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# Dental Implants in Growing Children: AReview

Dr. Sreejith V P[1], Dr. Sruthi Nandakumar[2], Dr. Muhammed Ajnas T[3], Dr. Arjun Gopinath[4]

[1]*Professor and HOD, Department of Oral and Maxillofacial Surgery, Kannur Dental College, Anjarakandy, Kerala.*
[2]*Post Graduate Student, Department of Oral and Maxillofacial Surgery, Kannur Dental College, Anjarakandy, Kerala.*
[3]*Post Graduate Student, Department of Oral and Maxillofacial Surgery, Kannur Dental College, Anjarakandy, Kerala.*
[4]*Reader, Department of Oral and Maxillofacial Surgery, Kannur Dental College, Anjarakandy, Kerala.*
*Corresponding author: Dr. Sruthi Nandakumar*

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**ABSTRACT:** Trauma, genetic syndromes like cleft palate, cleidocranial dysostosis, ectodermal dysplasia, and congenital hypodontia are some of the common reasons for the loss of teeth in children.Dental implants for childrenare an ideal treatment plan for aesthetic and functional problems of the oral cavity manifesting at an early age. Successful implant treatment in children has been achieved by several clinicians when they incorporated a multidisciplinary approach in their treatment plan.Implants can be successfully placed, restored and loaded in growing patients with ectodermal dysplasia and in patients with dentofacial deformities.[6, 12] The purpose of this review is to discuss the use of dental implants in growing children and to show that dental implant insertion is a possible mode of rehabilitation in children and adolescents even with the influence of maxillary and mandibular skeletal and dental growth on the stability of those implants, through a systematic treatment plan.

**KEYWORDS**: Dental implants, Children, growth.

## I. INTRODUCTION

An increase of implant placement is observed in daily clinical practice, raising confusions whether implants could be placed in growing children too.[3]Congenital partial anodontia, traumatic tooth loss and tooth loss due to genetic syndromes are frequently encountered in growing children.[1, 4, 9]Absence of teeth causesloss of function, unpleasant aesthetics and lack of normal alveolar growth that can sometimes hamper a child's psychological development.[1] Therefore, oral rehabilitation is required in such young patients even before skeletal and dental maturation has occurred. Removable partial denture is a good treatment of choice, but the complications arising due to its usage in young growing patients like increased residual alveolar resorption, periodontal complications and increased caries rate is a concern.[4]With a systemic planning of treatment including a proper design, multidisciplinary approach and correct type of dental implants, successful implant treatment ingrowing children can beguaranteed.

## II. MATERIALS AND METHODS

An electronic search was performed in Google scholar. The search was limited to articles in English with full texts, having enough clinical, radiological and histological data.

## III. DISCUSSION

Anodontia is a condition in which missing single anterior tooth or multiple missing teeth, is definitely a dental handicap that would influence communication behaviour, self-esteem, and academic performance of children as no treatment would interfere with the growth potential which is already impaired by missing teeth.[1, 8] Additionally, children have excellent blood supply and osseous healing thus improving the prognosis of this treatment option which may be beneficial to preserve alveolar bone as has been described for adults.[9] Lets discuss the implications of growth and growth assessment and recommendations for the formulation of treatment plan for dental implants in growing children.[1, 2, 3]

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## GROWTH

Growth in the maxilla and mandible does not happen uniformly in one plane. It is multidirectional, occurring in sagittal, vertical, and transverse planes. It does not happen at a fixed pace; slow periods of growth are followed by phases of accelerated growth called the growth spurts. The new-born lacks pronounced alveolar ridges. The teeth maintain their position in the arches by following this pace of growth through remodelling and drifting within the alveolar bone. Functional forces are balanced by a stable interarch occlusal relationship, achieved gradually as transition from primary to permanent dentition occurs.[1, 7]

## GROWTH DETERMINATION

It is an important factor when planning implant placement in children and adolescents. No reliable indicator is available to determine when growth has ceased, although a good quality method is the use of serial cephalometric radiograph taken 6 months apart with superimposed orthodontic tracings.If no changes occur over a period of 1 year, one may assume that growth is complete.[4] Another accurate way of determining skeletal age is to take a hand wrist radiograph and compare it to a standardized atlas.[14] As the skeletal growth of the long bones is complete, facial growth too stops, or it is safe to assume that it is near completion and implants can be safely placed.[1, 13]

## MAXILLARY GROWTH

During early childhood, the transverse growth of the maxilla is influenced by the increasing width of the cranial base and growth at the median suture. This sutural growth accelerates at puberty and is the earliest of the three dimensions to be completed in adolescence.[15] The maxilla comes down and forward secondary to sutural apposition and with downward and forward growth of the alveolar process associated with the eruption of primary and permanent teeth.Early placement of implant can give rise to a diastema with the adjacent teeth as transverse growth occurs, although transverse problems are not reported in implants placed in the anterior maxilla even as early as 9 years of age.[1, 16, 17]

