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Hypomineralized molars and incisors of unknown origin: treatment outcome at age 18 years

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Summary. *Objective.* To assess the outcome of treatment of hypomineralized molars and incisors of unknown aetiology (MIH) in 18-year-olds.

Design. A follow-up study including clinical examination, panoramic radiography and intraoral photos.

Sample and method. Seventy-six individuals treated at the Eastman Dental Institute in Stockholm during 1978–2001 with the diagnosis MIH. Severity of enamel defects in molars and incisors, prevalence and distribution of extracted molars, type, quality and median duration of restorations, periradicular condition of affected molars, dental occlusion and space closure in cases of extraction, as well as the individual's satisfaction with the treatment, were assessed.

Results. Severe defects with enamel surface breakdown in all four molars occurred in 42% of the individuals and 29% had at least one incisor with yellow/brown opacity in the enamel. At follow up, 42% of the individuals had at least one molar extracted; 18% had all four molars extracted. The median duration of the molar restorations (n = 153) was 5 years. Of the individuals with restored molars, 48% had at least one unacceptable restoration. Periradicular pathology was observed in three molars. The sagittal relations did not differ between individuals with and without extraction of molars. Space closure was acceptable in 87% of the individuals with extracted molars. Eighty percent were satisfied with the treatment.

Conclusions. Extraction of molars with severe enamel defects gave good or acceptable results in a majority of the patients while conservative restorative treatment resulted in a need for additional treatment in approximately half of the patients.

Introduction

Permanent first molars and incisors with severely hypomineralized enamel of unknown aetiology were first recognised in Sweden in the late 1970s. An epidemiological study showed a prevalence of 15% in children born in 1970 [1]. Later, prevalences of 9·7–19·3% were reported from Denmark, Finland, the Netherlands and Sweden [2–5].

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The typical clinical feature of these hypomineralized molars and incisors is demarcated enamel opacities, often followed by breakdown of the enamel. The appearance is asymmetrical, that is, one molar can be severely affected while the contra-lateral molar may be clinically sound or have only minor defects (Fig. 1). The same applies to incisors, although enamel breakdown is uncommon in them.

In 2001, Weerheijm *et al.* [6] suggested that the condition should be named molar incisor hypomineralization (MIH). Despite efforts to find the causes [7–11], no unambiguous aetiology of MIH has yet been established.

Proper cavity preparation can be difficult in that the border between demineralized and unaffected

Fig. 1. A 10-year-old boy with molar incisor hypomineralization. Note the asymmetric appearance, with severe defects in three molars and one upper molar, that is clinically almost sound (the arrow points to a small opacity on the mesio-palatal cusp). The opacities in the upper and lower incisors are also distributed asymmetrically.

enamel is often diffuse. Severe restorative problems arise when the cusps are affected [4,12]. Although unofficial local, national and international seminars have been held on this issue, there is practically no knowledge and no general agreement about the optimal treatment of patients with this diagnosis. That is, should seriously damaged permanent first molars be extracted at an early age or should temporary restorations be made while waiting for more permanent crown therapy later during adulthood?

The aim of the present study was therefore to evaluate retrospectively the treatment outcome of patients with MIH. This would involve evaluating the type of treatment, that is, extraction or restoration of affected molars, the type, duration and quality of the restorations, the dental occlusion, including space closure after extraction, and the extent to which the patients were satisfied.

