A Clinical Evaluation of Deproteinization and Different Cavity Designs on Resin Restoration Performance in MIH-Affected Molars: Two-Year Results

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Background: *The aim of this study was to evaluate the clinical effects of deproteinization of the hypomineralized enamel and different cavity designs on the performance of the composite resin restorations(CRRs) placed into the cavities of MIH (molar incisor hypomineralization)-affected molars.* ***Study design:*** *95 MIH-affected permanent first molars (PFMs) and 31 caries but not MIH- affected PFMs (126 teeth in total) were included in the study. The MIH-affected molars were divided into three groups. In Group I, all hypomineralized tissue was removed until healthy enamel was reached. In Group II, carious and cheesy hypomineralized tissue was removed until a reasonable resistance was detected in the hypomineralized tissue. In Group III, cavities designed as Group II, differently from this group deproteinization of the left hypomineralized tissue was performed prior to the placement of CRRs. Group IV served as the control group consisting of unaffected carious PFMs. Restorations were evaluated according to modified USPHS criteria for 24 months.* ***Results:*** *The retention rates were 93.7% for Group I, 80.7% for Group II, 93.5% for Group III and 100% for Group IV. The success rate for the restorations in Group II proved significantly lower (p<0.05) than that of the other three groups. No significant difference in success rates was observed between Group I, Group III and Group IV (p>0.05) at the end of 24 months.* ***Conclusions:*** *Failure of the restorations was predominant in the group that the hypomineralized tissue was left surrounding the cavities.* ***.*** *Deproteinization of the hypomineralized enamel was found to enhance the retention rates of CRRs.*

Key words: *Molar Incisor Hypomineralization, composite resin restoration, , deproteinization.*

INTRODUCTION

Weerheijm *et al* [1] introduced the term 'molar incisor hypomineralization' (MIH) to define the developmental enamel defects of permanent first molars (PFMs) and permanent incisors produced by insufficient mineralization and maturation. Studies from various countries have demonstrated a wide prevalence (2.5-40%) of MIH in children [1-4]. The etiology of MIH is unknown; however, contributing factors that damage ameloblast function include prenatal, perinatal and neonatal problems, childhood illnesses and environmental factors [5, 6] . The severity of the demarcated lesions varies greatly, from mildly affected creamy white to severely affected brown defects. Severely affected hypomineralized enamel is porous, cannot withstand the force of mastication and frequently undergoes post-eruptive breakdown, ultimately leading to unprotected dentin in young children. From then on, rapid caries development is inevitable, as hypersensitivity prevents tooth brushing and the removal of food and plaque from retentive areas [5,6]. The treatment of hypomineralized molars is complex for clinicians. An *in vitro* study [7] has shown that the microshear bond strength of resin to hypomineralized porous enamel is weaker than for normal enamel. Both the occurrence of secondary caries resulting from problems in bonding composite resin restorations (CRRs) and the breakdown of enamel adjacent to restorations, which necessitates further restoration, eventually lead to the loss of tooth structure. It has also been reported [8-10] that affected children require more than 3 times the re-treatment compared to unaffected group. A retrospective Swedish study demonstrated that by age 9, MIH-affected PFMs underwent treatment 10 times more frequently than unaffected molars; moreover, each defective molar was treated twice because of restoration failure or recurrent caries [11].

There are limited studies regarding bonding to hypomineralized enamel. A few of these [12, 13] noted that 5% sodium hypochlorite enhanced the bonding of resins to enamel with hypocalcified amelogenesis imperfecta. Mathu-Muju and Wright [14] suggested

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that a pre-treatment application of 5% sodium hypochlorite to MIH-affected enamel may remove the surface enamel proteins, thus enhancing etching patterns created by 35% phosphoric acid; however, no clinical or laboratory study has been conducted to support this claim.

