ORIGINAL ARTICLE

Controlled slicing in the management of congenitally missing second premolars

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This report describes a simple method of allowing permanent first molars to drift mesially in patients with congenitally missing second premolars, thus facilitating future orthodontic treatment. Controlled slicing of the deciduous second molar between the ages of 8 and 9 years produced a bodily controlled mesial movement of the permanent first molar in less than 1 year with no or minor rotations or inclination. These results are compared with controlled slicing in 10- to 11-year-olds and with treatment involving extraction alone. (Am J Orthod Dentofacial Orthop 2004;125:537-43)

After the third molars, the second premolars have the highest incidence (5%) of congenital absence.[1-5] The problem resides not in the percentage of congenitally missing premolars but in the selection of a treatment plan that will yield the best results over the long term. Today, 2 different orthodontic treatment approaches to resolving this problem are available: (1) extract the deciduous second molar, allow the permanent first molar to drift mesially, and then finish the case orthodontically; or (2) keep the deciduous molar for as long as possible and then seek a prosthetic solution.

Among the reasons to extract the deciduous second molars when a second permanent premolar is missing are pulpar pathology, large restorations, carious lesions close to the pulp, normal or pathologic root resorptions, crowding in the permanent dentition, ankylosis, and differences in tooth sizes between deciduous and permanent teeth. Early extraction has been reported to produce inclination in 46% of patients, with a mesial rotation of the permanent first molars. Also, 80% of closures include a contribution of distal drift of the first premolar and canine.[3]

On the other hand, caries-free deciduous second molars with long roots pose a serious dilemma for the clinician. In those cases,[5-8] we might try to sell the idea of maintaining the deciduous molars, suggesting they could last for 2 or 3 decades, thus avoiding the complexity of closing the spaces without tooth inclination and possibly creating periodontal problems in the future.[3] However, the physiologic resorption of the deciduous molars without the second premolar occurs at an average age of 22 years (10 years after normal exfoliation) (Andreasen JO, personal communication, 1992).[9]

Maintaining the deciduous molars could also pose a Bolton tooth-size discrepancy due to the mesiodistal crown difference between the deciduous second molar and the permanent second premolar (of 1.5 to2 mm[10]), altering the occlusion if the space is not properly managed. This phenomenon becomes more important when only the maxillary or mandibular missing premolars are involved.

Bjerklin and Bennett[11] showed that 41 subjects with deciduous second molars in situ had a 0.5- to 4.5-mm infraocclusion (ankylosis) at the age of 19 years. This creates the necessity of reestablishing crown height, in some cases to avoid supraeruption of the antagonistic tooth, and of reducing the possibility of a mesial inclination of the adjacent permanent first molar, which could jeopardize the finished orthodontic and prosthetic result.

The objective of this report is to describe a simple technique for allowing the physiologic mesial drift of permanent molars in patients with congenitally missing second premolars, to avoid long-term problems and the need for restorations. We compared 2 techniques. The first involves extracting the deciduous molar, and the second involves controlled slicing of the second deciduous molar followed by hemisection of the distal portion of the root (with no endodontic treatment) and extraction of the mesial portion of the tooth at later stages (Figs 1-3).

MATERIAL AND METHODS

A total of 34 patients (20 boys, 14 girls) with 52 missing premolars were included in this study. Of the

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Submitted, February 2003; revised and accepted, May 2003.
0889-5406/$30.00