Method

Study population

Eligible for inclusion were all individuals born in 1968–88 ($n = 91$) who had been referred to the Department of Paediatric Dentistry at the Eastman Dental Institute for treatment of hypomineralized molars and sometimes also incisors of unknown aetiology (hereafter called MIH). Children with developmental defects in the enamel caused by amelogenesis imperfecta, dental fluorosis, local trauma or major general health disturbances were excluded. The treatment outcome for individuals born in 1968–78 ($n = 35$) has been reported earlier [13]. In 2001, a letter was sent to all patients born in 1979–88 ($n = 56$) who had been treated for MIH, offering them a dental examination. Seventy-three percent (41/56) accepted (four did not want to participate, three could not be reached and eight did not show up despite repeated telephone calls). The participants gave their informed consent and the Ethics Committee of the Karolinska Institute gave ethical approval. The inclusion of individuals in the previous sample gave a final study group of 76 individuals: 45 females and 31 males. The mean age at referral was 8·5 years (SD = 2·16) with a range between 6 and 17 years. Ten percent had been referred at an age of 11 years or later. The mean age at follow up was 18·2 years (SD = 3·20). Eighteen dentists had performed the treatments. An orthodontist had been consulted if extraction of one or more molars was considered. Restorative treatment or extraction had been chosen on the basis of the number of affected molars, severity of the defects, possible orthodontic consequences of extractions and the requirements of the patient and the parents. In some cases the extractions had not been carried out according to plan mainly owing to insufficient compliance of the patients. Thus, a complexity of factors was involved in the actual treatment, and the results must be considered accordingly.

Data collection

As in the 1968–78 sample, the follow up consisted of a clinical examination that included a panoramic radiograph and intraoral photos of molars and incisors. The number and distribution of extracted permanent first molars (hereafter called molars) and the clinical status of existing molars and incisors were recorded. Furthermore, the quality of the restorations related to enamel defects and the periapical status of the molars were assessed, as were the sagittal relations, including the midline and the degree of space closure when molars had been extracted. After calibration sessions, the molars and incisors were classified by one of the authors (EB) according to the criteria proposed by Weerheijm *et al*. [14]; Table 1. For molars, scores 1 and 2 were combined. For assessing the status of restorations of the molars, criteria modified after Ryge [15] were used according to preservation of anatomic form and marginal adaptation. These criteria were the same as those used in the 1968–78 sample; Table 1. The patient's satisfaction (good, acceptable or not acceptable) with the treatment was gauged during an interview.

Clinical photos of good quality were available for all the patients from the time of referral (taken at the

Table 1. Criteria used to classify enamel defects, quality of restorations, and dental occlusion including the midline and space closure.

Enamel defects in molars and incisors
0 = clinically sound
1 = white or creamy demarcated opacities; no enamel surface breakdown
2 = yellow/brown demarcated opacities; no enamel surface breakdown
3 = posteruptive enamel breakdown

Quality of restorations
0 = good anatomic form and marginal adaptation
1 = acceptable anatomic form and marginal adaptation with only minor gaps or marginal staining
2 = unacceptable*; ditching or major gaps between restoration and tooth margins or abrasion with exposed dentin of > 2 mm^2

Dental occlusion
Sagittal relations between upper and lower posterior teeth
0 = normal on both sides
1 = postnormal on both sides
2 = prenormal on both sides
3 = mixed; normal on one side and postnormal or prenormal on the other
Midline
0 = no or minor deviation between upper and lower central incisors (< 1·5 mm)
1 = deviation = 1·5 mm

*Secondary caries was not used as a criterion because of difficulties in determining whether a discoloured margin was caused by caries or hypominerlized enamel.

first visit at the Eastman Dental Institute). These photos were used to classify the enamel defects according to the criteria given in Table 1. The dental occlusion (sagittal relations) at the time of referral was recorded and any orthodontic treatment was registered as well as dates of restorations, type of restorative material used and any remaking of restorations. From the files the number of dental visits were also recorded.

Data analysis

As no statistically significant differences in the distribution of the investigated variables could be found between the two samples, their data were combined in the analyses. The dependent variable 'quality of the restoration' was dichotomised into 0 = good/acceptable and 1 = not acceptable. The photos were used for testing intra- and interexaminer agreement. Chosen by lot, every fifth case was re-examined (including the individuals of the previous sample) by the principal investigator (EB) and by the other two authors. The tested variables were enamel defects of the molars and incisors at referral and the quality of the restorations. Life-table analysis was used to assess the cumulative proportion of acceptable restorations. Differences in proportions were tested with the chi-squared test, and Spearman's correlation was used for the bivariate analyses of distributions. The level of significance was set at 0·05. Statistical calculations were carried out with SPSS, version 11·5 (Chicago, IL, USA).

