Original Article

Impaction and Retention of Second Molars: Diagnosis, Treatment and Outcome

A Retrospective Follow-up Study

Cathrine Magnusson[a]; Heidrun Kjellberg[b]

ABSTRACT

Objective: To evaluate treatment outcome in patients with second molar impaction and retention.

Materials and Methods: A total of 135 second molars, 65 in the maxilla and 70 in the mandible were collected from 87 patients (45 girls and 42 boys) with a mean age of 15 years (range: 11–19 years). Available patient records, x-rays, study casts, and photos were studied. The mean follow-up period was 22 months (range: 4–106 months).

Results: A total of 166 second molars were diagnosed as impacted, 24 as primary and 5 as secondarily retained; 80% of the second molars were orthodontically or surgically treated. In more than half of the treated patients the second molars failed to erupt into a proper position. Surgical exposure of the retained or impacted second molar was the treatment found most successful (71%). The least successful treatment (11%) used the third molar to replace the second molar after the second molar was extracted. No clear difference in treatment outcome could be detected between the impacted and the primary or secondary retained teeth. However, a clear difference was found between the impacted and the primary retained second molars regarding treatment strategy: 9% of the impacted and 67% of the primary retained teeth were left untreated. Dental crowding was found in 70% of the patients.

Conclusion: In more than half of the treated patients the second molars failed to erupt into a proper position. The most common treatment given (extraction of the second molar) was the least successful. (*Angle Orthod.* 2009;79:422–427.)

KEY WORDS: Second molar impaction and retention; Orthodontic treatment evaluation; Surgical treatment evaluation

INTRODUCTION

Failure of tooth eruption or tooth impaction is a common problem that affects almost 20% of the population.[1] The definition of impaction is tooth retention due to an obstacle in the eruption path or ectopic position of the tooth germ (Figure 1). Primary retention is defined as impaction without an obstacle in the eruption path or ectopic position of the tooth germ before gingival emergence, and secondary retention is defined as arrested eruption without an obstacle but after gingival emergence.[2]

Knowledge about the etiology of second molar disturbances, according to Andreasen,[1] is based mainly on case reports and a few clinical studies. Three main causes have been distinguished: ectopic position, obstacles in the eruption path, and failures in the eruption mechanism.

The etiology can be traced to systemic (syndromes, multiple teeth) or local (one or few permanent teeth) factors such as crowding,[3–6] craniofacial morphology and deviation in the dentition,[7] or disturbances in the periodontal membrane[8] and disruption of nerve supply.[9] Systemic diseases connected with generalized failure of eruption are considered etiologic factors according to Suri et al.[10] Heredity is also mentioned as an etiologic factor.[1]

The prevalence of impacted second molars is low and varies from 0%–2.3%[11,12] The age varies from 9

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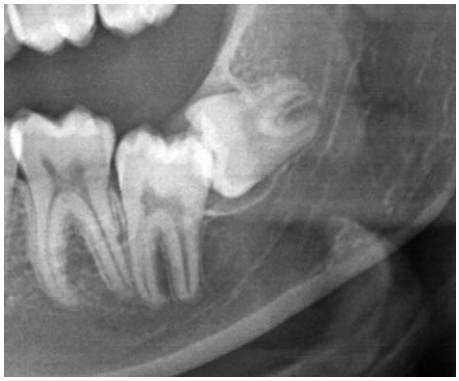

Figure 1. Impaction 37 due to posterior crowding.

to 26 years in these studies. Second molar impaction and retention are often diagnosed during orthodontic treatment as a secondary finding[13] and are rarely the primary reason for referral to an orthodontic clinic.[4]

Indications for treatment of impacted and retained second molars mentioned in the literature are the risk for resorption of neighboring teeth, caries and periodontal problems, follicular cysts, malocclusion, difficulties in treating deep bite, pericoronal inflammation, and pain.[1,2]

Treatment of these teeth often requires a multidisciplinary treatment approach.[14–16] Surgical techniques,[17–19] orthodontic solutions,[20–23] and combined surgical and orthodontic treatment[13] are all mentioned. One of the most common treatment solution mentioned is surgical exposure of the second molar and extraction of the third molar.[24] Modern techniques are described, such as the use of miniscrews as an anchorage for uprighting second molars.[25,26] Different treatment recommendations are given in the literature depending on the diagnosis and position of the second molars.[1,10,24,27] However, to our knowledge, no study is based on both diagnosis and outcome of treatment.