## Recommendation For Implant Placement By Quadrant In Maxilla

### 1. MAXILLARY ANTERIOR QUADRANT

Maxillary anterior quadrant is an important area for consideration due to traumatic tooth loss and frequent congenital tooth absence. Vertical and anteroposterior growth changes in this area are substantial.The vertical growth of the maxilla exceeds all other dimensions of the growth in this quadrant; therefore, premature implant placement can result in the repetitive need to lengthen the transmucosal implant connection.According to Krant, the placement of implants in the anterior maxillary quadrant before the age of 15 in female patients and 17 in male patients should be attempted to achieve unique treatment planning goals and with particular emphasis on the only determination of skeletal age, informed consent, and the possibility of future implant replacement.[4]

### 2. MAXILLARY POSTERIOR QUADRANT

Maxillary posterior quadrant is subject to same general growth factors described for the maxillary anteroposterior area. An additional growth factor is transverse maxillary growth at midpalatal suture, which produces rotational growth that anteriorizes the position of the maxillary molars.[4, 13]

## MANDIBULAR GROWTH

The mandible being more closely associated with the cranial structures shows a differential growth as compared to the maxilla. This is more in the sagittal plane which is responsible for converting the more convex facial profile of the child to a straighter adult profile. The sagittal growth of the mandible is through endochondral growth in the condyle that extends the length but has no impact on the shape of the mandible as such.[18] Growth in the vertical dimension occurs by the apposition at the dentoalveolar complex and rotation of the condyle that appears to displace the mandible downward and forward from the cranium. The vertical dimension is maintained through the dentoalveolar compensatory mechanism.This occurs when eruption proceeds normally, and there are no functional deviations.[19] The rotation of the mandible, which accompanies growth, did not cause a significant problem relative to the angulation of the implants and the prosthodontic occlusal plane in a 3-year-old patient with ectodermal dysplasia.Montanari et al. also showed in his studies that mandibular growth in sagittal and transverse direction showed no adverse effects on implant position in a 2-year-old patient. After a 3-

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year follow-up, the implant supported overdenture was well accepted by the patient.[6]

**RECOMMENDATION FOR IMPLANT PLACEMENT BY QUADRANT IN MANDIBLE**

**1. MANDIBULAR ANTERIOR QUADRANT**

Mandibular anterior quadrant is the best site for the placement of an osseointegrated implant before skeletal maturation. Mandibular anterior quadrant presents fewer growth variables. The closure of the mandibular symphyseal suture occurs during the first 2 years of life. Prosthesis supported by dental implants in the anterior mandible should be of a retrievable design to allow for an average increase of dental height of 5-6 mm as well as the anteroposterior growth.[4, 8]

**2. Mandibular Posterior Quadrant**

The dynamic growth and development of the posterior mandible in the transverse and anteroposterior dimensions coupled with its rotational growth presents multiple treatment concerns. Placement of osseointegrated implants in the posterior mandibular quadrant is best delayed until skeletal maturation.[4]

**Indications For The Use Of Implants In Children And Adolescents**

1. Pediatric patients with ectodermal dysplasia (1988 National Institute of Health Consensus Development Conference on Dental Implants at Bethesda)
2. Implants combined with bone grafting in patients with cleft of the alveolus and palate
3. Children and adolescents having anodontia, partial anodontia, congenitally missing teeth, teeth lost as a result of trauma
4. Uncooperative children who find it difficult to adjust to removable appliances.[11]

**Importance Of A Systemic Treatment Planning**

Important factors to be considered when treating a child with missing tooth, apart from growth, are dentition present, residual space between the teeth present in the arch, amount of alveolar bone, and the timing of implant placement.[5] Montanari et al. advocated a dental multidisciplinary team that includes a pedodontist, an orthodontist, a prosthodontist and an oral and maxillofacial surgeon for a successful outcome in implant placement in children.[5, 6] There can be loss of alveolar bone in many conditions such as trauma, congenitally missing teeth or severely malposed teeth which require bone augmentation procedures. The alveolar bone assessment should be carried out through computed tomography (CT) or cone beam CT.According to the 1988 National Institute of Health consensus Development Conference on Dental Implants at Bethesda, children with ectodermal dysplasia could benefit from the use of dental implants.[19]