Results

Intra-examiner agreement gave κ-values of 0·72–0·73. Interexaminer agreements gave κ-values of 0·68–0·70.

Clinical appearance at the time of referral

The mean number of affected molars and incisors per individual was 3·7 (SD = 0·75). In all molars with severe enamel defects (enamel surface breakdown) the whole or parts of one or more cusps were affected. The percent distributions of the number of severe enamel defects in the molars and incisors are shown in Fig. 2. Severe defects in all four molars occurred in 42% (32/76) of the individuals and 29% (22/76) had at least one incisor with a yellow/brown opacity. When white opacities in the incisors are also included, 64·5% (49/76) of the individuals were affected. Females had more molars with enamel surface breakdown than males. There was no statistically significant relationship between the number of molars with enamel surface breakdown and the number of incisors with enamel hypomineralization.

Number of treatment occasions and early treatment characteristics

The mean number of treatment occasions until follow up was 16·8 (SD = 8·40). There was no statistically significant correlation between the number of treatment occasions and the number of extracted

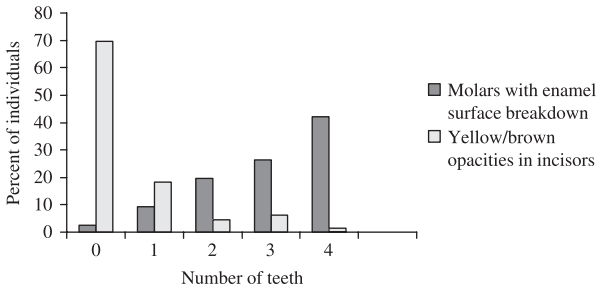

Fig. 2. Percent distribution of individuals ($n = 76$) according to the number of incisors with yellow/brown opacities in the enamel and the number of molars with enamel surface breakdown at the time of referral (mean age = 8·5 years).

molars (the time used for orthodontic treatment was not included). During the first 4–5 years after eruption of molars with severe enamel defects, the treatment was characterized by temporary fillings, application of fluoride varnish and in some cases the application of stainless steel crowns, with the main objective being to desensitize the molar and prevent further destruction of tooth substance. Even molars scheduled for extraction were included in these procedures, as extraction in many cases did not take place until the age of 11 years. This period was not analyzed in detail but is reflected in the large number of dental visits.

Treatment outcome

Extractions. The numbers and percentages of individuals according to the number of extracted molars and sagittal relations at the time of referral are given in Table 2. Eighteen percent (14/76) of the individuals had all four molars extracted, 24% (18/76) had 1–3 molars extracted and 58% (44/76) had no molar extracted. There was a statistically significant correlation between the individual-based number of molars with severe enamel defects (enamel surface breakdown) and the number of extracted molars, while no correlation was found between the sagittal relations at referral and the number of extracted molars. The mean age at extraction of lower molars was 11·0 years (SD = 1·55) and of upper molars 11·4 years (SD = 1·66).

In seven patients extractions were performed after the age of 12 years; the main reason being late referral. All but one of these patients received fixed appliances after the extractions. If these patients are excluded from the calculations, the mean age at extraction was 10·5 years for lower molars and 10·6 years for upper molars.

Restorations and periradicular conditions. At follow up, 83% (153/185) of the nonextracted molars with enamel defects had been restored. The median duration of the restorations of the molars was 5·2 years (SD = 3·29). There was no difference between upper and lower molars. After 6 years, the cumulative proportion of acceptable restorations was 65%.

The quality assessment of the restorations is presented in Table 3. Glass ionomer cements had the lowest and composites the highest success rate (the number of restorations with gold or porcelain was too small to be evaluated). Of the 62 individuals with one or more restored molars, 48% (30/62) had at least one restoration judged as unacceptable. Examples of acceptable and unacceptable restorations are shown in Figs 3 and 4. The glass ionomer cements more often showed severe abrasion, while a gap or ditching was typical of amalgam restorations. As judged from the panoramic radiographs, three molars showed signs of periradicular pathology and a further two had been root-filled for unclear reasons. Eleven incisors with composite restorations and two with veneers were scored as good/acceptable.

