilitation for the vertical and sagittal skeletal association, aesthetics, psychological condition, stomatognathic effect and enhanced TME function during craniofacial growth and development. Although there is not any reported exact time to initiate the dental treatment, the initial denture should be made prior to school age. The mean age is 5 years for early prosthetic treatment; however, prosthesis can be applied at the ages of 3-4. The youngest endosseous implant patient reported in the literature is a 1.5-year old French child¹⁰. In pediatric patients, removable dentures are recommended in order to replace dentures during the growth and development period. The removable dentures can be replaced when the patient turns 19 and it can be partially restored using additional endosseous implants or the whole dental arch can be restored using fixed dentures¹¹. Although it is deemed appropriate in pediatric dentistry to postpone the implant applications until the skeletal growth and development is completed or until a time close to its completion, specifically mandibular implant applications are indicated in cases of oligodontia and anodontia¹².

Lederman et al. applied a total of 42 endosseous implants to 34 patients with a mean age of 15.1 years and achieved a 90% success during the approximately 3-year follow-up. The authors reported that a substantial part of the complications and failures were due to traumatic injuries occurred during recovery⁸.

Cronin and Smith suggested that the earliest age for the placement of endosseous implants to the mandibular anterior region is 5¹³. Prachar and Vaneek applied cylindrical and screw-shaped implants to patients aged 15-19 and asserted a 96% success rate during the 5-year follow-up¹⁴. Shaw did not find implant application acceptable in infants and early childhood due to dramatic changes¹⁵. According to Dietschi-Schatza¹⁶ and Mackie-Quayle, implant application should be avoided before the

age of 16-18 in children¹⁷.

Mittal et al. reported satisfactory results regarding implant-supported dentures in two male patients aged 5 and 9, who had ectodermal dysplasia, despite the stability and retention problems. Additionally, Mello et al. applied two endosseous mini implants to the symphysis region in a 9-year-old patient with ectodermal dysplasia. The authors reported that they achieved patient satisfaction with implant-supported dentures applied 6 months later, and there were significant changes in talking and chewing functions^{18,19}.

According to Guckes et al., the alveolar bone volume is not adequate for implant placement in children²⁰. The vertical and anteroposterior changes of alveolar growth in total anodontia patients are not as important as those in partial anodontia patients. According to Bergendal et al., the completion of growth should be waited for implant placement, except for the ED patients with total aplasia²¹. A joint conference on pediatric implants concluded that the completion of growth and skeletal development should be waited for implant placement²⁰.

Congenital anodontia is common in hereditary diseases and frequently observed in the hypohidrotic form of ED²². According to national ED foundation, the ED patients account for the majority of patients with removable denture placed at around 3 years old. Implant-supported overdentures should be applied to the mandibular anterior region at around 6 years of age when the median suture of the mandible is closed^{23,24}.

Implant-supported overdentures have been applied to the anodontic mandibles of several ED patients aged between 3 and 6 since 1995^{20,23,25}. Although the youngest patient with implant treatment is a 1.5-year-old patient²⁶, dental implant placement is not recommended before the age of 6 because elective surgery decision is made at around 5 years of age²⁷. In the first published case, the implants applied to the mandible of the hypohidrotic ED and anodontia patient was followed-up for more than 20 years. The patient used overdenture until the age of 19 and it was proceeded to fixed denture by placing two more implants to the patient's mandible²⁸.

In the conference about implant placement in growing and developing patients

(Scandinavian Consensus Conference in Sonkoping, Sweden), the joint resolution regarding the optimum time to apply implant to children in such period is that the completion of skeletal growth should be waited²⁹. Patients with anodontia and oligodontia may be an exception for this rule.

Conclusion

There are limited reports about implant use in young patients; long-term clinical trials are required. If implant is used before the skeletal growth, the family and the patient should be informed about the potential complications. However, this treatment may be administered since the anticipated advantages are more than the disadvantages. Furthermore, clinicians and operators bear huge responsibilities about follow-up regarding these techniques used. In order to determine the individual optimum time for implant placement; the patient's state of dentition and compliance as well as the state of skeletal growth, the degree of hypodontia, the severity of the respective psychological stress should be considered.

Declaration of Interest

The authors report no conflict of interest and the article is not funded or supported by any research grant.

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