doi:10.1016/j.ajodo.2003.05.009

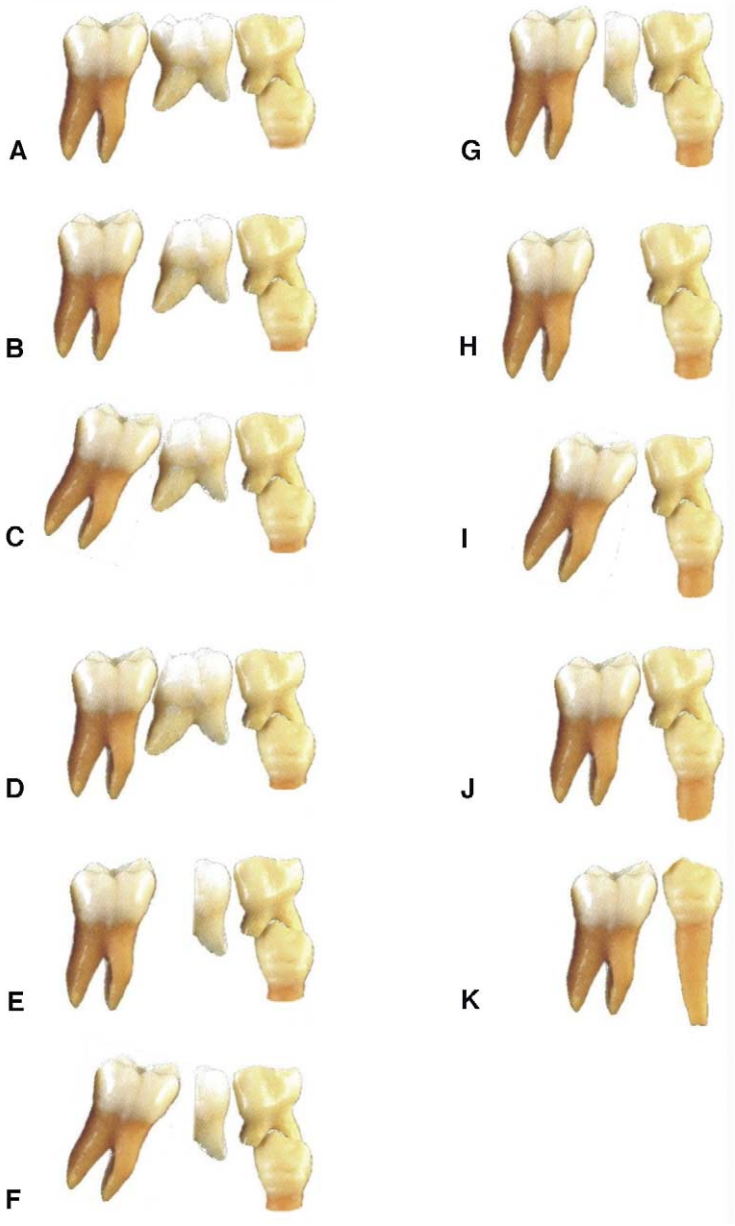

Fig 1. Controlled slicing technique. **A**, Initial view. **B**, Slicing of distal crown portion of second deciduous molar of 1.5 to 2 mm with a 699L or 700L high-speed bur. **C**, Mesial drift of first permanent molar. **D**, Parallelization of first permanent molar. **E**, Hemisection and extraction of distal crown and root portion of deciduous second molar (no pulpotomy or pulpectomy needed). **F**, Mesial drift. **G**, parallelization of permanent molar. **H**, Extraction of mesial crown and root portion of deciduous second molar. **I, J**, bodily migration of permanent molar. **K**, Eruption of first premolar.

missing teeth, 42 (81%) were mandibular, and 10 (19%) were maxillary. The diagnosis of missing premolars was made between the ages of 8 and 11 years, generally from periapical films (55.8%) or as part of a routine orthodontic work up (44.2%). Parental consent was obtained, and the patients were divided into different technique groups (controlled slicing and extraction), as follows.

In group I, controlled slicing was performed on 28 mandibular deciduous second molars. In group II, 14 mandibular deciduous second molars were extracted, followed by physiologic mesial migration of the man-

