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A reappraisal of the problem of submerged deciduous teeth

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Abstract
The etiology of submersence remains unconfirmed although various reasons have been advanced. The condition is generally more prevalent in older children but may be detected as early as 3 years. Treatment has invariably involved extraction. The natural history of the condition involves periods of remission. These remissions and the fact that extractions are not always desirable, led to the treatment of several cases by traction to the affected teeth.

Key Words: Submergence, Deciduous malocclusions

INTRODUCTION

Submergence of deciduous teeth is a well known condition. The mechanism of submergence has been demonstrated histologically. Various reasons have been suggested in the reports of Brauer (1934), Chapman (1937) and Biederman (1956, 1962). While it is conceded that the condition is progressive in many instances, this is not always the case and Dixon (1962) has drawn attention to the possible remissions which may occur from time to time, particularly with the first deciduous molars. This report includes investigation of a random sample of the Brisbane school population. A case is presented to demonstrate that extraction of submerging teeth is not always necessary or desirable and interceptive methods of treatment may be successful.

Prevalence

The percentage of children with submerged teeth is variously reported to be between 1.3% (Engh, 1958) and 8.9% (Kurol, 1981). Several authors have pointed out that the prevalence of submergence increases with age, being lowest in the early deciduous dentition group and highest in the late mixed dentition group before exfoliation of deciduous molars begins. The prevalence at different ages may vary markedly.

While there has been some disagreement, it is usually conceded that the lower second deciduous molar is most commonly affected although the lower first deciduous molar may be the first of several teeth in the dentition to be affected (Dixon, 1962). Brearley and McKibben (1973) and Steigman et al (1973) found the lower first deciduous molar to be most often affected while Dixon (1962), Biederman (1962) and Lamb and Reed (1968) found the lower second deciduous molar to be most often affected. Kurol (1981) showed that the lower first deciduous molar is more often affected before 9 years of age and the lower second deciduous molar is more often affected after 9 years. Clearly, the lower deciduous molars are more often involved than the upper deciduous molars. Brown (1981) found the order of frequency to be lower second deciduous molars, upper second deciduous molars, lower first deciduous molars and upper first deciduous molars.

Darling and Levers (1973) found that submergence may appear as early as 4-5 years. Steigman et al (1973) and Kurol (1981) in surveys of pre-school children found signs of the condition as early as 3 years. Most investigators agree that, with increasing age, prevalence and severity of the condition usually increase. Thornton and Zimmermann (1964) found a linear relationship between the duration of the ankylosis and the distance from the tip of the highest cusp of the ankylosed tooth to the occlusal plane. The general conclusion has also been that submergence is not sex-specific although Steigman et al (1973) found that lower first and upper second deciduous molars were more often affected in girls, while in boys the upper first and lower second deciduous molars were most commonly affected.

Etiology

The etiology of submergence is speculative and this uncertainty is reflected in the names which have been suggested including submergence, ankylosis, enclosure, depression, suppression and retention. While it is due to a bony ankylosis between bone and dentine, the triggering mechanism is not understood. Kurol (1981) pointed out that the more frequent submergence of lower second deciduous molars after 9 years and first deciduous molars before 9 years could be related in time to the development and eruption of the permanent successors. However, he did not comment on the much lower prevalence in the maxilla compared to the

mandible. Interestingly, Capon (1944) observed that the problem occurs more frequently in children with above-average oral health. Etiological factors which have been suggested include ricketts (Noyes, 1932), trauma and illness (Capon, 1944), abnormal occlusal stress (Aisenberg, 1941), reduced occlusal function (Dixon, 1962) and impaction (Wilson, 1962). Rygh and Reitan (1963) could find no evidence supporting impaction. However, Wilson (1962) claimed that when space was re-created, the deciduous teeth would often erupt.

Dixon (1962) pointed out that eruption of submerged teeth sometimes occurred during a favourable growth period and that this eruption could be stimulated by rocking the tooth. Brearley and McKibben (1973) further observed that ankylosed teeth sometimes exfoliate normally, particularly first deciduous molars. The importance of these observations is that the usually progressive nature of submergence is not invariant and that there might be some chance of success with interception.

