International Journal of Research in Health and Allied Sciences
Journal home page: www.ijrhas.com
Official Publication of "Society for Scientific Research and Studies" [Regd.]
ISSN: 2455-7803

REVIEW ARTICLE

Implants in Pediatric Dentistry: A Comprehensive Review

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ABSTRACT
Implants restore the function, preserve the alveolar bone and give excellent esthetics, restoring the child's confidence and social acceptability. Parents are usually overzealous and keen to get this treatment done as soon as offered the suggestion. In a growing child, replacing a permanent tooth lost from trauma with an implant poses a challenging dilemma. Hence; we planned the present review to highlight some of the important aspects of use of dental implants in pediatric dentistry.
Key words: Dental implants, Pediatric

Received: 15 June, 2019 Revised: 20 June, 2019 Accepted: 25 June, 2019

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This article may be cited as: Amandeep, Thakur S, Jayam C. Implants in pediatric dentistry. Int J Res Health Allied Sci 2019; 5(3):16-19.

INTRODUCTION
The growing patients are mostly in need of prosthetic rehabilitation in edentulous areas. Edentulism can be congenital or acquired. Trauma to tooth germ and hypodontia are the most prevalent abnormalities that cause congenital edentulism in children. Dental caries and trauma are common cause of acquired reason for edentulism.[1] Implants restore the function, preserve the alveolar bone and give excellent esthetics, restoring the child's confidence and social acceptability. Parents are usually overzealous and keen to get this treatment done as soon as offered the suggestion. However, dental implant placement in children has special consideration, the impending growth, which needs to be understood before commencing on the treatment plan. There is no comprehensive protocol for the use of dental implants in young patients, although the developmental stage and implant location are considered the two critical factors in planning this treatment. As for the appropriate age, most of the reports recommend to limit the treatment to children who are nearing or have already achieved complete alveolar bone growth.[2-4]

BIOLOGY OF OSSEO-INTEGRATION
The American Dental Association defines a dental implant as "material inserted or grafted into tissue; dental implant-device specially designed to be placed surgically within or on the mandibular or maxillary bone as a means of providing for dental replacement; endosteal (endosseous); eposteal (subperiosteal); transosteal (transosseous)".[5]
Osseo-integration marks the direct contact between bone and screw-thread is formed without intermediate tissues after the initial healing period. Implant/bone interface area is remodelled in response to functional loading. Failure of osseo-integration leads to formation of non-mineralised connective tissue at the implant-bone interface.[6]

CURRENT METHODS OF MONITORING THE STABILITY OF DENTAL IMPLANTS
Several methods and techniques have been used for monitoring the stability of dental implants.

PERIODONTAL PROBE
An examination with a periodontal probe is considered to be the main tool for assessing periodontal health in everyday practice. The diagnostic value and possible trauma of probing around dental implants has been studied thoroughly. In a previous study, authors discussed the difference between the probing measurements around teeth and dental implants including the factors that influenced the probe penetration around

dental implants such as their surface roughness and their threads.[7]

PERCUSSION TEST

The percussion test is a simple method that can be used to estimate the level of integration. It measures the stability of an integrated dental implant by simply tapping on the healing abutment with the handle of a dental instrument such as dental mirror. An integrated implant produces a high pitched sound (as if tapping on a marble) while a non-integrated implant produces a low and dull sound. The tone changes during the healing process as a result of increasing implant-bone interface contact. The disadvantage of this method is that good listening skills are required by the operator and hence it can be subjective, therefore it is not an accurate method.[8]

RADIOGRAPHIC ASSESSMENT

The radiograph is the most commonly used diagnostic/monitoring method to evaluate the amount of available bone for implant placement and around a previously placed implants, previous authors stated that radiographs could be used to measure the crestal bone level which was an indicator of the success of a dental implant.[9]

PERIOTEST

The Periotest instrument initially was developed to measure the stiffness of the natural dentition and hence the condition of the periodontium; at a later stage it was used in oral implantology to measure the bone/implant interface. It involved a damping capacity assessment, measuring the deflection/deceleration of a tooth or implant that had been struck by a small pistil fired from within the instrument's hand piece. The handpiece had an electronically controlled translational hammer bearing an 8-gram rod with a sensor at its tip. When activated, the rod tapped the implant abutment up to 16 times in four seconds withan action similar to that of a retractable ballpoint pen. The contact time of the accelerated pistil against the implant, which moved according to the strike, was calculated to produce a value called the Periotest t value (PTV), which ranged with decreasing stability of the tooth or implant, from 8 to 50 PTV units.[10- 12]

