Hopeless retained deciduous teeth without permanent successors pose a restorative challenge for clinicians as well as certain clinical problems for patients. Compromised aesthetics, shifting of adjacent teeth, altered occlusion, and super eruption of teeth are examples of problems that can arise when a permanent tooth is congenitally missing. The second mandibular premolars are the permanent teeth most often congenitally missing, followed in prevalence by the maxillary lateral incisors and the maxillary second premolars (which are approximately equal to each other in prevalence).\(^1\)

By definition, a person having less than 6 congenitally missing teeth is termed hypodontia.. Hypodontia can be regarded as a multifactorial condition and the association of hypodontia with other systemic conditions and dental anomalies is widely reported.\(^2\)

Reported studies of the prevalence of hypodontia vary from 2.6%-11.3%, and are based mostly on radiographic studies. There is a 3:2 ratio of females to males with hypodontia according to a literature review.\(^2\)

Congenital absence of one or a few permanent teeth without any systemic disorders, is regarded as an autosomally inherited dominant condition with varying gene expression and incomplete penetrance.\(^3\)
While various treatment approaches for congenitally missing teeth have been proposed, outcome data pertaining to these treatment options are lacking. Replacement of a missing tooth with a dental implant offers specific advantages over other options for tooth replacement such as removable dentures or a fixed bridge. These advantages include preservation of the alveolar crest, no need to restore the adjacent teeth, and improved aesthetics and function. By understanding the principles of treatment planning, implant surgery, and implant restoration, a clinician can successfully replace a hopeless retained deciduous tooth with a dental implant.

This article will discuss the treatment planning, surgical, and prosthetic principles for the replacement of hopeless retained deciduous teeth with implants. A case presentation will be used for illustration.

**Treatment Planning**

The literature supports keeping healthy retained deciduous teeth in adults when they are non-mobile and functioning. When a deciduous tooth is non-mobile, functioning, and meets a patient’s aesthetic standards, there is justification for maintaining the tooth. The advantages to retaining a healthy deciduous tooth include the psychological benefits of a person keeping their own tooth and the ability for that tooth to maintain the surrounding bone and soft tissue.

However, once it is determined that a retained deciduous tooth is hopeless, then options for replacement must be evaluated. Severe mobility, extensive caries, root resorption, and fracture are reasons a deciduous tooth may not be able to be retained.
Treatment planning for replacement of a hopeless retained deciduous tooth involves a periodontal evaluation, the status of the adjacent teeth, radiographic evaluation (sometimes including a CT scan), diagnostic study models, medical history, evaluation of prosthetic options, orthodontic evaluation, and assessment of the type of provisional restoration that will be required. The prosthetic outcome must be envisioned.

A CT scan can offer valuable information with regard to the available bone apical to a retained deciduous tooth. The vertical height and buccal/lingual width of remaining bone are the main determinants of soft tissue support. This bony support also determines if placement of a dental implant is feasible immediately after extraction of the deciduous tooth, or if bone grafting is needed.

A CT scan also offers valuable information regarding availability of space, bone density, and choice of the size of the implant. Since retained deciduous teeth generally have short roots, the bone apical to the root can be seen on the CT scan. Due to the relationship of the deciduous tooth to the bone, often a radiographic stent is not needed for a CT scan, because the deciduous tooth offers a natural radiopaque marker.

Another important consideration is to determine the post-surgical position of the papillae and soft tissue. Performing a periodontal examination is critical. The attachment level of the adjacent teeth is an important factor in achieving papillae preservation after tooth extraction.

Prior to dental implant placement, the design and type of implant must be determined. Greater surface area will distribute stress on the implant, and this can be accomplished through utilization of a treated surface such as hydroxyapatite or resorbable
blast media. Increased length, increased width, and using square shaped threads will also increase the surface area of an implant, therefore resulting in reduced shear forces.9

As part of the treatment planning process the clinician should also consider the many available dental implant systems so that choices can be made with respect to the prosthetic attachments available, the type of connection of the abutment, and other subtle differences in various systems that might affect the outcome of a case.

Surgical Principles

After comprehensive treatment planning, surgical placement of the dental implant can occur. In many cases when replacing deciduous teeth, flapless surgery can be accomplished due to the soft tissue space maintenance provided by the deciduous tooth. A deciduous tooth often has a short root, yet the intact coronal aspect of the tooth supports the adjacent soft tissue until a dental implant can be placed. One of the most important initial steps in replacing a deciduous tooth with a dental implant is to atraumatically extract the deciduous tooth. The goal is to remove the tooth without removing any adjacent bone, so there is sufficient bone for dental implant placement and support of the adjacent papillae. This atraumatic extraction can be accomplished through various methods, including forcep rotation, use of periotomes, and careful elevation.

As noted, retained deciduous teeth can offer the advantage of maintaining soft and hard tissue at the site. However, when a tooth is missing and there has been loss of bone at the edentulous area, bone grafting may be required, followed by placement of the dental implant at a later date. Alternatively, bone grafting and implant placement may occur at the same visit.
A surgical guide based on information from the CT scan will direct the osteotomy away from adjacent teeth or implants. If a CT scan is not performed, multiple radiographs during the osteotomy sequence should be taken.

Correct spacing of a dental implant in proximity to another implant or natural teeth is important for papillae preservation. A minimum of 1.5mm should be the distance between the implant and an adjacent tooth, and a minimum of 3mm should be allowed in relation to an adjacent implant.\(^\text{10}\) If an implant is too close to another implant or tooth, subsequent bone loss could occur, and the papillae could be lost.

