RESEARCH ARTICLE

Changes in oral health-related quality of life after treatment of molar incisor hypomineralisation using Glass Hybrid Restorations

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Abstract

Objective: To assess the changes in children's oral health-related quality of life following the treatment of severely affected molar-incisor hypomineralisation with Glass Hybrid Restorative System (GH) after selective caries removal.

Method: The observational cross-sectional study was conducted at the Marmara University, School of Dentistry, Department of Pediatric Dentistry, Istanbul, Turkey.. Children aged 11-14 years (n = 55) who were diagnosed with MIH and had finished their dental treatment from November 2018 to December 2019, were included. The children's MIH-affected teeth were treated with GH after SCR. Participants answered the Child Perceptions Questionnaire (CPQ11?14) prior to their dental treatment and 6 months after the treatment.

Results: Of the fifty-five patients, 40 patients (24 girls-16 boys) completed baseline and follow-up data. The mean age of the children was 11.85 ±1.02 years. The overall CPQ score ranged from 3-83 (average 33.27 ± 16.46) at baseline and 0-61 (average 11.67 ± 11.21) at follow up. The emotional well-being among children was the highest score at baseline. A significant decrease ($p < 0.001$) in the mean values was observed for both the overall CPQ scores and for the scores of the oral symptoms, functional limitations, and social-emotional well-being limitation. All subdomains showed large effect sizes and oral symptom limitation domain presented the greatest effect. Wilcoxon Rank test was used to determine the statistical significance of the changes and the magnitude of change was determined by calculating and classifying the effect size.

Conclusion: Restorative treatment with GH following selective caries removal positively influenced the oral health-related quality of life of children with severe molar-incisor hypomineralisation.

Keywords: Health-related quality of life, Dental enamel hypoplasia, Questionnaires, Child, Oral health.

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Introduction

Molar incisor hypomineralisation (MIH) is a developmental dental defect that is common in childhood and causes both aesthetic and functional deficiencies.[1] Recent reports show that 13-14% of children are affected by MIH globally.[2,3] This structural enamel defect affects at least one first permanent molar in children, causing post-eruptive breakdown and a variety of dental problems, such as hypersensitivity, rapid development of atypical carious lesions, insufficient local anaesthesia during treatment, and the need for recurrent dental treatment.[4,5] Such dental problems disrupt children's daily lives, resulting in negative social and aesthetic consequences in addition to dental pain.[4,6]

The extent and depth of the defect, the age of the child, and their cooperation are the main factors in planning dental restoration of atypical cavitated carious lesions in MIH molars.[7,8] Numerous studies have shown that selective partial caries removal in vital teeth with deep caries lesions is more beneficial than non-selective complete caries removal, particularly in cases close to the pulp.[9] Based on this evidence, selective caries removal (SCR) is becoming a popular and preferred method for MIH teeth. SCR is based on the principles of arresting the lesion by sealing active caries activity with a good restoration, and preventing caries progression by isolating the bacteria from the substrate. The technique consists of removal of all proximal caries until the hard dentine is felt, and soft and leathery dentin is left on the cavity walls over the pulp. Thus, the risk of pulp exposure is significantly reduced, especially in paediatric patients, and more complicated treatments, such as root canal treatment, are prevented.[9,10]

Oral health and dental therapy can have an impact on how one speaks, eats and looks as well as on the overall quality of life (QOL), which is a multidimensional concept. As a result, there has been an increased clinical emphasis on assessing QOL as a supplement to assessing oral health needs, prioritising care, and evaluating treatment strategy outcomes.[11] One of these scales, the Child Perception Questionnaire for children aged 11-14 years (CPQ_{11-14}), was developed[12] to assess the oral health QOL (OHRQOL) of children in that age bracket with various

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oral and orofacial disorders.[12] The impact of oral and orofacial problems in children is assessed on symptomatic, functional, emotional and social levels in all versions of the questionnaire.[13] The Turkish version of CPQ_{11-14} has also been cross-culturally adapted and validated.[14]

Although studies have evaluated the relationship between MIH and OHRQOL, there is scarce information on how dental treatment could help to improve the MIH-affected childrens' OHRQOL.[15-17] Therefore, the current study aimed to determine how treating severe MIH teeth with glass hybrid restorations (GH) following SCR affected children's OHRQoL as measured by the Turkish version of the CPQ questionnaire, as well as any differences in OHRQoL before and after treatment according to gender. The study's hypothesis was that treating MIH-affected molars with GH after SCR improved these children's OHRQoL, with gender differences in QHRLQoL.

