Clinical Update

Distribution and severity of molar hypomineralisation: trial of a new severity index.

Oliver K, Messer LB, Manton DJ, Kan K, Ng F, Olsen C, Sheahan J, Silva M, Chawla N.
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INTRODUCTION

Molar hypomineralisation (MH) represents a lower than normal mineral content within the enamel of affected molars. Children may have one or more first permanent molars affected and the condition can range in its extent and severity. Clinically, such molars present with well-defined white, yellow or brown opacities often on cusp tips and may show post-eruptive breakdown of enamel following tooth eruption. They may suffer sensitivity to temperature or tooth brushing and are more prone to developing caries. Such teeth can present significant challenges as they are not only more prone to developing disease, but can also be more difficult to anaesthetise and show more frequent failure of restorations. Where permanent incisors are concurrently affected, the condition is referred to as molar incisor hypomineralisation (MIH).

Current treatment planning for hypomineralised molars is based largely on an individual clinician's judgment. The present study aimed to assess characteristics of teeth affected by hypomineralisation and to score them in a Molar Hypomineralisation Severity Index (MHSI). Specialist treatment provided for each tooth and dentition was then compared to scores in this index to assess the index's value in predicting treatment and in guiding future treatment decisions.

MATERIALS AND METHODS

Included in this study were 283 patients, all having at least one molar with hypomineralised enamel. Patients included had to have at least three first permanent molars erupted and were between the age of 5 and 18 years of age at the beginning of the study. Teeth were deemed to be hypomineralised if they showed demarcated opacities, atypical restorations or had been extracted in the presence of other hypomineralised molars. The patients were seen in one of four different specialist private practices in Melbourne.

The children were classified as having:

Molar hypomineralisation (MH) – one or more first permanent molars affected but no affected permanent incisors.

Molar incisor hypomineralisation (MIH) – one or more first permanent molars affected AND one or more affected permanent incisors.

Provisional hypomineralisation (MH*) - one or more first permanent molars affected and no affected permanent incisors BUT at least one permanent incisor was still unerupted.

Children each saw one of the specialists for a baseline examination and had each hypomineralised tooth scored in the index according to the characteristics below:

- Eruption status:
  - Unerupted = 0
  - Erupted = 1
- Colour of most severe defect:
  - None = 0
  - White/cream = 1
  - Yellow = 2
  - Brown = 3
- Location of most severe defect:
  - None = 0
  - Smooth surface = 1
  - Occlusal surface (molars) = 2
  - Incisal edge (incisors) = 2
  - Cuspal involvement (molars) = 3
- Restorations placed prior to study:
  - None = 0
  - One = 1
  - Two = 2
- Atypical restorations prior to study:
  - None = 0
  - Present = 1
- Post eruptive enamel breakdown:
  - None = 0
  - Present = 1
- Sensitive to temperature (child report):
  - None = 0
  - Present = 1
- Sensitive to brushing (child report):
  - None = 0
  - Present = 1

Unaffected teeth received a score of 1, whilst teeth affected by hypomineralisation were scored from 3 to 13 (as above). Teeth with stainless steel crowns (SSC) were given a score of 10, whilst extracted teeth scored 12. Summed dentition scores were also compiled and ranged from 5 to 52. These scores included molars only and affected incisors were excluded.

Following the initial baseline assessment, children received treatment based on their needs as determined by the specialist paediatric dentist. Dentists made treatment planning decisions based on their own experience and knowledge and were asked not to directly consider the MHSI in order to allow independent comparison on the MHSI with treatments provided. Recall times for patients were individualised. Treatments completed between the initial assessment and the recall were recorded. A logistic regression model was used to assess the value of hypomineralisation characteristics in predicting treatments.

RESULTS

Of the 283 children included in this study, 152 (54%) were seen at recall and had data recorded. Children in this group are referred to as the treatment subset. Overall, around two thirds of children (68%) were diagnosed with MIH, which was more common than

a diagnosis of MH or MH*. In both the study population and the treatment subset, 81% of first permanent molars were affected by hypomineralisation. Affected teeth showed no predilection for any particular arch or quadrant. Distribution of hypomineralisation characteristics in the first permanent molars is outlined in the table below:

Although a high number (68%) of children were diagnosed with MIH, when all permanent incisors were assessed only 26% showed hypomineralisation defects. This represented 451 of the 1718 permanent incisors assessed. Central incisors were the most commonly affected, with maxillary central incisors being the most frequent of these. Post-eruptive breakdown, sensitivity and restorations were all much less common in the incisors than in first permanent molars and most visual defects noted were white in colour.

