

Orthodontic Management of Missing Teeth

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Approximately 2% to 10% of the population exhibit missing teeth. Excluding third molars, the most commonly missing teeth are maxillary lateral incisors and second premolars. Patients who exhibit congenital absence of teeth also experience increased ectopic dental eruption and other dental anomalies (Fig. 1).¹ Specifically, patients with missing lateral incisors frequently have contralateral lateral incisors peg-shaped or smaller than the normal mesial distal width. Patients with congenitally absent maxillary lateral incisors often exhibit palatal ectopic eruption of the adjacent maxillary permanent canines.^{1,2} Permanent canines adjacent to absent lateral incisors also erupt mesially. In cases of unilateral absence of a maxillary lateral incisor, the midline is often deviated toward that side (Fig. 2).

Second primary molars without underlying permanent successors show increased frequency of ankylosis and submergence.¹ The earlier that ankylosis exists, the more severe are the potential consequences. Progressive infraocclusion can result in compromised alveolar bone height, tipping of adjacent teeth and destruction of bone during the extraction. Because infraocclusion increases as vertical bone development occurs commensurate with facial growth, the earlier the infraocclusion occurs, the more necessary it is to have the primary molar extracted to preserve vertical alveolar bone. The larger mesiodistal width of a retained second primary molar compared to the smaller width of the absent second premolar can compromise molar occlusion.

Diagnosis and Treatment Planning Considerations

General Principles

The clinician should always ask two questions when faced with a patient who has congenital absence of permanent teeth.

1. What would you (the clinician) do if the missing tooth were indeed present?
2. Can this malocclusion be treated satisfactorily with extractions or not?

If the malocclusion can be satisfactorily treated with extraction, then the appropriate removal of the primary tooth (which has no permanent successor) can permit orthodontic space closure; thus, the congenital absence of the tooth has less long-term consequence. By contrast, if extractions are contraindicated, then consideration has to be given to the long-

term prosthetic management of the area where the permanent tooth is absent. Such management includes the management of any retained primary teeth (such as second primary molars where second premolars are absent).

The patient needs to be thoroughly diagnosed using a planes-of-space concept.³ Once a problem list has been established, then treatment objectives can be developed to meet the patient's needs. Based on these treatment goals, appropriate treatment alternatives can be investigated.³ Often, a diagnostic wax setup study model is needed to show the referring dentist, the patient and the parent the estimated final occlusion and the possible position of artificial tooth replacement. This diagnostic wax setup can determine anchorage requirements and help formulate a mechanical treatment plan. Furthermore, it can determine appropriate pontic widths, potential tooth-size discrepancies and the need for post-treatment bonding or interproximal tooth reduction. It also allows the restorative dentist the opportunity for input in the treatment planning stage (Figs. 2, 3 and 4). Obviously, this treatment planning exercise can be done only with comprehensive orthodontic records.

The Missing Maxillary Lateral Incisor

Esthetic requirements usually dictate space opening and subsequent post-orthodontic artificial replacement of the missing lateral incisor or incisors. The two instances where extraction and space closure (of the missing lateral incisors) would be appropriate are:

1. in patients with sufficient crowding to warrant an extraction treatment plan and who have congenital absence of one or both lateral incisors (Fig. 5) and
2. Class II malocclusions with an acceptable facial profile that can be satisfactorily treated with either a single upper arch extraction plan or with upper and lower arch extractions.

There are at least six major disadvantages to closing missing maxillary lateral incisor spaces:

1. Pointed maxillary canines require post-orthodontic grinding or cosmetic bonding to simulate an incisor (Figs. 5 and 6).
2. Maxillary canines are usually darker than lateral incisors; veneering may be necessary.
3. Maxillary canines are wider than adjacent absent lateral incisors, creating an esthetic mismatch and an anterior tooth-size discrepancy. The six upper anterior teeth (first

premolar, canine and central incisor) are relatively too wide for the corresponding lower six anterior teeth (canine, lateral and central incisor). This discrepancy can cause an increased overjet unless interproximal reduction is contemplated.

4. In canine substitution cases, the first premolar serves as a canine; the lingual cusp often needs to be reduced for esthetic or functional reasons.
5. Because the labiolingual thickness of the upper canine is greater than the corresponding missing lateral incisor, selective palatal reduction of the canine is often needed.
6. The final occlusion demonstrates group function rather than canine guidance.

Cost

Most patients with congenitally absent teeth require comprehensive orthodontic treatment. If the decision is made during treatment planning for spaces to be closed, then the patient needs no post-orthodontic restorative dentistry. By contrast, when pontic spaces are to be subsequently restored, the patient incurs restorative costs for bridgework or implants, possible periodontal costs for crown lengthening and possible endodontic costs in instances of repeated tooth preparation (which results in loss of tooth vitality). Furthermore, replacement of the restoration may be required two or three times during the patient's lifetime.⁴

Implants can be used in non-growing patients. They require a two-stage surgical procedure and, at present, are not covered by insurance. Additionally, patients who are candidates for implants may require bone augmentation, because patients without permanent teeth may not develop the alveolar bone that accompanies eruption.