The cavity patterns of defective teeth are also controversial, and two approaches have been proposed for determining cavity margins of MIH-affected teeth. Lygidakis *et al* [8] and Fayle [15] recommended removing the soft, porous enamel surrounding cavity margins until resistance of the bur is felt against the hypomineralized enamel, whereas William *et al* [7] and Mathu-Maju and Wright [14] suggested removal of the defective enamel in its entirety, leaving cavity margins ending in sound enamel, to improve the retention of resin restorations. It has also been suggested that CRRs be bonded to MIH-affected enamel using a self-etching primer adhesive [7].

Based on the above considerations, the aim of this study was to evaluate the clinical performance of CRRs in MIH-affected molars; placed into cavities prepared invasively or noninvasively and deproteinization of affected enamel.

MATERIALS AND METHOD

A total of 70 MIH-affected children aged 8-12 from among 685 patients attending the pediatric dentistry clinic in a 6-months period were assessed for eligibility in the study. MIH diagnosis was based upon the criteria proposed by the European Academy of Pediatric Dentistry (EAPD)[16]. Children with 1 to 4 PFMs with demarcated hypomineralized defects associated with incisors were accepted as MIH affected.

1 to 4 PFMs of 53 MIH-affected children were suffering from caries. The inclusion criteria were as follows: (a) MIH-affected PFMs requiring two surfaced restorations because of atypical cavities and post-eruptive breakdown associated with caries, (b) Possibility of restoration, (c) No pulpal or periradicular infection, (d) The decision to preserve the teeth after orthodontic consultation, (e) Cream or yellowish colored hypomineralized enamel near the cavity margins or a restricted defect on one of the undisturbed cusp, on buccal or palatal surface, (f) Normal occlusal and contact relationships with the opposite and adjacent teeth.

Based on these criteria; a total of 95 MIH-affected PFMs from 30 children (mean age: 8.88) were included in the experimental groups. In addition; 31 non MIH- affected PFMs with caries requiring two surfaced restorations from 12 children were included as the control group. Following approval from the Dental Faculty's Ethics Committee (No.163, 22.01.2008), informed consent forms were signed by the children's parents.

All dental procedures were performed under local anesthesia by the same pediatric dentist.

The cavities of the MIH effected PFMs were designed in two forms:

- Cavity Form I (invasive treatment): Soft carious tissue and surrounding hypomineralized enamel were removed until cavity margins ended in sound enamel.
- Cavity Form II (noninvasive treatment): Soft carious tissue and porous enamel surrounding cavity margins were removed until the bur met with significant resistance from the hypomineralized enamel.

Groups

- Group I: This group comprised 32 randomly selected MIH-affected PFMs. Cavity Form I (invasive treatment) were performed.
- Group II: This group comprised 31 randomly selected MIH-affected PFMs. Cavity Form II (noninvasive treatment) were performed.
- Group III: This group comprised 32 randomly selected MIH-affected PFMs. Cavity Form II (noninvasive treatment) were performed as Group II.
- Group IV (control group): Double-faced conventional resin cavities were prepared in 31 PFMs without MIH.

Restoration of the teeth

In all groups, cavities were etched with 37% phosphoric acid (ETCH-37TM, Bisco, Inc. Schaumburg, USA) for 20 seconds. Teeth were rinsed for 15 seconds and then dried gently. In Group III only, following etching with 37% phosphoric acid, 5% NaOCl was applied to the resistant hypomineralized enamel surrounding the cavity margins for 60 seconds and then rinsed for 15 seconds with water spray and dried.

A self-etch adhesive Futurabond NR, (VOCO, Inc. USA) was applied, then gently dried and polymerized with LED (Freelight 2 Elipar, 1200 mw/cm2, 3M ESPE, Ireland) for 10 seconds in all groups. A nano- hybrid composite material Grandio (VOCO, Inc., USA) was inserted into the cavities in two or three increments, with each part polymerized for 20 seconds. The restorations were finished off using carbide burs and disks (Sof-Lex™, 3M ESPE Germany).