Molar impaction and retention are the subjects of much discussion among clinicians when deciding the best treatment strategy in different clinical cases. The aims of this study are therefore to describe both the outcome of treatment in patients with second molar impaction and retention and to describe the outcome of no treatment.

Table 1. Number of patients and number of teeth included in the study

Clinic	No. of Patients	No. of Teeth
Departments of Orthodontics and Oral Surgery, Borås	42	71
Department of Orthodontics, Gothenburg	17	30
Department of Pedodontics, Gothenburg	28	34
Total	87	135

Table 2. Number of impacted or retained second molars according to diagnostic findings

Tooth No.	n	Impaction	Primary Retained	Secondary Retained
17, 27	65	48	14	3
37, 47	70	58	10	2
Total	135	106	24	5

MATERIALS AND METHODS

In this descriptive, retrospective, longitudinal follow-up study, 103 patients, 56 males and 47 females, with 166 retained/impacted second molars were identified. Sixteen patients with 31 second molars were excluded because they were not willing to participate in the follow-up examination or because the treatment was not yet completed. The subjects thus consisted of 87 patients (45 girls and 42 boys) with a mean age of 15 years (range: 11–19 years) and 135 impacted or retained second molars.

Patients were identified over a 2-year period from different specialist clinics in the Västra Götaland Region (Table 1). Patients with syndromes were not included in the study. The mean follow-up period, defined as treatment start to follow-up date, was 22 months (range: 4–106 months) and most of the treated second molars, 79 of 108 (73%), were followed up between 1 and 5 years.

The second molars were diagnosed as impacted or primary or secondary retained according to the definition given by Raghoebar.[2] The patients were diagnosed from computed tomography scans, orthopantomograms, and/or apical radiographs. Information was also gained from casts (41 patients), patient records, and photos. In addition, the material was studied according to the following parameters: crowding, presence of third molars and overeruption of the antagonist of the second molar.

Outcome after treatment or outcome without treatment was studied. If the first treatment failed, the second treatment, if present, was described. The number of visits and orthodontic treatment time were calculated.

Treatment was defined as failed if a second molar did not erupt 1 year after surgical intervention or orthodontic treatment. Occlusion of the second molar was defined as successful if it erupted in a good ver-

Table 3. Presence of third molars (n = 87)

Condition	No. of Patients
All third molars present	52
1 to 3 third molars present	16
Agenesis of third molars	9
Missing data	10

Table 4. Outcome of untreated teeth according to different diagnoses (n = 27)

	Impacted		Primary Retained		Secondary Retained		
	Maxilla	Mandible	Maxilla	Mandible	Maxilla	Mandible	Total
Erupted in good occlusion	4	0	7	1	0	0	12
Erupted without good occlusion	3	0	1	0	0	0	4
Failed to erupt	0	3	3	4	1	0	11
Total	7	3	11	5	1	0	27

Table 5. Outcome of treated teeth according to different diagnoses (n = 108)

	Impacted		Primary Retained		Secondary Retained		
	Maxilla	Mandible	Maxilla	Mandible	Maxilla	Mandible	Total
Erupted in good occlusion	18	23	0	3	1	0	45
Erupted without good occlusion	9	15	0	1	0	0	25
Failed to erupt	14	17	3	1	1	2	38
Total	41	55	3	5	2	2	108

Table 6. Number of impacted or retained teeth treated in different ways and outcome of treatment with different interventions (n = 108)[a]