Table 2. Individual-based distribution of the number and percent of extracted permanent first molars related to dental occlusion (sagittal relations) at the time of referral ($n = 76$).

Number (%) of individuals	Number of extracted molars	Sagital relations at referral			
		Normal*	Distal†	Mesial‡	Mixed§
44 (57·9)	0	25	13	3	3
8 (10·5)	1	4	3	0	1
7 (9·2)	2	5	1	0	1
3 (3·9)	3	3	0	0	0
14 (18·4)	4	6	4	0	4
Total		43	21	3	9

*Normal relation on both sides.
†Distal relation on both sides.
‡Mesial relation on both sides.
§Normal relation on one side and distal relation on the other side.

Table 3. Tooth-based distribution of the number and percent of good/acceptable and unacceptable restorations in first permanent molars of 76 individuals with molar incisor hypomineralization.

	Restorative material, *n* (%)						
Outcome	Glass ionomer cement (including resin-modified)	Compomer	Composite	Amalgam	Stainless steel crown	Gold or porcelain*	Total
Good/acceptable	31 (49·2)	9 (64·3)	29 (85·3)	25 (78·1)	1	9 (100)	104
Unacceptable	32 (50·8)	5 (35·7)	5 (15·6)	7 (21·9)	0	0 (0)	49
Total	63 (100)	14 (100)	34 (100)	32 (100)	1 (100)	9 (100)	153

*Except for one gold veneer crown, the gold and porcelain restorations were all castings.

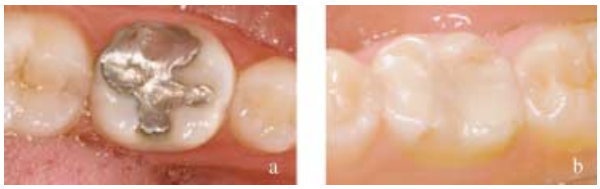

Fig. 3. Acceptable restorations with acceptable margins and anatomic form: (a) 11-year-old amalgam and (b) 5-year-old glass ionomer cement.

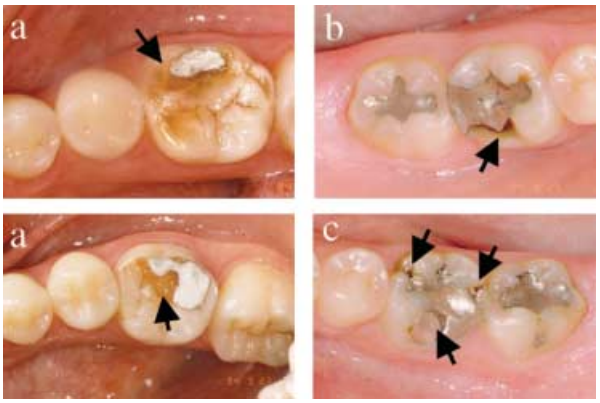

Fig. 4. Unacceptable restorations with (a) inadequate anatomic form (cusps missing) and exposed dentin owing to abrasion, (b) gap between restoration and tooth and (c) ditching at the tooth/restoration interface.

Occlusion, midline deviation, space closure, aesthetics and patient satisfaction. The distributions of individuals according to sagittal relations and prevalence of midline deviation at follow up in relation to treatment type (extraction vs. no extraction of molars) are shown in Fig. 5. There were no statistically significant differences in the distribution of the sagittal relations between the two treatment groups. Midline deviation (> 1·5 mm) was registered in 32% of the individuals with no extractions and in 50% of those with one or more extracted molar. The difference was not statistically significant.