REVERSE TORQUE

This method was first proposed by Roberts *et al.* and developed further by Johansson and Albrektsson. It measured the torque level at the breaking point of the bone implant contact.[13]

PULSED OSCILLATION WAVEFORM

Kaneko was the first to describe this method of analysing the mechanical vibration characteristics of the implant-bone interface using a forced excitation steadystate wave. This device consisted of an electric driver and receiver, pulse generator and oscilloscope. The frequency and amplitude of an excited implant were displayed on the oscilloscope screen.[14, 15]

RESONANCE FREQUENCY ANALYSIS

Previous authors reported the use of sonic resonance frequency measurements to assess the values of the implant-bone interface. Currently, two machines are in clinical use: Osstell (Integration Diagnostics, Goteborgsvangen, Sweden) and Implomates (Bio Tech-One, Taipei Hsien, Taiwan). The principle of this natural frequency detecting device is to measure the stiffness of the bone/implant interface by calculating the resonance frequency resulting from the reaction to oscillations applied to the implant bone system.[16]

IMPLANT AND THE PATTERN OF DENTAL AND SKELETAL 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 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.[17]

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. 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.[15]

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.[14]

The transverse growth in the mandible completes very early because of the closure of the symphysis in the 1 year of life, and only limited changes occur afterward through remodeling. Posteriorly, there is resorption of the bone lingually and deposition buccally that leads to remodeling. This pattern of bone growth may bring about lingual positioning of the implant in case it is placed early. Increase in the mandibular length is limited posterior to the primary second molars to accommodate the permanent molars.[13]

TIMING OF IMPLANT PLACEMENT IN GROWING PATIENTS

In a growing child, replacing a permanent tooth lost from trauma with an implant poses a challenging dilemma because the implant's lack of eruption potential can lead to discrepancies in the occlusal plane, esthetic problems and possible disruption of the normal development of the jaw.[12]

IMPLANT AND DIVERSITY OF GROWTH FACTORS

The range of growth is specific to individual and various factors, involving genetic, nutrition, systematic diseases, and psychological problems contribute to the issue. Major differences were also seen in skeleton jaws and direction of dental eruption. In general, the dental system compensate the skeleton diversity through change of direction and range of growth, the examples of which are long-faced people with longer and more vertical growth of incisors and prognathic people with labial steep of upper incisors and lingual steep lower incisors. Sex differences are also among the main growth variables. In total, the average age of tooth eruption is earlier in girls (2 years). With the onset of menstruation (around 15), the development process is almost complete in girls, whereas boys continue their growth up to 20. Such differences bring about longer skeletal and mandibular growth than maxillary.[16- 18]

Indications for use of implants in 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.[17]

Contra- Indications for the use of dental implants:

1. Pre- pubertal age group.
2. Individuals with pubertal growth spurt.
3. Inadequate mesiodistal space.[15]

MANDIBULAR DEFECTS

Mandibular discontinuity subsequent to tumor ablative surgery is effectively managed by immediate or delayed surgical reconstruction to re-establish continuity. The reconstructed mandible will be edentulous in the graft site. Endosseous implants in this grafted bone will allow the placement of a dental prosthesis that does not create deleterious compressive forces on the graft. Internal loading of the graft results in bone preservation, a situation that would otherwise not occur if transmucosal loading of the underlying bone were to occur.[18]

HARD AND SOFT PALATE DEFECTS

Obturator prostheses supported and retained by the residual natural dentition have a long history of successful clinical application. Relatively large obturator prostheses place substantial forces on the residual structures. When implants are used to retain such prostheses it is essential that the different forces be considered. These prostheses will have a tendency to rotate into the defect area when occlusal loads are placed on the defect side and they will have the tendency to rotate out of the defect area as gravity exerts its pull on the prosthesis.[18, 19]

CONCLUSION

The advantages of using implant in growing children are as much as its concerns about the early placement, which make it a challenging phenomenon. Hence it is the Pedodontist's responsibility to be aware and updated and hence the objective of this review was to establish the need for implant awareness in Pediatric dentists.

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