**DESIGN AND TYPE OF IMPLANT SYSTEM**

The design and type of implant system used in pediatric patients are also responsible for successful treatment outcome. Misch et al. placed the implants at a distance of least 1.5 mm from the adjacent teeth. Implant length range was 12–16 mm and the body diameter varied from 3.5 mm to 4.0 mm. This was based on the mesiodistal dimensions of the missing tooth and the buccolingual dimensions of the bone. All implant bodies were of a two-piece screw design in which surface treatment was done with a resorbable blast media or hydroxyapatite (Ha). All implants were left unloaded during the initial bone healing process.[1] Ledermann et al. used the Ha-titanium (Ti) implant system in their patients.[17] The advantage of the Ha-Ti system was that the crown is never cemented onto the implant base or onto any type of coping, rather, it is fixed with a Ti transverse screw. Hence, the crowns can be removed easily at any time by simply taking out the transverse screw.If the adjacent permanent teeth continue to erupt and the crown starts appearing short, additional porcelain can be added to the incisal edge. Their results showed successful use of implants as an alternative to fixed prostheses or orthodontics in young children, especially those who are nearing or have already reached complete alveolar bone growth. They also reported that the failures were not related to implant failure or the fact that the patients were children.[20]

**Dental Implants As An Alternative Treatment Option For Some Dentofacial Deformities**

**1. OLIGODONTIA WITH CLEFTS**

Osteoconstricted implants are gaining ground as a way to deal with oligodontia with clefts as prosthetic restorations alone without dental implants has to face the loss of dental tissue and the absence of mechanical tendencies in the osteoplasty-growing alveolar ridge.[3]

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**2. ECTODERMAL DYSPLASIA**

Many researchers are in favour of the use of osteoconstricted implants, because implant-supported restorations in these patients have high success rates. The disease does not seem to slow down the healing process around the implant, and osteointegration is successful.[3, 10]

**3. CLEIDOCRANIAL DYSOSTOSIS**

After the orthodontic mechanisms and remaining teeth are placed in the correct position on the arc, a Le Fort I osteotomy is made and finally, dental implants are placed. Implants are used as an effective way to support prosthesis, contributing to a better functional and aesthetic restoration of dentition.[21, 22]

**4. DENTAL IMPLANTS IN ORTHODONTICS**

In orthodontics, implants are used as support devices on which forces are exerted and thus have the ability to control the movement of the teeth during treatment, and even replace the conventional extraoral orthodontic device.Loading of the implants at least 3 months after implant placement helps in reducing mini- implants related complications that can arise in some patients such as fractures, implant loss, injuries to adjacent teeth, and the appearance of inflammation, often persistent, at their location place.The orthodontic treatment and surgical treatment can be initiated about a year before the planned implant placement. This would utilize the period and create a greater chance for success after the implant insertion.[3]

## IV. REVIEW OF LITERATURE

1. Agarwal N et al.[1] concluded that the insertion of dental implant is a possible mode of rehabilitation in children and adolescents with a systemic planning of treatment, creating a greater physiologic harmony within the teeth, the alveolar bone and the growth.
2. Heuberer S et al.[2] demonstrated long – term survival of dental implants in young individuals signifying the importance of more long – term research in dental implant treatment in children and adolescents.
3. Koufatzidou M et al.[3] showed that dental implants are alternative treatment option for some dentofacial deformities for psychological and functional reasons.
4. Mishra S K et al.[4] discussed the use of dental implants in normal growing patients and in patients with ectodermal dysplasia and the influence of maxillary and mandibular skeletal and dental growth on the stability of those implants.
5. Valle A L et al.[5] showed that the maintenance of the primary teeth combined with orthodontic treatment allowed for the placement of endosseous implants to replace the missing teeth, enhancing the aesthetics and function in children.
6. Montanari M et al.[6] showed that Implants can be successfully placed, restored and loaded in growing patients with ectodermal dysplasia.
7. Carmichael R P et al.[7] showed the use of dental implants in the management of nonsyndromal oligodontia in growing children.
8. Bhatlu M V et al.[8] discussed the use of dental implants in normal growing children and in patients with ectodermal dysplasia and the influence of maxillary and mandibular skeletal and dental growth on the stability of those implants.
9. Attia S et al.[9] concluded that the survival and success rates of dental implants in patients with congenitally absent teeth were very high and did not differ significantly from results achieved in an unaffected population and that dental implants are a reliable therapy for patients with dental aplasia.
10. Smith R A et al.[10] concluded that functional implants can be placed successfully in a growing child with ectodermal dysplasia.
11. Shah R A et al.[11] concluded that despite the growth spurts related to maxilla and mandible if the protocol for implant placements in adolescents is followed, their success rate can be guaranteed and they can be used more routinely.

## V. CONCLUSION

Dental implants are a possible mode of rehabilitation in growing children and adolescents with a systemic planning of treatment including a proper design and correct type of dental implants, that helps in creating a greater physiologic harmony within the teeth, the alveolar bone and the growth. Despite the growth spurts related to maxilla and mandible if the protocol for dental implant placements in growing children is followed, their success rate can be guaranteed and they can be used more routinely.It's not just a treatment modality for normal growing children, but also an alternative treatment option for some dentofacial deformities and genetic syndromes like ectodermal dysplasia for psychological and functional reasons.

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