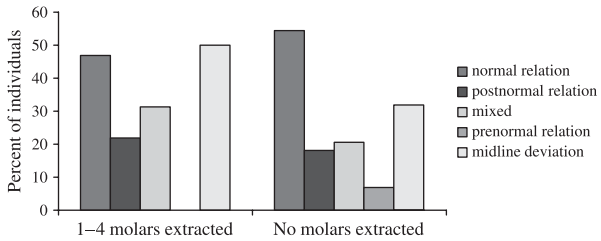

Fig. 5. Percent distribution of individuals at follow up according to sagittal relations and presence of midline deviation (> 1·5 mm) related to type of treatment (extraction of one or more molars versus no extraction of molars). Normal relation (total $n = 39$): normal sagittal relation on both right and left side; postnormal relation (total $n = 15$): postnormal relation on both sides; prenormal relation (total $n = 3$): prenormal relation on both sides; mixed (total $n = 19$): normal relation on one side and postnormal ($n = 18$) or prenormal ($n = 1$) on the other.

Of the 32 individuals with one or more extracted molar, 11 had received orthodontic treatment. Half of the 14 individuals with all four molars extracted had had orthodontic treatment. Space closure was considered good or acceptable in 87% (27/31) of individuals with one or more extracted molar (in one individual this assessment could not be carried out). The cases with unacceptable space closure (one women and three men) were equally distributed among individuals with and without orthodontic treatment and were twice as common in the lower compared with upper jaw.

In five individuals, where one or both lower molars had been extracted, no compensating extraction was performed for the opposing upper molar. The mean age at extraction was 10·5 years (SD = 1·06). The reasons were either a sound opposing molar (four cases) or noncompliance to show up for a planned extraction (one case). In none of these cases was over-eruption of the opposing upper molar noticed. One opposing upper molar showed rotation, however. In cases with no extraction of molars, 18% (7/39) of the patients showed over-eruption of a molar opposite a restored molar; Fig. 6.

Fig. 6. Over-eruption of an upper first molar owing to abrasion and inadequate anatomic form of the restoration of the disto-buccal cusp of the opposite lower first molar.

Eighty percent (61/76) of the individuals were satisfied with the outcome of the treatment and 9% (7/76) were dissatisfied. None of the patients complained about pain from the hypomineralized molars. While the number of molars with severe defects was positively correlated to the number of treatment occasions, there was no correlation between satisfaction with the treatment and the number of treatment occasions.

Discussion

The present sample is not representative of individuals with MIH. Rather, it represents a group with relatively severe enamel defects, as such cases are more likely to be referred to a specialist. Because of the lack of a control group the impact of MIH on the general need of restorative treatment of molars could not be evaluated in the present study, but in a group of Finnish children with MIH the DMFT values in 7–13-year-old children were more than twice as high as in a control group [3].

An important clinical issue is the preferred treatment for patients with severe MIH. At age 18 years, the number of treatment occasions was approximately the same whether or not extractions had been performed, while for those with orthodontic treatment ($n = 11$), additional time was required. Space closure was acceptable in the majority of the cases where extractions had been performed. Furthermore, the individuals were equally satisfied irrespective of the type of treatment. Additional treatment need was considered necessary for almost half of the patients with restored molars. Moreover, evidence of over-eruption of the opposite molar was observed in some of these patients (seven of 39). Although no evidence of future adverse effects from a single over-erupted molar could be found in the literature, exposed dentin of the defect molar would need protection to prevent further abrasion. Based solely on future restorative treatment needs, extraction of molars with severe enamel defects might be the most rational alternative. It should be noted, however, that as the individuals were not randomly allocated to extraction or restorative treatment, comparisons between the two types of treatment must be interpreted with caution.

Although there is little supporting data in the literature, it is widely held that there is a potential for over-eruption of upper first permanent molars following extraction of the opposing lower molar, and that this might result in a poor buccal segment relationship. Notably, no such over-eruption could be observed in the present sample. It should be appreciated though, that the number was small (five patients).

The optimum age for extraction of first permanent molars would seem to be 9–11 years [16]. The mean age at extraction in the present study was 11 years and it might be argued that this was late. Besides late referral of a number of patients, the main reason for that was a Swedish report on the occurrence of equally hypomineralized second molars [17]. It was therefore recommended to wait for the crown of the second molar to be fully mineralized as judged radiographically. As later reports, however, do not confirm this fear, it might be more appropriate to extract permanent first molars at an earlier age than was performed in the present study. Knowledge about the outcome of extraction of permanent first molars in relation to age and other clinical factors seems, however, to be very scarce and present dental practice is still based upon clinical experience or conventional wisdom [18].