Evaluation

The clinical exams were performed per the recommendations of the World Health Organization. The restorations were evaluated with three month intervals for 24 months using modified USPHS criteria [17] for anatomical form, marginal integrity, marginal discoloration, secondary caries, surface integrity and postoperative hypersensitivity by one blinded and calibrated examiner (HS). For each criteria, Alpha was used to indicate highest degree of clinical acceptability, Bravo scores represented clinically acceptable scores, and Charlie meant a clinically unacceptable score. If the highest score (C=Charlie) was recorded for any of the USPH criteria, the restoration was designated as failure and subsequently excluded from the study. For the criteria concerning secondary caries and retention, only two of the scores (Alpha and Charlie) were used. The modified USPHS criteria are provided in Table 2.

Calibration

Following the criteria accepted by European Academy of Pediatric Dentistry (EAPD) children were diagnosed with two examiners. The first clinician (SS) implemented the cavity preparations and restorations while the second clinician (HS) evaluated the restorations according to modified USPHS criteria during the follow-ups. The intra-and inter-examiner validity was assessed by using kappa statistics. Kappa values ranged from 0.85 to 1, demonstrating good reliability.

Table 1. Cavity designs and outline of treatment procedures in the groups.

Group I	Group II	Group III	Group IV (Control)
Cavity pattern I	Cavity pattern II	Cavity pattern II	Conventional Cavity
15 sec. Etching with 37% H_2PO_4	15 sec. Etching with 37% H_2PO_4	15 sec. Etching with 37% H_2PO_4	15 sec. Etching with 37% H_2PO_4
		60 second 5% NaOCl	
Futubond NR	Futurabond NR	Futurabond NR	Futubond NR
Grandio	Grandio	Grandio	Grandio

Table 2. Modified USPHS (Ryge) criteria.

	Alpha	Bravo	Charlie
Anatomic Form	Restoration is contiguous with the original tooth anatomy.	Slight discontinuity, clinically acceptable.	Discontinuous, failure.
Marginal Adaptation	Closely adapted, no visible crevice.	Visible crevice, explorer will penetrate.	Crevice in which dentin is exposed.
Marginal Discoloration	No discoloration.	Discoloration without axial penetration.	Discoloration with axial penetration.
Secondary Caries	No caries present.		Caries present.
Postoperative Hypersensitivity	No sensitivity.	Mild sensitivity with no pain, no retreatment required.	Sensitivity with severe pain, retreatment required.

Retention No retention is present Restoration is absent

Statistical analysis

Statistical analysis was carried out using SPSS 15.0 (SPSS, Chicago, IL, USA). Pearson's chi-square test at a significance level of 5% was used to compare performance criteria between groups and between baseline and recall for each group.

RESULTS

The overall recall rate was 100%, as all patients were available for clinical evaluation every 3 months for two years. The results of the clinical examination scores according to USPHS criteria are displayed in Table 3.

The 3 and 6 months results showed that there were no differences between the four groups with regard to each criterion, except post-operative sensitivity.

For anatomic form after 12 months, changes from Alpha to Bravo and Charlie observed for all groups and no significance ($p>0.05$) was found between the groups at this period. At 15 months and the following periods Charlie scores were found more significant in restorations in Group II ($p<0.05$) than the other three groups, while no significant difference was found between the Groups l, lll and lV ($p>0.05$). At the end of the second year; the failure of the restorations for anatomic form was significantly higher in Group ll ($p<0.05$) and the results were not different between Groups l, lll and lV ($p>0.05$).

One tooth at 6 months, four at 12 months, three at 18 months and two teeth at 21 months were scored as Charlie because of marginal defects in Group ll. At the end of the second year the failure of the restorations due to marginal adaptation was significantly higher in Group ll ($p<0.05$) and no difference was detected between the other three groups ($p>0.05$).