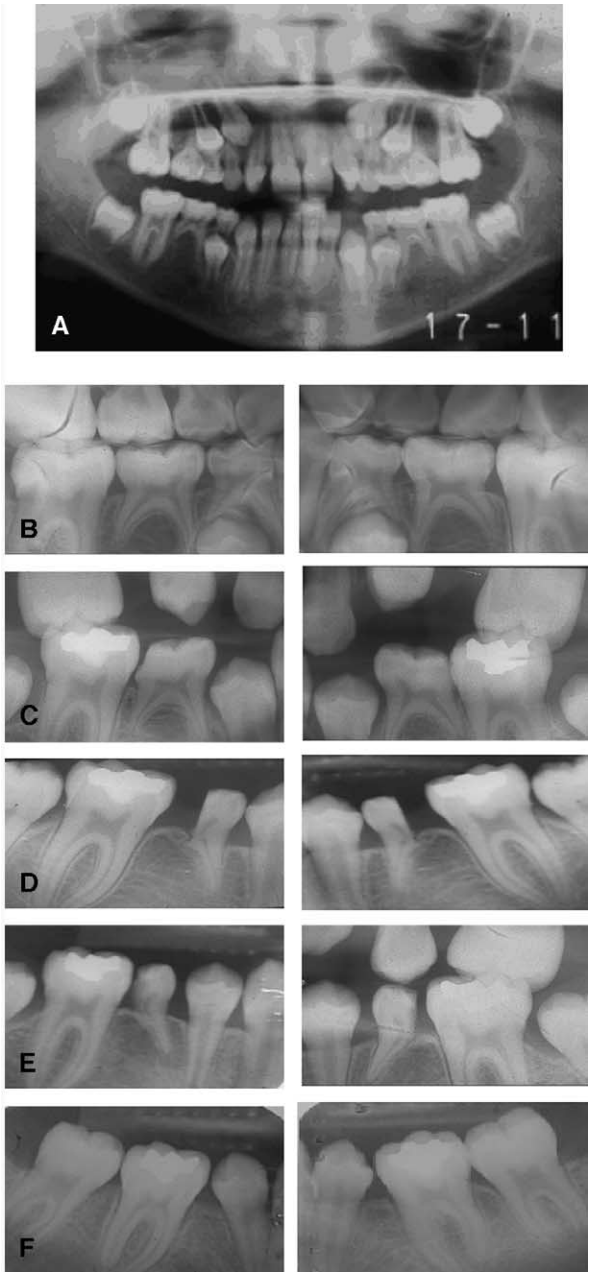

Fig 2. Radiographic progress of controlled slicing on patient with congenitally bilaterally missing second premolars. **A, B**, Initial view. **C**, 4 months after initial distal slicing of crown portion of deciduous second molar. **D**, After hemisection and extraction of distal portion of deciduous second molar. No pulpotomy or pulpectomy (see Fig 3). **E**, Bodily migration of first permanent molar (note obliteration of pulp chamber and continuity of periodontal ligament). **F**, Final space closure of permanent first molar (12 months after initial slicing). Lack of parallelism between permanent molar and first premolar is due mostly to distal crown tipping of premolar. Situation can be easily corrected orthodontically.

dibular permanent first molar. In group III, 10 maxillary deciduous second molars were extracted, followed by physiologic mesial migration of the maxillary permanent first molar (Figs 4 and 5). The groups were subdivided into 2 age groups: 8 to 9 years, and 10 to 11 years or older. The patients were seen monthly, and the results were evaluated for space closure, molar rotation and inclination, timing, and midline shift.

The results were defined as good, average, or poor. Good results meant 80% or greater space closure, without or with only slight mesial rotation or inclination with no midline shift, achieved in less than 12 months (Table I). Average results meant 60% to 80% space closure with slight mesial rotation, inclination, or midline loss; treatment results were observed from 12 to 18 months. Poor results had less than 60% space closure, with major mesial rotation, inclination, or midline loss; treatment results were assessed with more than 18 months of follow-up.

RESULTS

Of the 52 missing premolars, 28 (54%) were treated with controlled slicing, 14 (27%) with extraction of the mandibular deciduous second molars, and 10 (19%) with extraction of the deciduous maxillary second molars. Maxillary extractions are not reported in Table II to differentiate controlled slicing from extractions in the mandibular arch; results were satisfactory in all 10 of the maxillary extraction cases.

Of the 20 missing teeth treated with controlled slicing in the 8- to 9-year-old group, 18 (90%) showed the best clinical response; the results were average in the remaining 2 (10%). In the older group, controlled slicing showed a greater tendency toward average or poor results, with only 2 cases (25%) having good clinical responses (Table II).

In the 8- to 9-year-old extraction group, only 2 (28.5%) performed well, 3 (42.8%) were average, and 2 (28.5%) poor. The response was similar in the older group.

When considering the 3 clinical responses in the 2 treatment modalities, disregarding age, we found the best results with controlled slicing, with 71.4% having good results and 21.4% average results. The extraction group showed a greater tendency toward average to poor results (71.5%) (Table II).

DISCUSSION

If our aim is the best result over the long term, then controlled slicing is a good option for treating patients with congenitally missing second premolars, because it removes obstacles such as the need for prosthetic