The median duration of the restorations was approximately 5 years. Data on the longevity of restorations in young permanent teeth are very scarce. According to a recent report [19], the median survival time of Class I and Class II composite and amalgam restorations in teenagers was 3 and 5 years, respectively. Thus, the present results suggest that restorations of molars with MIH during late adolescence survive at least as long as other restorations in young permanent teeth. It should be noted, though, that the first 4–5 years after eruption of molars with severe enamel defects are characterized by great difficulties in restoration owing to the hypomineralized enamel.

The most commonly used restorative material was glass ionomer cement, which also showed the highest failure rate. Composite and amalgam had each

been used in approximately 20% of the restorations, and their failure rates were 15–22%. It is doubtful whether new and improved composites would function better during the first 4–5 years after eruption, as the major problem is not the restorative material but rather the soft and weakened surrounding enamel that breaks, leaving ditches or gaps between the tooth and the restoration. The use of a stainless steel crown could not be evaluated because it had been used in so few cases. In general, there is a poor tradition for making stainless steel crowns among Swedish dentists. Those made were considered temporary, and they were all made in the early phase of the treatment period, mainly to overcome the hypersensitivity of the molar. During the late teens, nine molars had been successfully restored with gold or porcelain. If it is decided not to extract severely damaged molars, the latter materials may be the most cost-effective in the long run, although the limited number of the various materials used does not allow for any firm conclusions.

It is noteworthy that although a majority of the molars had severe defects and large restorations, only three of them showed periradicular pathology. In this respect the present study suffers from the fact that only panoramic radiographs were available and that sensitivity tests were not performed. It is therefore conceivable that periradicular pathology was overlooked. However, no pain was reported and clinical experience of treating patients with MIH indicates that the pulp tissue is surprisingly resistant to permanent damage even in molars with severe defects.

In conclusion, at age 18 years the patients were equally satisfied and the mean number of treatment occasions was the same in both types of treatment. Dental occlusion and space closure after extraction of one or more molars were satisfactory in a majority of the patients, whereas an additional treatment need for restored molars was found in almost half of the patients where a conservative treatment strategy had been used.

Résumé. *Objectif.* Evaluer les resultants du traitement de l'hypominéralisation molaire et incisive d'étiologie inconnue (MIH) chez des sujets âgés de 1 à 8 ans.
Protocole. Suivi incluant un examen clinique, radiographie panoramique et phtographies intra-buccales. *Echantillon et méthodes.* Soixante seize enfants traités au Dental institute de Stockholm entre 1978 et 2001, avec un diagnostic de MIH. La sévérité des défauts de l'émail des molaires et incisives, la prévalence et la distribution des molaires extraites, le type, la qualité, la durée de vie moyenne des restaurations, l'état péri-radiculaire des molaires atteintes, l'occlusion dentaire et la fermeture d'espace après extraction, de même que la satisfaction des patients ont été étudiés.
Résultats. Des défauts sévères avec perte d'émail au niveau des quatre molaires ont été rencontrés chez 42% des individus et 29% avaient au moins une incisive avec une opacité jaune/marron de l'émail. Lors du suivi, 42% des individus avaient au moins une molaire extraite, 18% avaient les quatre molaires extraites. La durée moyenne des restaurations molaires (N = 153) était de 5 ans. Parmi les sujets avec les molaires restaurées, 48% présentaient au moins une restauration non acceptable. Une pathologie périradiculaire a été observée au niveau de trois molaires. Les relations sagittales n'ont pas varié entre les individus avec ou sans extraction de molaires. La fermeture d'espace était acceptable chez 7% des sujets avec molaires extraites. Le traitement a satisfait 80% d'entre eux.
Conclusions. L'extraction des molaires avec défaut sévère de l'émail a donné des résultats bons et acceptables chez une majorité des patients, tandis que les traitements conservateurs de restauration ont entraîné des traitements supplémentaires chez environ la moitié des patients.