Bravo and Charlie scores were also highly recorded for marginal discoloration in Group ll at 12, 15, 18 and 24 months and both scores were found to be significantly higher when compared to other groups ($p<0.05$). No difference was found between the Groups l, ll and lV ($p>0.05$).

For secondary caries, no difference was found between the study groups ($p>0.05$) over the entire course of the study at all recalls. In Group l, lll and lV one tooth in each group exhibited secondary caries at 21,18 and 18 months respectively. Two of the restorations in Group ll were recorded as failure at 15 and 24 months respectively because of secondary caries.

With regards to surface texture, scores were generally recorded as Alpha and no Charlie score was detected in the groups. In terms of retention; none of the restorations lost during the study course. No statistically significant differences were found among the cavity preparation groups in any of the evaluation criteria at all recalls for surface texture and retention ($p>0.05$).

For the postoperative sensitivity, one week after the placement of restorations the findings were recorded as Bravo in 6 teeth, 13 teeth, 14 teeth and 1 tooth respectively in the Groups I, II, III and IV. The number of the teeth recorded with hypersensitivity in Groups II and III were significantly higher when compared to Groups I and IV at both one week and 6-month clinical examinations ($p<0.05$). The postoperative sensitivity of the teeth disappeared completely after 6 months in Groups I and IV and after 12 months in Groups II and III. After 12 months, there was no difference in postoperative hypersensitivity between the groups ($p>0.05$).

Intragroup evaluation indicated that failures detected for anatomic form, marginal adaptation and marginal discoloration increased significantly ($p<0.05$) after 12 months in Group ll and after 18 months in Groups l and lll. No difference was found in group lV between the recalls.

The total survival rates of the groups over the 24-month are displayed in Table 4. At three, six and nine months, the survival rates of the restorations were 100% for Group I, Group lll and Group IV. At 12 months, survival rates of the restorations were 93.7% for

Table 3. The clinical results of the groups according to the USPHS criteria.

	Group 1			Group 2			Group 3			Group 4		
Anatomic Form	A	B	C	A	B	C	A	B	C	A	B	C
Baseline	32	0	0	31	0	0	32	0	0	31	0	0
3 m	32	0	0	30	1	0	32	0	0	31	0	0
6 m	32	0	0	30	0	1	32	0	0	31	0	0
9 m	30	2	0	28	2	0	30	2	0	31	0	0
12 m	27	4	1	22	5	2	29	2	1	29	2	0
15 m	26	2	2	21	3	1	29	1	0	28	2	1
18 m	26	1	0	18	4	2	26	2	1	28	1	1
21 m	24	3	0	18	2	1	25	2	1	26	2	0
24 m	24	2	0	17	2	1	23	2	1	26	2	0
Marginal Adaptation	A	B	C	A	B	C	A	B	C	A	B	C
Baseline	32	0	0	31	0	0	32	0	0	31	0	0
3 m	32	0	0	30	1	0	32	0	0	31	0	0
6 m	32	0	0	30	0	1	32	0	0	31	0	0
9 m	30	2	0	28	1	1	30	2	0	31	0	0
12 m	27	3	2	22	3	4	29	1	2	29	2	0
15 m	26	1	3	21	3	1	29	0	1	28	2	1
18 m	26	1	0	18	3	3	26	2	1	28	0	2
21 m	24	2	1	18	2	1	25	1	2	26	2	0
24 m	24	2	0	17	1	2	23	2	1	26	1	1
Marginal Discoloration	A	B	C	A	B	C	A	B	C	A	B	C
Baseline	32	0	0	31	0	0	32	0	0	31	0	0
3 m	32	0	0	30	1	0	32	0	0	31	0	0
6 m	32	0	0	30	0	1	32	0	0	31	0	0
9 m	30	2	0	28	2	0	30	2	0	31	0	0
12 m	28	3	1	24	3	2	30	1	1	30	1	0
15 m	27	1	2	21	3	1	29	1	0	29	1	1
18 m	26	1	0	20	2	2	26	2	1	28	1	1
21 m	26	1	0	18	2	1	25	2	1	27	1	0
24 m	25	1	0	17	2	1	24	1	1	27	1	0
Surface Roughness	A	B	C	A	B	C	A	B	C	A	B	C
Baseline	32	0	0	31	0	0	32	0	0	31	0	0
3 m	32	0	0	31	0	0	32	0	0	31	0	0
6 m	32	0	0	31	0	0	32	0	0	31	0	0
9 m	32	0	0	30	0	0	32	0	0	31	0	0
12 m	32	0	0	29	0	0	32	0	0	31	0	0
15 m	30	0	0	24	1	0	28	2	0	31	0	0
18 m	26	1	0	23	1	0	27	2	0	30	0	0
21 m	26	1	0	20	1	0	27	1	0	28	0	0
24 m	26	0	0	20	0	0	26	0	0	28	0	0
Secondary Caries	A	B	C	A	B	C	A	B	C	A	B	C
Baseline	32		0	31		0	32		0	31		0
3 m	32		0	31		0	32		0	31		0
6 m	32		0	31		0	32		0	31		0
9 m	32		0	30		0	32		0	31		0
12 m	32		0	29		0	32		0	31		0
15 m	30		0	24		1	30		0	31		0