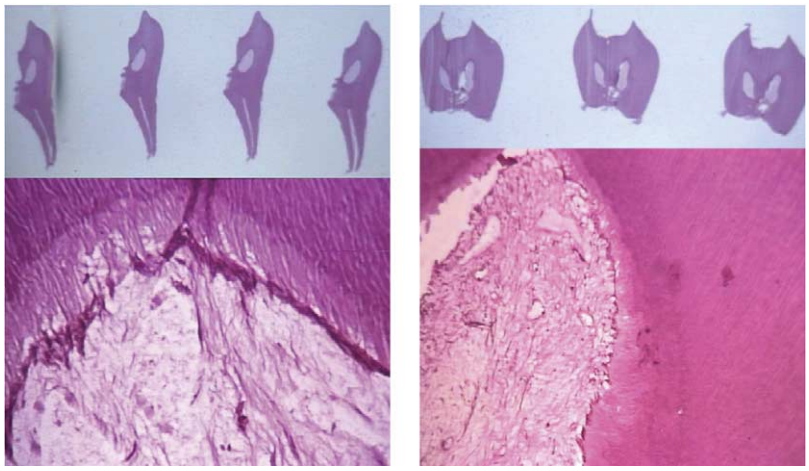

Fig 3. Histologic section after extraction of mesial crown root portion of deciduous second molar. Note lack of inflammatory response or necrosis 4 months after hemisection.

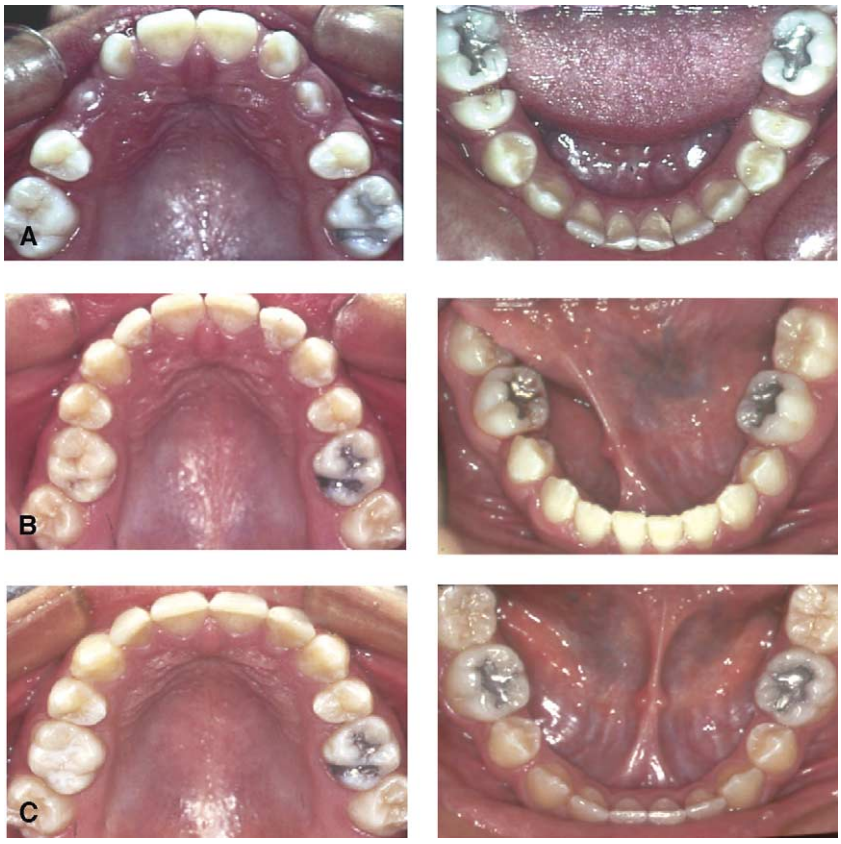

Fig 4. Long-term occlusal follow up of mesial migration of permanent first molars. **A**, Several months after extraction of maxillary deciduous second molar and controlled slicing technique in mandibular arch. Note initial bodily migration of permanent molars. **B**, 12 months after initial treatment. Note space closure and slight rotation of mandibular permanent molars. **C**, 24 months after **B**. Note occlusal adjustment of permanent molar. Beginning orthodontic treatment should be considered once space closure is almost complete.

Fig 5. **A**, Bodily migration of permanent first molar after removal of distal crown and root portion of deciduous second molar. **B**, Space completely closed after 12 months. **C**, Final natural occlusal adjustment 24 months after initial treatment. Note midline alignment and lack of lateral buccal bony depression, which is often seen after premolar removal.

Table I. Classification criteria for different clinical outcomes

	Good	*Average*	*Poor*
Space closure	80%	60–80%	<40%
Rotations	None or minor	Minor	Major
Inclination	None or minor	Minor	Major
Time	<12 mo	12–18 mo	>18 mo

replacement, which could compromise the final occlusion or create bony defects.

Maintaining the space by retaining the deciduous molar, especially when an implant is planned for the future, will often compromise the occlusion due to the differences in crown height (longer in permanent molars and premolars) and crown length (longer in deciduous molars).