Subjects and Methods

The observational cross-sectional study was conducted at the Marmara University, School of Dentistry, Department of Pediatric Dentistry, Istanbul, Turkey. Children aged 11-14 years (n = 55) who were diagnosed with MIH and had finished their dental treatment from November 2018 to December 2019 were included. The study protocol was reviewed and approved by The Marmara University's Research Ethics Committee (Protocol number 2016-43). Children, the parents or guardians were informed verbally and signed a written informed consent form to participate in the study. The reporting of this study is according to the STROBE checklist.[18]

Children who received a diagnosis of specified MIH lesions were observed prior and 6 months after treatment The modified European Academy of Paediatric Dentistry criteria[19] and the MIH treatment need index (TNI) were used to define MIH.[20] The following inclusion criteria were applied: (1) a fully erupted MIH (in occlusion = B code)[19] with cavitation without hypersensitivity, pain or signs of pulp necrosis (MIH TNI 2a-c)[20] (2) treatment under local or no anaesthetic was expected; (3) children able to read and write in Turkish.

Clinical cases with other types of enamel defects (e.g., moderate/severe dental fluorosis, amelogenesis imperfecta, enamel hypoplasia, enamel tooth malformation linked to syndromes), any dental or facial anomaly other than MIH (e.g., hypodontia, cleft lip and palate), or learning disabilities, or none dental experience were excluded from the study.

GH restorations after SCR were performed by a paediatric dentist with 10 years of clinical experience. Using a low-speed rosehead bur, caries was removed from the cavity's lateral walls. SCR on the pulpo-axial walls was preferred, with no need for local anaesthesia, using a sharp spoon, double-ended excavator until leathery or firm dentin (resistant to hand excavator) was reached. The final cavity was washed with water spray and gently dried. GH (Equia Forte, GC, Tokyo, Japan) was used for the restoration according to the manufacturers' instructions and the coat applied on the restoration surface.

Sample size calculation was performed to focus on the effect of treatment on OHRQoL. Based on previous studies,[15,17] the power calculation indicated that at least 40 samples were required to compensate for a 20% drop-out rate at the 5% significance level and 80% statistical power.

Data Collection: Turkish version of the CPQ_{11-14}, which consists of 37 general questions spread over 4 OHRQOL dimensions: oral symptoms (6), functional limitations (9), emotional wellbeing (9) and social wellbeing (13).[14] In the Turkish version of the CPQ, the children are asked about the frequency of experiences and emotions experienced due to their teeth, lips and jaws during the preceding 3 months. Each question is answered on a 5-point Likert scale, with options ranging from 0 = never to 4 = every day/almost every day. The total CPQ_{11-14} score is calculated by summing up the scores of all the 37 items, and ranges 0-148. Higher scores reflect a more negative OHRQOL. This questionnaire was answered by children prior to their dental treatment and 6 months after the completion of the treatment when they booked for a recall examination.

The CPQ_{11-14} was administered by two trained examiners in the waiting area of the dental clinic to assist the participants in completing the questionnaire. All participants took a maximum of 10 minutes to complete the questionnaire.

With the pre-treatment questionnaire application, we intended to learn the impact of MIH on everyday life activities and emotions of children. Children were recalled six months after treatment and instructed to reflect on post-treatment changes while completing the CPQ_{11-14}.

Impact on OHRQoL represented by the total CPQ score was the dependent variable. Gender, pre-treatment, and post-treatment were the independent variables.