	Group 1			Group 2			Group 3			Group 4		
18 m	27		0	24		0	28		1	29		1
21 m	26		1	21		0	26		0	28		0
24 m	26		0	19		1	26		0	28		0
Retention	A	B	C	A	B	C	A	B	C	A	B	C
Baseline	32		0	31		0	32		0	31		0
3 m	32		0	31		0	32		0	31		0
6 m	32		0	31		0	32		0	31		0
9 m	32		0	30		0	32		0	31		0
12 m	32		0	29		0	32		0	31		0
15 m	30		0	25		0	30		0	31		0
18 m	27		0	24		0	29		0	30		0
21 m	27		0	21		0	28		0	28		0
24 m	26		0	20		0	26		0	28		0
Hypersensitivity	A	B	C	A	B	C	A	B	C	A	B	C
1 week	26	6	0	18	13	0	18	14	0	30	1	0
6 month	32	0	0	23	8	0	26	6	0	31	0	0
12 month	32	0	0	28	1	0	31	1	0	31	0	0
18 month	27	0	0	24	0	0	29	0	0	30	0	0
24 month	26	0	0	20	0	0	26	0	0	28	0	0

A: Alpha, B: Bravo, C: Charlie

Table 4. The survival rate of the restorations with number and percentage per group at baseline and each recall interval.

		Baseline	3 m.	6 m.	9 m.	12 m.	15 m.	18 m.	21 m.	24 m.
Group 1	Acceptable (n) %	32 (100)	32 (100)	32 (100)	32 (100)	30 (93,75)	27 (84,37)	27 (84,37)	26 (81,25)	26 (81,25)
	Unacceptable (n)	-	-	-	-	2	5	5	6	6
Group 2	Acceptable (n) %	31 (100)	31 (100)	30 (96,77)	29 (93,54)	25 (80,64)	24 (77,41)	21 (76,74)	20 (64,51)	18 (58,06)
	Unacceptable (n)	-	-	1	2	6	7	10	11	13
Group 3	Acceptable %	32 (100)	32 (100)	32 (100)	32 (100)	30 (93,75)	29 (90,62)	28 (87,50)	26 (81,25)	25 (78,12)
	Unacceptable	-	-	-	-	2	3	4	6	7
Group 4	Acceptable %	31 (100)	31 (100)	31 (100)	31 (100)	31 (100)	30 (96,77)	28 (90,3)	28 (90,32)	27 (87.09)
	Unacceptable	-	-	-	-	-	1	3	3	4

Group I, 80.7% for Group II, 93.5% for Group III, and 100% for Group IV. Group ll was the least successful at the end of the first year ($p<0.05$). The total number of the failures recorded for the restorations were 6, 13, 7 and 4 in Groups I, II, III and IV, respectively at 24 months. The rate of success at the end of second year for Group II (58.06%) was significantly lower ($p<0.05$) than the other three groups. No significant differences were observed among the success rates of Group I (81.25%), Group III (78.12%) and Group IV (87.09 %) at the end of the second year ($p>0.05$); however, greater failure was observed in Group lll.