Zusammenfassung. *Ziele.* Bestimmung des Behandlungsergebnisses bei Molaren und Inzisiven mit Hypomineralisation (MIH) bei 18jährigen Patienten.
Design. Eine follow-up-Studie unter Einbeziehung von klinischer Untersuchung, Panorama-Röntgenaufnahme und intraoralen Photos.
Stichprobe und Methoden. Sechsundsiebzig Individuen, die am Eastman Dental Institute in Stockholm zwischen 1978–2001 mit der Diagnose MIH behandelt worden waren. Schweregrad der Schmelzdefekte an Molaren und Schneidezähnen, Prävalenz und Verteilung der extrahierten Molaren, Art, Qualität und mediane Haltbarkeit von Restaurationen, apikale Verhältnisse betroffener Molaren, Okklusion und Lückenschluss (im Fall von Extraktionen) sowie die Patientenzufriedenheit mit der Behandlung wurden ermittelt.
Ergebnisse. Schwere Defekte mit Substanzverlust der Schmelzoberfläche bei allen vier Molaren traten bei 42% der Stichprobe auf, 29% wiesen mindestens einen Schneidezahn mit einer gelb/braunen Schmelzopazität auf. Bei der Nachuntersuchung war bei 42% mindestens

ein Molar extrahiert worden, bei 18% waren alle ersten bleibenden Molaren extrahiert. Die mediane Haltbarkeit von Restaurationen (n = 153) an Molaren lag bei 5 Jahren. Unter den Individuen mit restaurierten Molaren wiesen 48% mindestens eine insuffiziente Restauration auf. Apikale Veränderungen lagen bei drei Molaren vor. Die sagittale DiKieferrelation war bei Patienten mit oder ohne Extraktionen nicht unterschiedlich. Ein zufriedenstellender Lückenschluss fand sich bei 7% der Individuen mit Extraktionen. Achzig Prozent waren mit der Behandlung zufrieden. *Schlussfolgerungen*. Extraktionen von Molaren mit Schmelzdefekten ergaben gute oder akzeptable Ergebnisse in einer Mehrzahl von Patienten, die Restauration solcher Molaren erbrachte einen Behandlungsbedarf bei rund der Hälfte der Patienten.

Resumen. *Objetivo*. Valorar el resultado del tratamiento de molares e incisivos hipomineralizados de etiología desconocida (MIH) en jóvenes de 18 años. *Diseño*. Un estudio de seguimiento que incluye el examen clínico, radiografías panorámicas y fotos intra-orales.

Muestra y métodos. Setenta y seis individuos tratados en el instituto Dental Eastman en Estocolmo durante 1978–2001 con el diagnóstico de MIH. Se valoró la severidad de los defectos del esmalte en molares e incisivos, prevalencia y distribución de los molares extraídos, tipo, calidad y duración media de las restauraciones, condición perirradicular de los molares afectados, oclusión dental y cierre de espacios en casos de extracción, así como satisfacción del individuo con el tratamiento.

Resultados. El 42% de los individuos tenía defectos severos de la superficie del esmalte fracturada en los cuatro molares y el 29% tenía al menos un incisivo con opacidad amarillo/marrón en el esmalte. En el seguimiento, el 42% de los individuos tenían al menos un molar extraído; el 18% tenían los cuatro molares extraídos. La duración media de las restauraciones de los molares (N = 153) fue de 5 años. De los individuos con molares restaurados, el 48% tenía al menos una restauración inaceptable. La patología perirradicular se observó en tres molares. No hubo diferencias en las relaciones sagitales entre individuos con o sin extracción de los molares. El cierre de espacio fue aceptable en el 7% de los individuos con los molares extraídos. El 18% estaba satisfecho con el tratamiento.

Conclusiones. La extracción de los molares con defectos del esmalte severos dio resultados buenos o aceptables en la mayoría de pacientes mientras el tratamiento restaurador conservador obligó a considerar un tratamiento adicional en la mitad de los pacientes.