Post-Orthodontic Restorative Choices

Immediately post-debanding, removable retainers with denture teeth are used for full-time wear. Most adolescents and adults prefer fixed prosthesis for replacement of missing teeth. In most instances, implants supporting crowns are the



Figure 1: Panoramic x-ray shows ectopic canine, absent lower right second premolar, ankylosed primary second molar, ectopic lower left second premolar and absent third molars.



Figure 2: Pre-orthodontic anterior view showing missing right lateral incisor, small left lateral incisor and maxillary midline deflected to right side with ectopic palatal upper canine.



Figure 3: Post-orthodontic view of patient seen in **Figure 2**. Midlines centred. Appropriate space opened up for prosthetic management of missing lateral incisor and small left lateral incisor.



Figure 4: Post-restorative view of patient seen in **Figures 2 and 3**. Implant and crown replaces missing right lateral incisor. Porcelain veneer on left lateral incisor. Cosmetic bonding reshapes central incisors.



Figure 5: Absent maxillary lateral incisors, deep overbite and overretained right primary canine. Pretreatment view.



Figure 6: Post-treatment view. Absent maxillary lateral incisor spaces closed due to crowding. Canines reshaped and bonded.

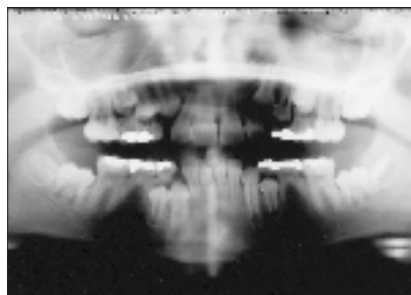


Figure 7: Pre-treatment panoramic x-ray shows missing lower second premolars and developing canine crowding. Case managed by extraction of upper first premolars and lower second primary molars.



Figure 8: Post-orthodontic panoramic x-ray shows absent lower second premolar spaces closed and extraction of upper first premolars.

preferred restorative choice, because they save tooth destruction of virgin abutment teeth (Fig. 4).

Implants can be placed only after all vertical alveolar growth has ceased. In a girl, growth cessation may occur by age 15, but boys and young men may not complete growth until their early 20s. Placing an implant in a growing individual invites submergence, as the implant behaves like an ankylosed tooth; the resulting clinical crown length and emergence profile of the restoration are highly undesirable. Because teenagers usually do not want to wear removable retainers from the completion of orthodontics until they may be ready for implants, minimal tooth-reduction Maryland bridges can serve as useful interim restorations.

The Extraction/Non-Extraction Dilemma for Missing Premolars

Despite rhetoric to the contrary, scientific evidence suggests that appropriate extraction followed by space closure affects the facial profile negligibly.⁵ Early extraction of second primary molars in instances of congenital absence of underlying second premolars can often result in mesial drifting of the posterior dentition, affording the opportunity to close spaces.⁶ Therefore, aggressive early modified serial extraction can eliminate the need for major restorative dentistry.

When crowding is severe, space maintenance is needed to conserve anchorage while canines and first premolars drift distally, or extractions can be delayed until the permanent dentition (Figs. 7 and 8). In Class II cases, anchorage requirements dictate extraction timing and mechanical space closure management.

By contrast, later extraction of premolars can have a more negative effect on incisor position⁷ and therefore can result in flattening of the facial profile if there is excessive incisor retraction. For these reasons, it is imperative that patients be assessed orthodontically as early as possible so that all treatment options are available.

During treatment planning, the following factors increase the likelihood of extraction:

1. a large degree of crowding,
2. midline discrepancy,
3. anteroposterior molar discrepancy between right and left sides,
4. procumbency of the incisors on the underlying alveolar structures (double-dental protrusion),
5. full facial profile requiring reduction in lip support,
6. increased vertical dimension of the lower facial height, and
7. a shallow overbite or anterior openbite.

Dental Health Considerations

There is no evidence that temporomandibular joint health is compromised by either orthodontics or extractions.⁸ Therefore, this should not be a factor in decision making. The periodontal health of patients with missing lateral incisors treated by space opening versus space closing shows some differences in response. While the esthetics were markedly improved in instances where spaces had been opened, long-term periodon-

tal health was compromised secondary to restorative care.⁹ Translating this information to patients with missing premolars, space closure is the treatment of choice in the posterior region wherever possible

Coordinated Treatment Planning

Emphasis has been placed on the need to involve the patient and the restorative dentist in the treatment plan. Because patients with congenitally missing teeth have other dental anomalies associated, it is imperative that they be supervised closely from an early age. The patient is afforded more treatment opportunities if seen at the age of early mixed dentition rather than only at the age of early permanent dentition.

During the final stages of orthodontic care, referral to the diagnostic wax setup helps check the targeted final tooth position and pontic size. Referral to the restorative dentist before orthodontic appliance removal allows the restorative dentist input into final tooth position. ♦

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