Data Analysis: Statistical Package for Social Sciences version 22.0 for Windows was utilized for data

processing and statistical analysis (SPSS Inc., Chicago, IL, USA). The outcome variables were overall CPQ scores and scores for the subdomains. These were applied as count variables. Wilcoxon Rank test was used to determine the statistical significance of the changes and the magnitude of change was determined by calculating and classifying the effect size. Partial Eta Squared (ηp2) was used to calculate effect size. Suggested norms for partial eta-squared are: small = 0.01; medium = 0.06; large = 0.14.

Results

Sixty children with MIH invited to participate in this study between November 2018 and December 2019. Five of these excluded because they did not answer the questionnaires. The remaining 55 children with MIH agreed to take part in the study. The pre-treatment survey included responses from these 55 patients, but there was a drop-out of 15 cases as the patient did not have a follow-up appointment, the primary caregiver declined to complete the post-treatment survey or did not attend the appointment. Therefore, a total of forty children were included in the study, 24 girls and 16 boys (Figure-1).

Table-1: Patient characteristics (n = 40).

n (%)	Mean ±SD
Age	
Girls n=24 (60%)	11.79 ±1.06
Boys n=16 (40%)	11.93 ±0.99
Age (years)	
11-12	11.33±0.48
n=30 (75%)	
13-14	13.4 ± 0.52
n=10 (25%)	
Total	11.85 ±1.02
n: 40	
DMF-T	
Boys	3.56 ± 1.02
Girls	3.75 ± 1.45
Total	3.6 ± 1.22

SD: Standard deviation, DMF-T: Decayed, missing and filled teeth.

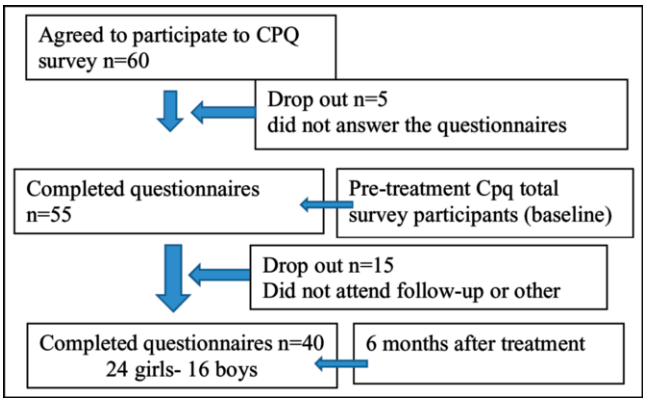

Figure-1: Flowchart of the recruitment, inclusion and drop-out at follow-up of participants.

Table-2: Mean values of total CPQ11-14 scores and subscales at baseline and 6 months after treatment (n = 40).

CPQ11-14	Baseline Mean (SD)	Follow-up Mean (SD)	Difference Mean (SD)	Effect size (ES)**	p-value
Oral symptoms	9.20± 4.24	3.52± 2.82	5.67±3.73	0,70	0,001*
Functional limitation	7.20± 5.03	3.35± 2.79	3.85±3.95	0,49	0,001*
Emotional well-being	11.87± 8.73	3.18± 5.87	8.70±7.47	0,58	0,001*
Social well-being	5.00± 6.00	1.62± 4.05	3.37±4.28	0,39	0,001*
Overall CPQ11-14	33.27± 16.46	11.67± 11.21	21.6±12.44	0,76	0,001*

*p<0.05, Wilcoxon rank testi
** Partial Eta Squared (ηp2)
SD: Standard deviation, CPQ11-14: Child perceptions questionnaire for children aged 11-14 years.

Table-3: Baseline and follow-up CPQ11-14 scores according to gender.