A number of workers have observed that increased vertical dimension may be an etiological factor. An increase in vertical dimension may occur naturally or as a result of treatment. Brauer (1934) suggested that bite opening associated with activator treatment could initiate submergence and further stated that bite opening associated with an anterior bite plane might also be responsible. These observations suggest that submergence is associated with decreased function, if not with increased vertical dimension per se. Dixon (1962) also postulated that increased vertical facial height might be associated with submergence, but Brown (1981) found no evidence to support this view.

An association between submerged deciduous teeth and missing permanent teeth has often been suggested. Brown (1981) clearly demonstrated that when submergence is seen, absence of the permanent successor should always be suspected. The association was found to be much stronger in females than in males.

The familial, if not hereditary, tendency of submergence has been reported. Capon (1944) and Visick (1944) reported cases in brothers and sisters. Via (1964) showed that 1.3% of a sample of 2,342 children were affected. However, of those 30 children, 44% of their brothers and sisters were affected. Via concluded that submergence was a heritable trait because of the absence of any other logical explanation for a familial tendency. Brearley and McKibben (1973) came to no firm conclusions about the importance of a familial tendency. Kurol (1981) reported a significantly higher prevalence in siblings and concluded that submergence is inherited on a multifactorial, polygenic basis.

Histology

Brearley and McKibben (1973) defined ankylosis as an anatomical fusion of tooth cementum with alveolar bone. Dixon (1962) found that ankylosis was commonly associated with simultaneous tooth resorption. Deposition of bone-like material occurred in previously resorbed areas. Dixon also found that submerged teeth may later reach a stage of relative histological inactivity with no further apparent resorption. He further found that histological ankylosis cannot always be shown and a complete periodontal membrane may be seen histologically.

Rygh and Reitan (1963) found that bone is formed in resorption lacunae on the root surfaces. Resorption appeared both internally and externally. Resorption was not observed close to areas of the root surface covered by cementoid. Furthermore, resorption having occurred, repair by cellular cementum was never seen. New bone was laid down directly in the resorption lacunae.

Several investigators have stressed the importance of radiographic examination but Thornton and Zimmermann (1964) while generally supporting previous histological investigations, concluded that, radiographically, ankylosis was not visible in many cases. They also found that a submergence associated with congenital absence of the permanent successor generally showed ankylosis only in the apical region whereas if the permanent successor was present, resorption and ankylosis were much more widespread along the root surface.

DIAGNOSIS AND TREATMENT

Apart from the obvious feature of submergence below the occlusal plane, other diagnostic features which have been suggested include lack of mobility even when associated with marked root resorption, a characteristic solid resonant sound on percussion, obliteration of the periodontal membrane on radiographs (Lamb and Reed, 1963). The importance of radiographic examination has been stressed by Brauer (1934) and Vorhies et al (1952) although Thornton and Zimmermann (1964) disputed the value of radiographs.

The recommended treatment has, almost without exception, involved extraction of the affected tooth and space maintenance. However, Lamb and Reed (1963) outline several qualifying factors including dental age, presence of a successor, duration of the ankylosis and physical condition of the patient. They add that

in nearly all cases, removal is indicated. This is in spite of the evidence of Dixon (1962) and Brearley and McKibben (1973) that natural exfoliation may sometimes occur. Rygh and Reitan (1963) advocated early extraction to encourage normal development of the alveolus which was considered to be impeded by the continuing presence of the submerging tooth.

Of particular interest was the observation of Visick (1944) that attempts to move a submerged tooth resulted only in movement of the anchor tooth. Wilson (1963) stated, however, that often when space was re-created, submerged teeth erupted. Capon (1944) also failed in his attempts to move a submerged tooth. Observations by a number of people including Dixon (1962) and Wilson (1962) would suggest that submerged teeth might on some occasions be encouraged to erupt.