References

1 Koch G, Hallonsten AL, Ludvigsson N, Hansson BO, Holst A, Ullbro C. Epidemiologic study of idiopathic enamel hypomineralization in permanent teeth of Swedish children. *Community Dentistry Oral Epidemiology* 1987; **15**: 279–285.

2 Jälevik B, Klingberg G, Barregard L, Norén JG. The prevalence of demarcated opacities in permanent first molars in a group of Swedish children. *Acta Odontologica Scandinavica* 2001; **59**: 255–260.

3 Leppäniemi A, Lukinmaa PL, Alaluusua S. Nonfluoride hypomineralizations in the permanent first molars and their impact on the treatment need. *Caries Research* 2001; **35**: 36–40.

4 Weerheijm KL, Groen HJ, Beentjes VE, Poorterman JH. Prevalence of cheese molars in eleven-year-old Dutch children. *ASDC Journal of Dentistry Child* 2001; **68** (259–62): 229.

5 Esmark L, Simonsen P. Occurrence of hypomineralized teeth in 7-year-old Danish children. Göteborg, Sweden: 15th Congress of International Association of Paediatric Dentistry, 1995. Report no. Abstract no. 56.

6 Weerheijm KL, Jalevik B, Alaluusua S. Molar-incisor hypomineralisation. *Caries Research* 2001; **35**: 390–391.

7 Alaluusua S, Lukinmaa P-L, Vartiainen T, Partanen M, Torppa J, Tuomisto J. Polychlorinated dibenzo-p-dioxins and dibenzofurans via mother's milk may cause developmental defects in the child's teeth. *Environmental Toxicology and Pharmacology* 1996; **1**: 193–197.

8 Beentjes VE, Weerheijm KL, Groen HJ. [Factors involved in the etiology of hypomineralized first permanent molars]. *Ned Tijdschr Tandheelkd* 2002; **109**: 387–390.

9 Jälevik B, Noren JG. Enamel hypomineralization of permanent first molars: a morphological study and survey of possible aetiological factors. *International Journal of Paediatric Dentistry* 2000; **10**: 278–289.

10 van Amerongen WE, Kreulen CM. Cheese molars: a pilot study of the etiology of hypocalcifications in first permanent molars. *ASDC Journal of Dentistry Child* 1995; **62**: 266–269.

11 Alaluusua S, Lukinmaa PL, Koskimies M, *et al*. Developmental dental defects associated with long breast feeding. *European Journal of Oral Sciences* 1996; **104**: 493–497.

12 Jälevik B, Klingberg GA. Dental treatment, dental fear and behaviour management problems in children with severe enamel hypomineralization of their permanent first molars. *International Journal of Paediatric Dentistry* 2002; **12**: 24–32.

13 Hammarberg U, Malmgren B, Mejàre I, Strömberg U. Idiopathic enamel hypomineralization in permanent teeth. A follow-up study. Göteborg, Sweden: 15th Congress International Association of Paediatric Dentistry, 1995. Report no. Report No102.

14 Weerheijm KL, Duggal M, Mejàre I, *et al*. Judgement criteria for molar incisor hypomineralisation (MIH) in epidemiologic studies: a summary of the European meeting on MIH held in Athens, 2003. *European Journal of Paediatrics Dentistry* 2003; **4**: 110–113.

15 Ryge G. Clinical criteria. *International Dental Journal* 1980; 30: 347–358.
16 Thilander B, Jacobsen S, Skagius S. Orthodontic sequelae of extraction of permanent first molars. A longitudinal study. *Odont Tidskr* 1970; **71**: 380–412.
17 Forsman B. Mineralisation disturbances of a special type. *Tandläkartidningen* 1979; **71**: 1482–1483. [In Swedish]
18 Williams J, Gowans A. Hypomineralised first permanent molars and the orthodontist. *European Journal of Paediatrics Dentistry* 2003; **4**: 129–132.
19 Mjör IA, Dahl JE, Moorhead JE. Age of restorations at replacement in permanent teeth in general dental practice. *Acta Odontologica Scandinavica* 2000; **58**: 97–101.