Molar Characteristic	At Study Entry	Treatment Subset
Total number of molars	1124	604
Hypomineralised molars	**908 (81%)**	**491 (81%)**
Prior extraction	58 (6%)	45 (9%)
Prior Stainless Steel Crown	41 (4%)	29 (6%)
Prior atypical restoration	230 (25%)	109 (22%)
One prior restoration	275 (30%)	129 (26%)
Two or more prior restorations	47 (5%)	31 (6%)
Defects Visible	**805 (89%)**	**414 (84%)**
Brown defect colour	379 (47%)	153 (37%)
Yellow defect colour	291 (36%)	184 (44%)
White defect colour	135 (17%)	77 (19%)
Cuspal defect location	599 (74%)	318 (77%)
Occlusal defect location	99 (12%)	42 (10%)
Smooth surface defect location	107 (13%)	54 (13%)
Post eruptive breakdown	386 (48%)	188 (48%)
Presence of sensitivity	181 (22%)	84 (20%)

Treatment was performed in the dental chair for 51% of children with the remaining 49% receiving treatment under general anaesthesia. The 417 affected first permanent molars in the treatment subset received a total of 572 treatment interventions, which was five times more than that completed in molars unaffected by hypomineralisation (unaffected molars MHSI = 1). Treatment is summarized in the table (right) according to MHSI scores:

Summed MHSI scores were compiled for each dentition, ranging from scores of 5 to 52. Permanent incisors were not included in these summed scores. As MHSI dentition scores increased, the frequency of children with at least one extracted first molar increased and all first molars were extracted for patients with scores in the range of 45-52. Increasing MHSI dentition scores were associated with decreased fissure sealant use, with dentitions scoring a low score (5-12) receiving at least one fissure sealant in 93% of cases.

A logistic regression analysis was performed in order to assess the predictive value that hypomineralisation characteristics might have for treatment provided. The full model made use of six characteristics (colour, location, post-eruptive breakdown, sensitivity, prior restorations and atypical restorations) and was predictive for all treatments provided (remineralisation, fissure sealants, interim GIC, adhesive restoration and extraction). Treatment with SS crowns or amalgam showed insufficient frequencies to be included in the analysis.

DISCUSSION

This study was completed within several different specialist paediatric dentistry practices in Melbourne. Most children included were new patients who had been referred to the practices as a result of having teeth affected by hypomineralisation. Treatment of children with molar hypomineralisation (and the related molar incisor hypomineralisation) can be challenging for several reasons, including susceptibility to sensitivity, post-eruptive breakdown, caries and repeated loss of restorations. Assessing the severity of hypomineralised teeth can require a multi-faceted approach. The MHSI used in this study aims to create an objective way to assess the severity of affected teeth and hence to guide treatment planning decisions.

At both the baseline examination and in the treatment subset presenting for recall, 81% of first permanent molars were affected with hypomineralisation. This is a high number but is in a population of children who have already been diagnosed with MH (or MIH), which was a prerequisite for inclusion in this study. Hypomineralisation defects were most often brown or yellow in colour and were most often located in cuspal areas. Post-eruptive breakdown of enamel was noted in almost half (48%) of cases.

The restorative burden was significantly greater in hypomineralised first molars compared with unaffected molars. Not only was there a five-fold increase in the number of treatments provided for affected molars but such treatments were more commonly restorative in nature. Conversely, unaffected teeth or teeth with lower MHSI scores were more likely to receive preventive treatments such as fissure sealants. This is in line with previous studies showing that restorations are more commonly required for hypomineralised teeth and that such restorations may be more likely to fail and require replacement.

The MHSI was developed to address deficiencies in indices concerning hypomineralisation severity. Logistic regression showed that all six characteristics (colour, location, post-eruptive breakdown, sensitivity, prior restorations and atypical restorations) were predictive of treatment received by affected FPMs, thereby validating the use of these characteristics. Some levels within the characteristics were also predictive for treatment. Having an index with predictive value can be a useful tool in treatment planning for hypomineralised teeth. There may

MHSI Score	1		3-4	5-6	7-8	9-10	11-13	Total affected	p
Number of teeth	113		44	108	150	96	19	417	
Remineralisation	11		12	14	22	28	5	81	0.006
Fissure sealant	76		34	59	53	24	3	173	0.0001
Interim GIC	6		3	9	42	30	6	90	0.0001
Adhesive restore	8		10	18	61	42	13	144	0.0001
SS crown	2		1	0	1	3	1	6	N/A
Amalgam	0		0	0	1	1	0	2	N/A
Extraction	4		0	8	34	31	3	76	0.0001
Total treatments	107		60	108	214	159	31	572	

be distinct advantages to assessing the severity of affected teeth as early as possible and being able to make definitive treatment planning decisions early in life.