	Oral Symptoms	Functional Limitation	Emotional Well-being	Social Well-being	Overall CPQ11-14
Girls (n=24)					
Baseline score	8.58±3.65	6.38±4.91	11.5±8.95	4.87±6.87	31.33±17.45
Follow-up scores	3.75±3.04	3.25±2.95	3.38±6.35	2.13±5.11	12.5±13.09
p-value	0,001*‡	0,001*‡	0,001*‡	0,002*‡	0,001*‡
Boys (n=16)					
Baseline scores	10.12±4.97	8.43±5.11	12.44±8.65	5.19±4.66	36.19±14.92
Follow-up scores	3.18±2.53	3.5±2.63	2.88±5.26	0.88±1.31	10.44±7.85
p-value	0,001*†	0,001*†	0,001*‡	0,002*	0,001*†

*p<0,05
†Paired t test
‡Wilcoxon rank test
CPQ11-14: Child Perceptions Questionnaire for children aged 11-14 years.

The mean age of the examined children was 11.85 (± 1.02) years, ranging from 11 to 14 years of age. A total of 86 teeth were treated, all of which had a similar MIH severity (B code; MIH TNI 2a-c). The mean number of DMF-T in total was 3.6±1.22. Table-1 shows the characteristics of the children.

Data on the before treatment and following treatment at 6 months period OHRQoL scores, as well as differences in scores with effect sizes, are presented in Table-2. The overall CPQ score ranged from 3-83 (average 33.27±16.46) at baseline and 0-61 (average 11.67±11.21) at follow up. The means values of overall CPQ score and its subscale scores show significant reductions after treatment (p<0.001) with effect sizes indicating large changes. The largest effect size was observed in the oral symptoms subscale with an average of 0.70.

All children (100%, 40) reported an improvement in their

Table-4: Time-related changes between baseline and follow-up CPQ11-14 scores according to gender.

		Baseline Mean±SD	Follow-up Mean±SD	Gender p
Oral Symptoms	Boys	10.12±4.97	3.18±2.53	0,629
	Girls	8.58±3.65	3.75±3.04	
	Time p		0,001*	0,080†
Functional Limitation	Boys	8.43±5.11	3.5±2.63	0,320
	Girls	6.38±4.91	3.25±2.95	
	Time p		0,001*	0,159†
Emotional Well-being	Boys	12.44±8.65	2.88±5.26	0,918
	Girls	11.5±8.95	3.38±6.35	
	Time p		0,001*	0,558†
Social Well-being	Boys	5.19±4.66	0.88±1.31	0,264
	Girls	4.87±6.87	2.13±5.11	
	Time p		0,001*	0,760†
Overall CPQ_{11-14}	Boys	36.19±14.92	10.44±7.85	0,737
	Girls	31.33±17.45	12.5±13.09	
	Time p		0,655	0,085†

*p<0,05, two way repeated measures analysis of variance (ANOVA).
†gender and time interaction.
SD: Standard deviation, CPQ_{11-14}: Child Perceptions Questionnaire for children aged 11-14 years.

OHRQoL after treatments on the over-all CPQ scores. No changes in scores were observed in only 3 children (7.5 %) for oral symptoms, in 4 children (10%) for functional limitation, in 4 children (10%) for emotional well-being, and in 9 children (22%) for social well-being.

At baseline, boys and girls had similar overall and subscale domain scores on the CPQ questionnaires (oral symptoms, functional limitations, emotional limitations, and social well-being). The mean values of both the overall CPQ score and the subscale scores showed significant reductions after treatment in both genders ($p < 0.05$) (Table-3). There was no time-gender interaction in overall CPQ score and the subscale scores (p<0,05) (Table-4).

Discussion

It is critical to assess the impact of MIH, which has emerged as a major public health issue affecting children's OHRQOL. This evaluation helps to determine the needs perceived by the patient in the early stages of the disease and to develop preventive dentistry policy and practices. The negative effect of MIH on children's OHRQOL had been demonstrated in some previous studies.[4,15-17] However, clinical-based studies are rare.[15,21-23] To the best of our knowledge, the current study is the first to investigate the potential relationship between OHRQOL and treatment using SCR technique of first permanent molars with MIH in Turkish children using the Turkish version of the CPQ_{11-14}.