	Good Results		Not Satisfied			
Therapy/Outcome	Maxilla	Mandible	Maxilla	Mandible	N	Successfully Treated, %
Extract 7, replaced by 8	3	0	8 + 2** + 1*	11 + 1** + 1*	27	11
Extract 8, 7 erupted	5	3 + 1**	4 + 1**	7	21	42
Orthodontic treatment	2	6	3	8	19	42
Surgical exposure, 7 erupted	3 + 1*	7 + 1**	1	3 + 1*	17	71
Extract 8 and surgical exposure/luxation of 7	2	4 + 1**	4	2 + 1**	14	50
Extract 6, 7 erupted	3	1	2	0	6	66
Surgical exposure and luxation of 7	0	2	1	1	4	50
Total	19	26	27	36	108	42

[a] * indicates secondary retained teeth; ** primary retained teeth.

tical position with the occlusal surface <2 mm from the occlusal plane. If a second molar was extracted, treatment was defined as successful only if the third molar had erupted in a good vertical position with the occlusal surface <2 mm from the occlusal plane.

RESULTS

A total of 106 second molars were diagnosed as impacted, 24 as primary retained, and 5 as secondarily retained (Table 2). The presence of third molars is shown in Table 3. Of 118 teeth with a corresponding impacted or retained antagonist, 49 were elongated, most in the maxilla (69%). In 60 patients in whom an orthodontic diagnosis was available, 42 (70%) showed crowding.

Twenty percent of the second molars were left untreated. Of the teeth that were *not* treated, 44% erupted into good occlusion (Table 4). Tables 4 and 5 show that the distribution between impacted and retained molars differed among treated/untreated teeth in that a high percentage (91%) of the impacted teeth were treated compared with 41% of the retained teeth. The failure rate between impacted and retained teeth differed neither among treated and untreated teeth nor between the maxilla and mandible.

Of the impacted and retained second molars, 80% were treated with either surgical or orthodontic interventions. Of the 108 treated second molars, only 42% achieved successful results (Table 6). In 25 teeth a second treatment was given or planned, and 19 teeth were in the mandible.

Surgical exposure was the most successful treatment (71%). The success rate was 50% when surgical exposure was combined with extraction of the third molar and or luxation of the second molar. Extraction of the second molar, replaced by the third molar, was the treatment most commonly given (25%), but it was successful in only 11% of cases. The mean number of visits per patient for the treated teeth was 5.6 (range: 2–16). The mean treatment time for the orthodontically treated patients was 8.3 months (range: 1–20 months).

DISCUSSION

Management of retained second molars is considered difficult and unpredictable and success depends

