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## Secondary retention of molars

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## SUMMARY

Eruption is the axial or occlusal movement of the tooth from its developmental position within the jaw to its functional position in the occlusal plane. It continues throughout life to compensate for growth of the jaws and occlusal wear. Eruption disturbances of molars can lead to severe malocclusion, and to loss of the affected tooth and neighbouring teeth due to plaque accumulation followed by caries or periodontal disease. *Secondary retention* refers to the cessation of eruption neither due to a physical barrier in the path of eruption nor as a result of an abnormal position. The criteria currently used to diagnose secondary retention are confusing and often not reliable. The etiology of secondary retention is essentially unknown, but ankylosis has been suggested as being the main factor. There are no proper guidelines for treatment of this eruption disorder, especially when it occurs in the permanent dentition.

The aim of this study was to obtain insight in the present knowledge of secondary retention and other eruption disturbances of molars, to state factors that may contribute to the etiopathogenesis, to state reliable diagnostic criteria, and to recommend guidelines for proper treatment. These goals were achieved by:

- a review of the literature regarding secondary retention (chapter 2);
- a study of the clinical, radiographic and histological characteristics and recommendations for proper treatment of secondary retention in the deciduous dentition (chapter 3);
- a description of the eruption disturbances underlying impaction, primary retention and secondary retention in the permanent dentition (chapter 4);
- a study of the clinical and radiographic characteristics of secondary retention of permanent molars (chapter 5);
- a study of the role of hereditary factors of secondary retention of permanent molars (chapter 6);
- a study of the histological characteristics of secondary retention of permanent molars (chapter 7);
- an evaluation of the outcomes of different approaches of treatment and a proposal for guidelines for proper treatment of secondary retention of permanent molars (chapter 8).

In **chapter 2**, a review of the literature regarding secondary retention in the deciduous and permanent dentition is presented. Secondary retention is less frequently observed in permanent than in deciduous molars, but it can lead to severe malocclusion and loss of neighbouring teeth, particularly in the permanent dentition. The etiology of secondary retention in both the deciduous and permanent dentition is probably the same. The factors causing secondary retention are most likely of local origin and are probably due to remodelling disturbances in the periodon-

tal ligament. On the basis of histological studies in deciduous molars, ankylosis is generally accepted as an important factor in the etiopathogenesis of secondary retention. Although there are two case studies reported in the literature stating that ankylosis is also involved in secondary retention of permanent molars, this aspect must be studied in more detail. Clinically, percussion tests and partial absence of the periodontal ligament space on radiographs have been suggested to be valuable additional tools to the observation of infraocclusion in the diagnosis of secondary retention. There seems to be no consensus concerning the treatment of secondary retention of permanent molars in particular. Orthodontic movement of the affected molar is not possible.

In a group of 34 patients with 77 secondarily retained *deciduous molars*, the clinical, radiographic, and histological features of secondary retention and its treatment are evaluated (**chapter 3**). Thirty-two of the 41 deciduous molars studied histologically, showed small local areas of ankylosis. The clinical signs of ankylosis (solid, clear percussion sound, and partial absence of periodontal ligament space) turned out to be unreliable to detect ankylosis (many false negative results). In nine patients, secondary retention was observed in both deciduous and in permanent molars in the same dentition. Therefore, secondarily retained deciduous molars probably may predispose to a similar disorder in the permanent dentition. The recommended treatment policy, which is in accordance with the view of Kurol, is to wait for normal eruption of the permanent successor, because in most cases occlusal disturbances will recover spontaneously. A follow up is necessary to observe the occlusal development and to detect new cases of secondary retention in the same patient. Active therapy in the deciduous dentition, for example extraction, is only indicated in case of severe infraocclusion, severe malocclusion, and dislocation or agenesis of the successor.

In **chapter 4**, the eruption disturbances reported in *permanent molars* are analyzed. Eruption disturbances of permanent molars may become clinically and radiographically manifest as *impaction*, *primary retention*, or *secondary retention*. Which of these disorders develops, depends primarily on the eruptive stage. *Primary retention* is the cessation of eruption before emergence neither due to a physical barrier in the eruption path nor as a result of an abnormal position. *Impaction* is cessation of eruption caused by a clinical and radiographically detectable physical barrier in the eruption path or due to an abnormal position of the tooth. Treatment recommendations of these three eruption disturbances are given. The clinical features and the guidelines for treatment as derived from the data presented in chapters 5–8 and reported in literature are summarized in Table 1 (p.32) and Fig. 6 (p.37).