Teeth affected by MIH may be hypersensitive to thermal and mechanical stimuli during dental treatments. Furthermore, teeth that have been severely affected by MIH are more prone to restoration failure and repeated treatments.[7,8] This combination may have an impact on these children's QOL and increase their risk of developing behaviour management issues. When compared to conventional caries removal, the advantages of SCR-GH in clinical practice, particularly in public dental clinics, are its ease of administration, shorter procedure time, and better handling of behavioural problems in MIH.[10] In 2015, a newer class of restorative materials,[24,25] the Glass hybrid restorative system was launched and showed to be a reliable treatment option for MIH affected teeth.[26]

In our study, we observed that treating hypomineralised molars improved children's OHRQOL overall. Despite the fact that all domains had large effect sizes, the oral symptoms subscale showed the greatest improvement, with an effect size of 0.70. The subscale asked about symptoms, such as pain, bad breath and food impaction. Children may experience symptoms, such as pain, bad breath, food impaction, and subsequent atypical caries due to the hypomineralised structure of the enamel of MIH-affected first permanent molars. Aside from caries, the post-enamel breakdown areas create a surface suitable for dental plaque, and dental plaque accumulation increases due to ineffective brushing due to sensitivity. Dental plaque can foster the development of caries as well as cause bad breath and bleeding gums in children. It is encouraging to see the highest effect due to the reduction of symptoms in this subscale after the treatment of dental caries, and it shows the success of the treatment from the children's point of view.

The social wellbeing subscale asks about the effects of children's oral and dental health on school activities and their relationships with peers. Previous research found that children with opacities in their permanent incisors due to MIH experienced aesthetic concerns and were teased by their peers. These aesthetic concerns caused consequences, such as shyness, lack of self-confidence and avoiding smiling. Hasmun et al.[21] stated that after minimally invasive treatment of opacities in permanent incisors, QOL scores increased significantly, and the greatest improvement was in the social-emotional wellbeing subscale depending on the improvement of aesthetics. But in the current study, social and emotional wellbeing subscales had a lower effect size than other domains. This can be explained by not taking into consideration any aesthetic

approach regarding opacities in the permanent incisors.

Dantas-Neta et al.[4] stated that girls had higher CPQ scores in oral health and functional limitations subscales than boys; thus, MIH affected girls' OHRQOL more than boys'. Similar studies from Mexico and Colombia found that girls with MIH had poorer OHRQOL than boys.[15,16] This difference observed between genders in the past studies might be because females are more concerned about their appearance and what others think about them compared to males. On the other hand, Hasmun et al.[21] reported that their investigation did not reveal any significant gender differences in reported OHRQoL, either before or after aesthetic treatment. In parallel with that study, in the current study, no gender difference was observed between the baseline and post-treatment scores. The colour and size of opacities present in the permanent incisors of children may affect social and emotional subscale scores and can lead to different results in OHRQOL than expected. For this reason, the classification of opacities in future studies may also be useful in evaluating gender-based differences.

However, the results of this study, should be analyzed with caution because of the size of the sample and short follow-up time. In our study, noteworthy improvements were observed in the total and all subscale mean scores of the CPQ scale after treatment which enable clinicians to assess the quality and success of their treatment from the patient's point of view. Also, the OHRQoL of children was measured 6 months following the dental treatment, and it is possible that the results found could be different at different time points. Even so, this result shows us that the responsiveness of the Turkish version of the CPQ to treatment in the MIH patient group is satisfactory. Further OHRQoL analysis with various treatment techniques should be determined to gain a better understanding of how to improve the daily lives of MIH-affected children.

Conclusion

Treating MIH-affected molars with Glass Hybrid restorations after SCR improved these children's OHRQoL with no gender differences in QHRLQoL. The CPQ_{11-14} demonstrated responsiveness to treatment in children with MIH. The results of this study can be used to encourage interventions on oral health in this special group.

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