A comparison of the 12 and 24 month results showed significant differences in Groups I, II, III ($p<0.05$), but not in Group IV. Compared to the first year's results, the success rates from the second year were significantly lower in Group II ($p<0.05$).

Beyond the one-year recall, an increase in negative step formations caused by marginal hypomineralized enamel cracks was detected in Group II (Table 3). Marginal adaptation and marginal discoloration scores were also found to be more negative in Group II, decreasing the success of the restorations beyond the 12 month recall. The surface roughness of all restorations was evaluated as acceptable (Alpha or Beta) in each group over the course of the study. No significant difference for retention, secondary caries or surface roughness was found between the groups ($p>0.05$).

DISCUSSION

The disruption of the ameloblast function during the maturation phase is believed to encourage the development of high organic content in MIH-affected enamel[18]. Post-eruptive breakdown and severe loss of enamel causing atypical cavities, hypersensitivity and increased treatment requirements have been attributed to unfavorable enamel consistency [19]. Hardness and elastic modules of elasticity of MIH affected enamel are reduced by between 50 and 70% and mineral content is reduced by 20% (20). SEM studies have shown that regardless of the etching time, exposure of hypomineralized enamel to phosphoric acid fails to produce similar etching patterns seen in sound enamel [7,20]. This microstructural difference was attributed to the excess proteins in the hypomineralized enamel [21]. An *in vitro* study [22] showed that the mean microshear bond strengths (MPa) of resin bonded to hypomineralized enamel were significantly lower than those bonded to sound enamel.

A common consensus has not been reached in the literature regarding the cavity forms of the MIH-affected teeth. Contrary to Fayle [15], William *et al* [7], proposed the removal of all defective enamel until sound enamel surfaces were reached. While this invasive approach has its benefits, it means more tooth loss.

Adhesive restorations placed on teeth with Amelogenesis Imperfecta (AI), have also shown high failure rates due to inadequate bonding between restorations and enamel similar to MIH. The high organic content of these teeth have led clinicians to remove excess protein in order to enhance resin bonding. Venezia *et al* [12] found that a 5% NaOCl pretreatment increased the success of bonding an orthodontic bracket to an AI affected tooth. They suggested 5% NaOCl enhanced enamel bonding by removing excess protein, thereby establishing a successful etch pattern. In an *in vitro* study, Saroglü *et al* [13] also reported that deproteinization using 5% NaOCl post-acid conditioning enhanced the shear bond strength of the resin composite to AI affected primary tooth enamel and dentin. They predicted that treating acid-etched enamel surfaces with NaOCl could make enamel crystals more accessible to the bonding agent, thereby resulting in higher bond strength.

The findings of this study with respect to modified USPHS criteria showed that at the end of 24 months the failure rate of Group II was significantly higher ($p<0.05$) than that of the other three groups. This indicated that noninvasive cavities without removal of hypomineralized tissue are not available for CRRs in MIH-affected teeth. Although no significant differences were observed between the success rates of Groups I, III and IV ($p>0.05$); 24-month results pointed that Group IV (control), consisting of unaffected molars, had the highest success rate among all groups. Removal of whole affected enamel (Group I) significantly increased the success of resin restorations of MIH-affected molars compared with noninvasive restorations (Group II). In a previous study, Lygidakis *et al* [8] also noted the high clinical performance of resin restorations placed in hypomineralized teeth, attributing this success to the removal of all clinically defective enamel until normal enamel structure is reached. The undesirable side-effect of this approach is that it engenders more tooth loss.