In **chapter 5**, the clinical and radiographic aspects of secondary retention in *permanent molars* are described. In a large group of 53 patients with 81 secondarily retained permanent molars these features were examined (**section 5.1**). First molars turned out to be affected most frequently. The mean infraocclusion at the

patients' first visit was 4.3 mm. After six months, infraocclusion had increased in adolescents. It seemed to be stable in adults. Tilting of adjacent teeth was observed in 39 cases of secondary retention. A solid, clear percussion sound and a partial absence of the periodontal ligament space on radiographs were noted in less than 20% of the affected molars, while histological examination of 38 removed molars revealed that local areas of ankylosis were present in all cases. From the histological, percussion and radiographic data of the 38 removed molars a sensitivity of the percussion test and of radiographs to detect ankylotic areas of, respectively, 29% and 21% was calculated. This implies that percussion tests and judgement from radiographs result in many false negative outcomes and are thus non-reliable diagnostic tools. During a follow up period of four years, six new cases of secondary retention were observed in the same population.

In **section 5.2**, three cases of secondary retention of the first permanent molar and impaction of the adjacent molar in the mandible are reported to elucidate some of the clinical problems. Histologically, the roots of the secondarily retained molars showed the presence of local areas of ankylosis, while these were completely absent on the roots of the impacted molars. This difference has not been described before in the literature and supports the concept described in chapter 4. Early detection of secondary retention followed by prompt treatment greatly minimizes the progressive negative effects of this dental condition such as the development of severe malocclusion and impaction of the adjacent molar (chapter 8).

Spontaneous re-eruption of a secondarily retained permanent molar is a very rare phenomenon and has never been reported in the literature before (**section 5.3**). The case described is in accordance with the theory that secondary retention is caused by local areas of ankylosis and that these areas can be resorbed during remodelling of the bone of the alveolar process.

In **chapter 6**, first degree relatives of 52 patients with secondary retention of *permanent molars* are screened to study the familial occurrence. Familial occurrence could be demonstrated in five families. The pedigrees agreed with autosomal dominant inheritance as suggested in the literature. HLA phenotypes and bloodgroup ABO, rhesus and P<sub>1</sub> were studied in two positive families. The lod scores for linkage with secondary retention were added to previously reported information. The lod score for linkage for bloodgroup P<sub>1</sub> increased from +0.940 to +1.475 at a recombination fraction of 5%. The HLA phenotypes and bloodgroup ABO and rhesus showed negative lod scores. It was concluded that secondary retention of permanent molars is an etiologically heterogeneous condition of which some cases are caused by the presence of an abnormal autosomal dominant gene. Because of a familial occurrence over 10%, it is advisable to examine family members, especially the younger ones, of each patient with secondary retention to detect this disorder as early as possible in order to enable adequate treatment.

In **chapter 7**, the histological features of secondary retention of *permanent molars* are described. Twenty-six secondarily retained permanent molars and six normal

molars were examined histologically in order to detect the frequency of occurrence, extent and localization of ankylosis (**section 7.1**). Local areas of ankylosis were observed along roots of all secondarily retained molars. In 81% of the cases these areas were located at the bifurcation and interradicular root surface. No signs of ankylosis were found in control molars of the same dentition that had to be removed also. The roots of 12 other affected molars and two normal molars were examined by means of scanning electron microscopy (SEM) and light microscopy (LM) (**section 7.2**). With SEM it was observed that the root surface of retained molars showed local areas covered with bonelike tissue. LM of these areas showed that this tissue was bone indeed, that was in direct contact with the root surface. Ten to 60% of the whole root surface was ankylotic. In the five molars that were clinically suspected to be ankylotic (solid, clear percussion sound and partial absence of the periodontal ligament space) more than 40% of the root surface was ankylotic.

The morphological and histological observations outlined in this chapter, make it quite probable that local areas of ankylosis between the root and alveolar bone are a significant factor in secondary retention of permanent molars.

In **chapter 8**, the efficacy of five different treatment modalities for secondary retention of *permanent molars* is evaluated in 59 patients with 88 affected molars. The aim of this study was to develop guidelines for treatment of this disorder as the current knowledge is mainly based on case reports. The results showed that a prosthetic build up is the proper treatment if secondary retention develops after the growth spurt. In these cases the extent of infraocclusion is slight and relatively stable. If secondary retention starts before the growth spurt, immediate removal of the retained molar followed by orthodontic treatment to close the diastema gives maximal success. When secondary retention develops during the growth spurt, the tooth affected has to be observed at six monthly intervals. In such cases, no active treatment is indicated if the neighbouring teeth do not show tilting and if the extent of infraocclusion is minor and stable. A prosthetic build up can be made to avoid tilting of the neighbouring teeth and over-eruption of the antagonist. In all other cases the affected molar should be removed, followed by orthodontic closure of the diastema. Orthodontic treatment and luxation of the affected molar was not successful.

Eruption disturbances of molars cannot be considered as a curiosity. Therefore the knowledge about these phenomena should be a substantial component of the dentist's, orthodontist's and oral and maxillofacial surgeon's basic knowledge. Early detection of secondary retention followed by timely treatment can minimize progressive negative effects of these eruption disturbances, such as the development of a severe malocclusion.