The authors suggest that MHSI scores for a tooth and for a dentition as a whole may be able to guide treatment and make recommendations as such within the article. It is acknowledged that longer term follow-up of patients would be desirable and that further study is required in this area.

CONCLUSION

Children in this study showed a wide range of hypomineralisation defects in term of defect severity and number of teeth affected. Individual teeth and dentitions were scored with the MHSI, which was found to be predictive for treatment provided. This index may serve as a tool to guide clinical decision-making in cases of molar hypomineralisation.

ADAVB in Action - Continued from page 4

notice in the Victorian Government Gazette on 19 August 2015 - refer to page 21 - what to do leading up to the public holiday) and Easter Sunday being made a public holiday. In a submission to the Victorian Government, ADAVB says that the additional holidays would result in a significant economic cost to dental practices as well as impacting on public access to dental care. The Branch recommends that the current public holiday schedule be maintained with no further public holidays introduced.

ADAVB wrote to State Health Minister Ms Jill Hennessy urging the Victorian Government to press the Federal Government for more funding for public dental services. The National Partnership Agreement on Adult Public Dental Services that was supposed to provide Victoria $220 million over three years, was cut in the recent Federal Budget to just $38.5 million for one year only. During Dental Health Week, the State confirmed that it was investing $207 million in public dental services this financial year.

The Branch commented on a consultation paper which canvassed a number of key issues requiring attention in Victorian legislation. This included the definition of 'health service'. See the CEO's column on page 5.

As stated in the President's column, August was a particularly busy time with the Association promoting oral health. The media was very helpful embracing the key themes of Dental Health Week - sports drinks and mouthguard protection.

Clinical Update Review – SEPTEMBER 2015

Completion and return of this questionnaire with 9 correct answers will gain 1 scientific CPD hour towards satisfying Dental Board of Australia requirements. This is an ADAVB members only service. An administration fee of $11 (GST inclusive) applies. Circle the correct response on this form (or a photocopy) and return it with payment to: CPD Coordinator, ADAVB, PO Box 9015, South Yarra, Victoria 3141 - Submit by 30 September.

Or submit your answers online AT NO COST at www.adavb.net

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Answers to last issue's Clinical Update (AUGUST 2015)
1 A, 2 C, 3 B, 4 TRUE, 5 C, 6 A, 7 C, 8 FALSE, 9 D, 10 B

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Questions

1. ***Within the classification of this study, a child presenting with three hypomineralised first permanent molars and one hypomineralised permanent incisor would be diagnosed with:***
   a. Molar hypomineralisation (MH)
   b. Molar incisor hypomineralisation (MIH)
   c. Provisional molar hypomineralisation (MH*)
   d. Amelogenesis imperfecta

2. ***Molar hypomineralisation involves:***
   a. A reduction in the organic protein content in affected enamel
   b. An increase in translucency in affected enamel
   c. A reduction in mineral content in affected enamel
   d. The absence of enamel on affected teeth

3. ***Patients in this study were examined and treated in:***
   a. A university environment
   b. Private general dental practices
   c. Private specialist dental practices
   d. A combination of general and specialist practices

4. ***What MHSI score would an unrestored first permanent molar with a yellow hypomineralisation defect located on a cusp receive, assuming there is no post-eruptive breakdown or sensitivity?***
   a. 5
   b. 6
   c. 7
   d. 8

5. ***What MHSI score would an unrestored first permanent molar with a brown hypomineralisation defect located on the occlusal surface receive, assuming there is some post-eruptive breakdown but no sensitivity?***
   a. 5
   b. 7
   c. 9
   d. 11

6. ***TRUE or FALSE?***
   The clinicians in this study had treatments for each tooth dictated to them by the results of the initial MHSI score.

7. ***Which of the following statements is true?***
   a. At the baseline examination, 1124 hypomineralised molars were recorded
   b. At the baseline examination, 604 hypomineralised molars were recorded
   c. In the treatment subset, 604 hypomineralised molars were recorded
   d. In the treatment subset, 491 hypomineralised molars were recorded

8. ***Most children included in this study:***
   a. Had a diagnosis of molar incisor hypomineralisation (MIH)
   b. Had a diagnosis of molar hypomineralisation (MH)
   c. Had a diagnosis of provisional molar hypomineralisation (MH*)
   d. Had molars free from hypomineralisation

9. ***Which of the following was not a hypomineralisation characteristic considered in the logistic regression model?***
   a. Colour of hypomineralisation defect
   b. Presence of post eruptive breakdown
   c. Prior restorations
   d. Size of hypomineralisation defect

10. ***TRUE or FALSE?***
    The MHSI showed predictive value for treatment provided and may be used to guide treatment planning decisions.