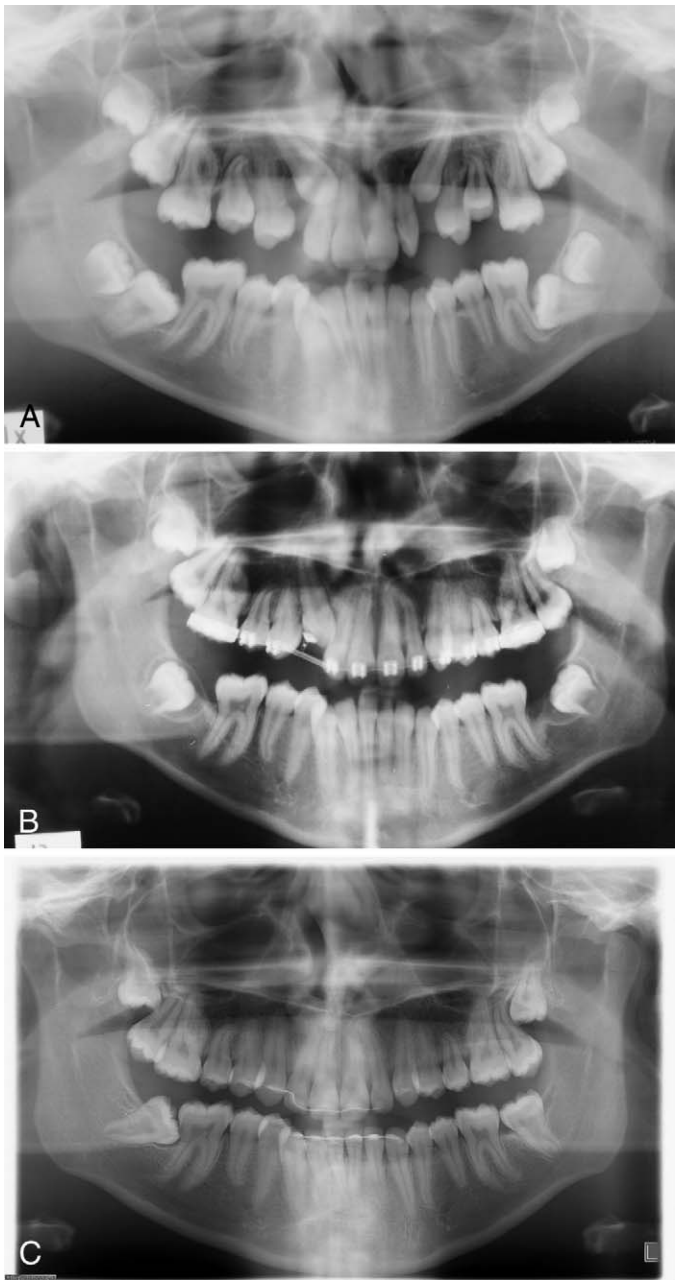

Figure 2. (a) A 12-year-old girl with crowding and impaction of 37, 47. (b) Extraction of 37 and 47 at the age of 14 years 9 months. (c) At the age of 19 years 1 month, failed replacement with 48 after extraction of 47 was seen. Good position of 38, which replaced the extracted 37.

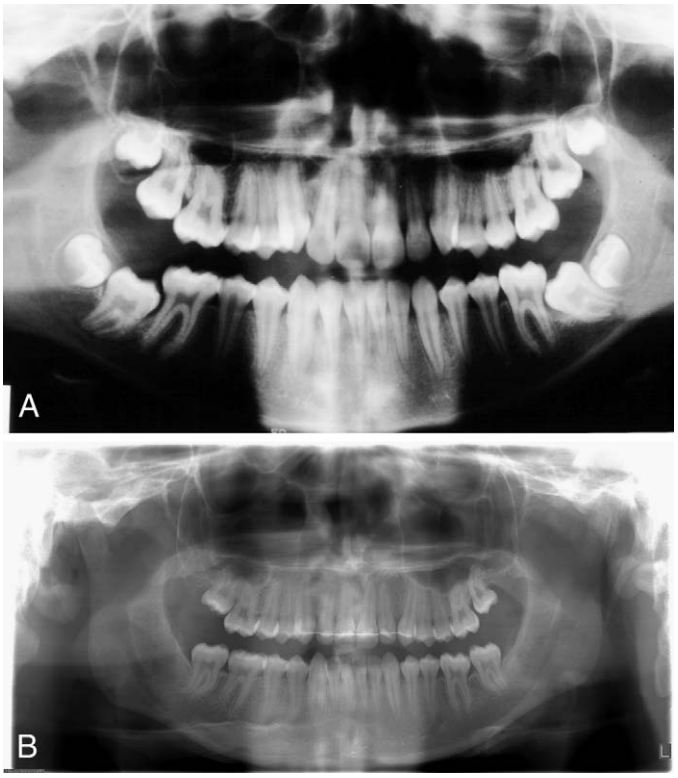

Figure 3. (a) Impacted 37 and 47 in a 13.5-year-old boy before treatment with extraction of 38 combined with luxation and a mesial ligature 37 and orthodontic treatment with sectional arch wire for uprighting; 48 was extracted and 47 was carefully luxated; 17 and 27 were not impacted but were extracted because of a class II treatment with distalization of the upper first molars. (b) At the age of 16 years, 18, 28, 37, and 47 erupt nicely.

on an early diagnosis and early treatment.[28] In the present study, only 42% of the treatments of the retained/impacted second molars were considered successful (Figures 2 and 3).