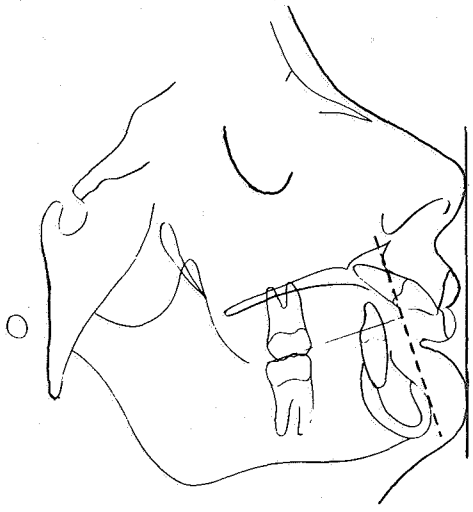

Figure 1: Cephalometric tracing showing the poor profile, low facial height and mandibular plane angle. The lower incisor lies at -7mm to the APo line.

SURVEY RESULTS

The study models of one hundred and seventy-eight (178) children were selected from a sample of Brisbane school children. This sample was obtained in 1970 and was randomly selected by personnel in the Queensland Department of Education. The criterion for selection in the present case was that the stage of occlusal development should be between DS02 and DS2 inclusive (Bjork, Krebs and Solow, 1964). This means that the deciduous dentition is complete or that eruption of canines and premolars has not begun. Any child with extraction of all deciduous molars was eliminated. Cases with extraction of some deciduous molars were included and adjustments made by a count of the number of remaining deciduous molars.

No distinction was made between males and females. Previous studies have not demonstrated sex specificity in relation to submergence. The stages of development selected should have maximised the prevalence of submergence in the sample. Several studies have alluded to the increasing prevalence of submergence with increasing age in the mixed dentition up until exfoliation begins. A tooth was classed as submerged when its occlusal surface was at least 1mm cervical to the occlusal plane defined by the fully erupted adjacent teeth. There was no evidence that any of the missing teeth had been extracted because of submergence.

The total number of patients was 178 and the expected total number of deciduous molars was 1424. The total number of missing deciduous molars was 174 (12%) distributed as follows (each tooth is designated by the F.D.I. system) in Table 1.

Teeth	55	54	64	65
	11	18	15	14
	26	33	29	28
Teeth	85	84	74	75

Table 1. Distribution of missing Deciduous Teeth

Submergence was seen in 10 of the 178 patients (5.6%). The total number of submerged molars was 17 being 1.4% of the total number (1250) of deciduous molars present. Nearly all the affected teeth were lower molars with equal numbers of lower first and second deciduous molars. (Table 2).

†Teeth	55	54	64	65
	0	0	1	0
	4	4	4	4
Teeth	85	84	74	75

Table 2. Distribution of Submerged Deciduous Teeth.

CASE REPORT

While the extraction of first deciduous molars may not lead to loss of space, extraction of second deciduous molars is likely to result in significant space loss if undertaken before the successor is ready to erupt, particularly before 9 years (Ronnerman, 1965). In addition where the submergence of deciduous second molars is associated with congenital absence of the permanent tooth, it may not be desirable to extract the deciduous tooth where the remaining permanent teeth are small and where satisfactory space closure is unlikely to be achieved. Thus, there are occasions where extraction of the deciduous tooth is not desirable even if long term exfoliation does occur.