**Prosthetic Principles**

Often, the presence of a deciduous tooth will preserve the bone and soft tissue, which allows immediate implant placement into the extraction site. If immediate dental implant placement is performed, the next decision to be made is whether to place a provisional restoration on the implant or wait a period of time for increased implant stability. If the treatment plan includes a period of time between dental implant placement and attachment of a provisional restoration, then a healing cap can be placed to preserve the soft tissue emergence profile.\(^\text{11}\) If possible, an index impression should be made during surgery when an implant will not be immediately loaded. The index impression at the time of surgery allows a dental laboratory to prepare an abutment and create a laboratory processed provisional restoration.\(^\text{12}\)

If a bone graft is performed after extraction of a deciduous tooth, then an ovate pontic should be considered for papillae preservation.\(^\text{8}\)
Case Presentation

A healthy 41 year old male presented with retained deciduous teeth c, d, g, and h. These teeth did not have permanent successors. Deciduous tooth b was missing, as was its permanent successor (Figures 1 & 2). Teeth c, d, g, and h were mobile, and the patient was unhappy with his appearance.

The treatment plan consisted of replacement of the retained deciduous teeth and missing deciduous tooth b with a cement-retained fixed prosthesis supported by dental implants. A CT scan utilizing an interactive CT program (Sim Plant/Materialise) was used for planning implant placement (Figures 3, 4, 5).

After simple extraction of teeth c, d, g, and h, 3.5mmX12mm external hex implants (Biohorizons Inc.) were placed in those positions and the “b” position (Figure 6). Flapless surgery was performed.

Healing caps were placed at the time of surgery, and a removable acrylic provisional prosthesis was placed for the 3-month healing period (Figure 7). Further, at the time of surgery, an index impression was taken and a laboratory model was fabricated so that the abutments could be prepared and fixed provisional restorations could be created (Figures 8 & 9).

Three months after implant placement the healing caps were removed and the laboratory processed abutments and provisional restorations were placed in the mouth (Figures 10, 11, 12). The abutments were torqued to 33 Ncm.

A traditional closed tray crown and bridge impression was made with polyvinylsiloxane, and a metal try-in of the frame was accomplished. The metal frame try-in allows the clinician to assess the marginal fit of the crowns and framework.
integrity before proceeding to porcelain baking (Fig. 13). All crowns were splinted for increased stability.

The final PFM crowns were cemented with ZOP cement (Figure 14).

**Discussion**

Although it is rare to observe the number of congenitally missing adult teeth described in this case, the planning and treatment approach demonstrate the principles that are appropriate for any number of hopeless retained deciduous teeth. Multiple congenitally missing teeth may be associated with certain systemic and skeletal conditions, although there was no such association with the patient described in this case.

**Conclusion**

By following sound treatment planning principles, including a CT scan, dental implants can be predictably placed to replace hopeless retained deciduous teeth in adults. Maintenance of bone and soft tissue associated with retained deciduous teeth offers advantages for dental implant placement. This article has outlined the treatment planning, and surgical and prosthetic principles, and presented a case report, for successful replacement of hopeless retained deciduous teeth with dental implants.
References:


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Figure Legends:

Fig 1  Patient at presentation with retained deciduous teeth in the anterior region.

Fig 2  Panograph at initial visit demonstrating deciduous teeth without permanent successors

Fig 3  Image from Sim Plant CT program showing buccal lingual positioning of the dental implant in the area of tooth “b”.

Fig 4  Axial view from Sim Plant CT program demonstrating planned position of the implants

Fig 5  3D view from Sim Plant Interactive CT program showing planning of case with relation to existing deciduous teeth

Fig 6  Panograph after implant placement

Fig 7  Healing caps in place allowing formation of emergence profile

Fig 8  Laboratory model allowing preparation of stock Biohorizons abutments

Fig 9  Laboratory model showing provisional restorations on abutments

Fig 10  Laboratory prepared abutments after placement

Fig 11  Close up view of abutments. Note papillae formation.

Fig 12  Delivery of laboratory processed provisionals

Fig 13  Metal frame try in to check marginal integrity

Fig 14  Delivery of final prosthesis
Fig 1
Patient as initially presented with deciduous teeth in anterior region. Patient wanted improved esthetics and stability

Fig 2  Panograph at initial visit showing deciduous teeth without permanent successor
Fig 3 Image from Sim Plant CT program showing buccal lingual positioning of dental implant below deciduous tooth
Fig 4 Axial view from Sim Plant CT program showing axial view of implant positions
Fig 5 3D view from Sim Plant Interactive CT program showing planning of case with relation to existing deciduous teeth.

Fig 6 Panograph after implant placement showing Biohorizons implants in place.
Fig 7 Healing caps in place allowing formation of emergence profile
Fig 8 Laboratory model allowing preparation of stock Biohorizons abutments prior to intra oral delivery
Fig 9 Laboratory model showing provisionals on abutments prior to intra oral delivery
Fig 10 Laboratory prepared abutments after intra oral delivery
Fig 11 Close up view of abutments after soft tissue has formed. Note papillae formation.
Fig 12 Delivery of laboratory processed provisionals
Fig 13 Metal frame try in to check marginal integrity
Fig 14 Delivery of final prosthesis