Bjerklin and Bennett[11] showed that deciduous second molars tend to become ankylosed over time, displaying between 0.5 and 4.5 mm infraocclusion at age 19. This phenomenon can alter the occlusion through the supraeruption of the antagonistic teeth and the inclination of the adjacent permanent molar covering the deciduous ankylosed second molar. Extracting these teeth is sometimes difficult, requiring a flap and bone removal that could narrow the buccolingual alveolar ridge. Ostler and Kokich[12] investigated the changes in ridge width over time in patients with congenitally missing second premolars. Their findings indicated a 25% ridge width decrease within 3 years after deciduous molar extraction. This narrowing was slightly greater than the ridge width of the adjacent premolar. Also, greater buccal ridge resorption (74%) was seen compared with resorption on the lingual side (24%). This could jeopardize the success of the implant placement in the future and require bone grafting.[13] Controlled slicing preserves the buccolingual ridge and prevents the formation of a lateral buccal bony depression that can develop between the canine and the premolar in serial extraction patients (Fig 6).

Table II. Results of space closure distribution of controlled slicing versus extraction in different age groups

	Performance					
	Good		*Average*		*Poor*	
Age Groups (y)	*Controlled slicing*	*Extraction*	*Controlled slicing*	*Extraction*	*Controlled slicing*	*Extraction*
≤8–9	18 (90%)	2 (28.5%)	2 (10%)	3 (42.8%)		2 (28.5%)
9–11						1 (100%)
≥11	2 (25%)	2 (33.3%)	4 (50%)	3 (50%)	2 (25%)	1 (16.6%)

Fig 6. Note maintenance of bucolingual alveolar ridge, bodily mesial migration of permanent first molar, and lack of gingival inflammation 3 months after hemisection of deciduous second molar

Robertson and Mohlin,[14] in their study of congenitally missing lateral teeth, showed that patients preferred space closure over the prosthetic replacement of lateral teeth, and prosthetic replacements had a greater tendency to accumulate plaque and develop gingivitis. In the molar region, keeping the tooth clean is more difficult, and this could jeopardize periodontal health, the prosthetic result, and the functional status.

Uncertainty regarding when a deciduous molar will start to resorb or become ankylosed does not justify the decision to maintain it. Implant placement is not recommended until most of the alveolar growth has been completed, at age 20 years in women and even later in men. Late decisions (after age 11) on extraction or controlled slicing of second deciduous molars would increase the likelihood of average to poor results (Table II). This result is not shared by Ostler and Kokich,[12] who found no correlation between the age of the patient at the time of extraction and the changes in ridge width and height.

On the other hand, the success rate of controlled slicing was more than 90%, which represents a significant positive response, compared with more than 75% average to poor results in extraction cases (Table II).

The benefit of controlled slicing at an early age lies in the controlled inclination of the permanent first molar. The sequential slicing and the forces of occlusion bring about this adjustment. This also allows the permanent tooth to move through the labiolingual bone plate, which is maintained by the residual crown-root portion of the second deciduous molar, thus avoiding unwanted mesial rotation. The main difference with the Mamopoulou et al[3] study is the timing of space closure. They claimed a 46% space closure in the first year and 80% in 4 years, whereas our results showed 80% closure in the first year without mesial rotation or loss of the midline.

Care must be taken to avoid late crown formation of the second premolars (11 or 12 years); this has been reported anecdotally.[1,6,15]

With a 100% success rate, the bodily drift of the maxillary first molar was more successful than that of its mandibular counterpart. In these cases, sequential slicing is not recommended because of the root configuration of the maxillary deciduous second molar; a simple extraction will allow the permanent molar to move bodily.

The drawback of the controlled slicing technique is that the patient must visit the pediatric dentist or oral surgeon's office twice for the hemisection and the extraction of the deciduous tooth. The initial slicing of

the distal crown portion of the deciduous molar can be done in the orthodontic office and requires only topical anesthetic. Care must be taken to protect the permanent molar.

CONCLUSIONS

- Sequential slicing followed by hemisection and extraction of second deciduous molars in cases of congenitally missing second premolars showed a greater success rate compared with extraction.
- Permanent molars showed an 80% bodily space closure within 1 year, without mesial rotation and midline loss, leading to better final orthodontic results.
- A 90% success rate was achieved when the technique was applied at an early age (8 to 9 years); the success rate tended to decrease as age increased.
- Extraction of the deciduous second molars, without the controlled slicing technique, showed an average to poor result in 75% of the cases, with no different clinical response in any age group.

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