It was decided, therefore, to try to treat some cases of submergence conservatively by

elevation of affected second molars. This involved banding of adjacent permanent teeth, creation of space and elevation of the tooth. Where submergence was associated with over-eruption of opposing deciduous teeth, the opposing teeth were ground occlusally. Four cases were treated. In three cases the submerging

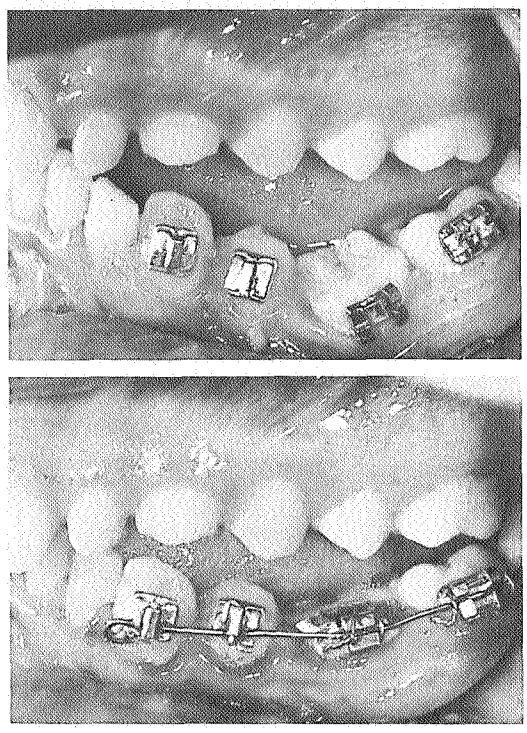

Figure 2: Pre-treatment and post-treatment photographs showing the poorly positioned lower second deciduous molar and its elevation by means of a simple sectional arch.

deciduous tooth responded to elevation but the response was not readily predictable. In two cases the response was immediate but there followed a further period where no response could be gained suggesting that ankylosis had again occurred. In one case the deciduous tooth would not move and the traction caused depression of the first permanent molar. These observations suggest that submergence is not a static process but involves periods of remission at which times the tooth can be moved. This agrees with the observations of Dixon (1962).

Figure 1 demonstrates a case of submergence where the permanent successor was congenitally absent. The profile is retrusive with the lower lip lying behind the E line and the lower incisor at −7mm to the APo line. Both the lower facial height and the Frankfort-mandibular plane angle were well below normal values. This case demonstrates a compromised profile where the results of extraction and space closure are certain to result in further retro-positioning of the lower incisor and deterioration of the profile. Treatment was, therefore, conservative. The poorly positioned lower left second deciduous molar (Figure 2) was uprighted by means of fixed appliances. The response was immediate and movement occurred rapidly over a period of about 6 weeks. The response then slowed and slight submergence again appeared. While the longterm prospects for such a tooth are clearly not good, the overall diagnostic analysis suggested that extractions were not indicated in any case.

Summary

A review of the literature indicated that the problem of submergence is generally progressive and ultimate coverage of the tooth might occur. In at least two previous reports attempts to move submerged deciduous molars failed and in one instance only the anchor tooth moved. However, histological studies do not invariably show bony union to the tooth. Clinical observation would suggest that interception by rocking or space opening may be rewarded by eruption. It has also been shown that the natural history of the condition is occasionally associated with a remission and eruption of a previously submerged tooth. For these reasons and to avoid long term space maintenance, it was decided to attempt orthodontic elevation of submerged lower second deciduous molars in four patients, one of whom is demonstrated. In three cases the attempt was successful, suggesting that we should re-appraise the interception and treatment of these problem teeth, particularly where the facial morphology mitigates against successful treatment by extraction and space closure.

CONCLUSIONS

1. The prevalence of submerged deciduous molars is approximately 4% of children but varies at different age levels. Submergence becomes more prevalent in the late mixed dentition stages.
2. Lower deciduous molars are more frequently affected than upper deciduous molars.
3. Submergence is generally a progressive condition which becomes more pronounced with vertical growth of the jaws. Occasionally, natural remissions of the condition occur.
4. The etiology of the condition is obscure but histologically it is seen to be due to a union between bone and dentine in previously resorbed areas of the root.

5. There is some evidence of a familial tendency and where one child is affected, the siblings are more likely to be affected.
6. There is a strong association between submerged deciduous molars and congenital absence of the permanent successors.
7. Diagnosis of the condition radiographically is not to be expected in all cases.
8. Extraction is not always necessary. Orthodontic elevation has been shown to be successful whereas it was previously thought to be unlikely to succeed.

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