In the present study, the significant difference between Group II and Group III demonstrated the benefits of deproteinization of the hypomineralized enamel with 5% sodium hypochlorite. The success rate of the restorations in Group III was not significantly different than Group I and Group IV. This finding points that less tooth removal with NaOCl application maybe a promising treatment for the clinicians.

William *et al* [22] showed better results of bond strength of self-etching adhesive to hypomineralized enamel than that of an all-in-one adhesive. Authors attributed this to two characteristics of self-etch adhesives, namely both mechanical and chemical bonding and the lack of contact between the bond and water (as rinsing is omitted). Studies [23,24] also demonstrated that etching with phosphoric acid caused increased loss of mineralized tissue compared to self-etch adhesives leading weak bonding in hypomineralized enamel. In contrast to this data, favorable results were achieved by etching enamel with phosphoric acid before applying self-etch adhesives [25, 26]. In a two-year follow-up clinical study [24], higher rates of marginal defects were reported in restorations placed without phosphoric acid etching. In the present study, 37% phosphoric acid was applied to the enamel before treating it with the one-step self-etch adhesive system (Futurabond NR (Voco)) in all groups. Wright [27] also reported acceptable clinical results with the etch-bleach-seal technique. Before applying the sealant material, enamel was first etched with 37% phosphoric acid and then bleached with 5% sodium hypochlorite. Future clinical studies should focus on the performance of treating hypomineralized enamel with self-etch adhesives or other resin-based materials.

Beyond the one-year recall, an increase in negative step formations caused by marginal hypomineralized enamel cracks was detected in Group II. The failure of the restorations in Group ll was frequent for anatomic form, marginal adaptation and marginal discoloration. In the current study, contrary to expectations; no Charlie scores were recorded in retention of the restorations throughout the study including in Group ll. This was correlated with the removal of the unsuccessful restorations from the study during short recall periods (three months).

In a recent study [28] the success of the GIC restorations applied to the MIH affected PFMs without removal of the area affected by MIH was found to be high especially in single-surface restorations. Authors considering this finding advised that the invasive treatment should be postponed until child is mature enough to cooperate with more complex treatment procedures. Compared to Fragelli *et al 's* study[28], our findings showed more failures in the non invasive treatment group (Group II). In a longitudinal case report [29], the GIC restorations placed in early ages were replaced with resin restorative material due to wear and tear and resin restorations showed better results compared to GIC in MIH affected child.

Hypersensitivity tends to be associated more with hypomineralized enamel. The present study recorded a particularly high rate of hypersensitivity levels recorded as Bravo in Groups II and III, in which hypomineralized enamel tissue remained in the cavomargins. At the 6-month recall, hypersensitivity disappeared in Groups I and IV, but continued in almost half of the teeth in Groups II and III. After 12 months, hypersensitivity disappeared in all groups. Failure to remove hypomineralized tissue, even when it is treated with NaOCl, has been observed to be associated with hypersensitivity.

Based on the findings of this study; instead of removal of all affected enamel, treatment of acid-etched hypomineralized enamel with NaOCl, enhances successful retention of resin restorations in MIH-affected teeth. NaOCl treatment is a more conservative technique, as it prevents major tissue loss when compared to extending cavities up to sound enamel.

CONCLUSIONS

1. The present study showed that CRRs placed in hypomineralized teeth are unsuccessful compared those placed in normal teeth.
2. The structure of the enamel where the cavity margins end has been found to be a significant factor in the success of CRRs in MIH-affected teeth.
3. Deproteinization of the hypomineralized enamel with 5% NaOCl enhanced the success of the CRRs.
4. Further clinical and laboratory studies are required in order to achieve improved bonding to hypomineralized enamel.

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