The results show that there is no clear standard solution for how to treat retained or impacted second molars, as treatment depends on several local factors such as the angulation/inclination of the impacted/retained tooth, the position of the third molar, and the degree of crowding or follicle collision.

In the present material the follow-up period was more than 1 year in 72 patients but less in 15, which was considered acceptably long enough in most of the patients. Of the examined teeth, 20 had a follow-up period less than 1 year. Of these, 12 were considered successful (60%). This percentage is not higher than for those who were followed up longer, where the success rate was 61%. Of those, two teeth with the shortest follow-up (4 months) both had erupted successfully.

Nevertheless, the definition of successfully erupted teeth used here is quite narrow. Some of the erupted third molars defined as unsuccessful can be expected to erupt into better occlusion in time, increasing the number of successfully treated teeth.

Andreasen[1] stated that ''active treatment generally is indicated of impacted ectopic erupting teeth, even if in rare cases they can erupt spontaneously into normal occlusion.'' In this study, more than 50% of the second molars managed to erupt spontaneously without any treatment. Most of these second molars, es-

pecially in the maxilla, may have been delayed in the time of their eruption and not primary retained, pointing to the difficulties in making a correct diagnosis.

Extracting the retained or impacted second molar, with the intention of replacing it with the third molar, was the least successful treatment regimen. One factor that might influence the outcome of this intervention can be disturbances in the periodontal membrane.[8] Extracting the second molar in the maxilla seems to be nearly as unsuccessful as extracting in the mandible. The few third molars, both in the maxilla and mandible, that did erupt were all malpositioned; that is, they were tipped in a cross or scissors bite or not fully erupted. In addition, there is a risk for elongation of the antagonist because of the delayed eruption of the third molar.[6]

These results indicate that extraction of the second molar with no further intervention shall be avoided or, if performed, the patient should be informed about the poor prognosis for the eruption of the third molar into a good position.

Crowding is another factor strongly correlated to the impaction of second molars.[3–6] This is in agreement with the present study, where 70% of the patients showed crowding, compared with 9%–27% in an unselected population.[13] Orthodontists thus have a key role in treatment planning of crowding in cases with a risk for impacted or retained second molars.

Surgical exposure of the second molar, with or without extraction of the third molar and/or luxation of the second molar, seems to result in the most successful treatment in both jaws (60%). These results are remarkably lower than those presented by Wellfelt and Varpio,[24] who found that surgical exposure of the lower second molars combined with extraction of the third molar was successful in 95% of patients. The reason for the divergent success rates can be found in different definitions of success and in the age difference between the subjects in the studies.

Orthodontic treatment was more often given in the mandible, and the success rate was the same for both jaws. These results deviate from those of Wellfelt and Varpio,[24] who found that orthodontic treatment alone or combined with surgery was more commonly used and was primarily successful in the maxilla.

The secondary retained permanent second molar seems to be the most difficult to treat,[28] and it seems that partially retained molars show less favorable results than totally retained molars. In the present study only one of four treated secondary retained molars managed to erupt into an acceptable position.

Alternative treatments, such as surgical repositioning of the second molar or autotransplantation of the third molar after extraction of the second molar, are procedures described by several authors[1,6,17,19,29] that usually lead to predictable successful results if root formation is not completed.

In view of the poor prognosis in the treatment of retained second molars and the fact that, for chewing purposes, people need only two occlusal units in symmetrical position, that is, 20 teeth,[30] the different treatment alternatives should be thoroughly discussed with the patient before intervention.

CONCLUSIONS

- More than half of the treatments failed, and extraction of the impacted/retained second molar replaced by the third molar was the least successful (11%) but most common treatment in the present study.
- Surgical exposure of the second molar seems to be the best choice of treatment, with a success rate of 70%.
- Orthodontic treatment planning in cases of crowding must include evaluation of distal crowding.
- Intervention before root formation is completed may increase the number of successful treatments.

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