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Correspondence
✉ Hina Arif, hinaarif818@gmail.com

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Comparison of Retention Rate for Fissure Sealing Between Glass Ionomer and Resin Composite

Hina Arif[1], Syed Atta Ullah shah[2], Sana Kanwal[3], Fahad Salim Khan[4]

1 Resident operative dentistry and endodontics at Civil Hospital Quetta Designation: Demonstrator BUMHS., Quetta, Pakistan
2 Supervisor and Consultant operative dentistry and Endodontics, Quetta, Pakistan
3 Resident Operative dentistry and Endodontics, Quetta, Pakistan
4 MCPS operative dentistry and Endodontics Demonstrator BHUM, Quetta, Pakistan

ABSTRACT

Background: Children with psychological and/or physical disabilities face elevated caries risk and practical barriers to moisture control, making fissure sealant selection critical for preventive dentistry in special-needs settings (1,3). Objective: To compare short-term retention of a resin-based fissure sealant versus a resin-modified glass ionomer sealant on permanent first molars in children with disabilities. Methods: A split-mouth clinical comparative study was conducted at Bolan Medical College/Sandeman Provincial Hospital, Quetta, Pakistan (6 October 2019–7 April 2020). Thirty-two eligible children with disability diagnoses received both materials across permanent first molars (Clinpro resin sealant; Vitremer resin-modified glass ionomer). Retention was assessed at 3 and 6 months using a three-level scale (completely present/partially present/lost) and a binary outcome (success = completely present). Results: At 3 months, complete retention was 65.63% for Clinpro and 70.31% for Vitremer, with no significant difference in the 3-category distribution (p=0.285) and a non-significant success difference (RD +4.69%). At 6 months, complete retention was identical (53.12% each), with no significant difference in retention distribution (p=0.240) or binary success (RR 1.00). No cavitated caries was detected on clinical examination during follow-up. Conclusion: In special-needs children, resin-based and resin-modified glass ionomer sealants achieved comparable complete retention at six months, supporting flexible material choice based on clinical feasibility and preventive strategy.

Keywords

fissure sealing; pit-and-fissure sealant; glass ionomer; resin composite; retention; special needs dentistry.

INTRODUCTION

Dental caries remains disproportionately concentrated in pits and fissures, where plaque stagnation and limited fluoride access create a persistent microenvironment favorable to demineralization, making sealant-based prevention a core component of occlusal caries control strategies (3). Preventive delivery is further complicated in children with developmental, cognitive, or neuromotor disabilities, where compromised self-care, caregiver dependence, dietary and medication-related factors, and practical challenges to chairside cooperation increase caries susceptibility and limit the feasibility of time-intensive procedures (1). In this context, selecting a fissure sealant that can tolerate relative moisture contamination while still providing durable retention and sustained protection is clinically important.

Resin-based pit-and-fissure sealants provide an effective physical barrier but are technique-sensitive and particularly vulnerable to salivary contamination during placement, which can jeopardize micromechanical bonding and lead to early sealant loss (3). Glass ionomer cements offer distinct preventive advantages through chemical adhesion and fluoride release, and they have been advocated as fissure sealants when ideal isolation is difficult or when cooperation is limited, including in recently erupted molars (11,15). However, conventional glass ionomer sealants have historically shown lower retention than resin sealants, even when caries prevention remains comparable or favorable, creating a clinically relevant trade-off that is especially consequential in special-needs populations (12,13). Resin-modified glass ionomer formulations were developed to improve handling and retention performance while retaining fluoride-related benefits, yet the extent to which they match resin sealants in early and short-term retention under challenging clinical conditions remains inconsistently reported across settings (7,16).

Accordingly, this study assessed short-term retention of a resin-based fissure sealant compared with a resin-modified glass ionomer sealant applied to permanent first molars in children with psychological and/or physical disabilities, using standardized follow-up at 3 and 6 months. The research question was whether the resin-modified glass ionomer sealant demonstrates superior or comparable complete retention relative to the resin-based sealant over 6 months in a special-needs clinical setting (4,16).

MATERIALS AND METHODS

A split-mouth clinical comparative study was conducted in the Dentistry Department of Bolan Medical College/Sandeman Provincial Hospital, Quetta, Pakistan, from 6 October 2019 to 7 April 2020. Children presenting during the recruitment window were screened and enrolled using consecutive eligibility assessment. Eligibility required a documented psychological disability diagnosis, the presence of all four fully erupted permanent first molars without cavitation and within a post-eruptive period not exceeding two years, absence of bruxism, and provision of informed consent by the legal guardian. Children with hypoplastic first molars or other developmental dental anomalies were excluded.

Sealant placement and follow-up examinations were performed clinically by trained dental personnel using standardized procedures. The two materials were a resin-based fissure sealant (Clinpro Sealant, 3M Dental) and a resin-modified photopolymerizable glass ionomer sealant (Vitremer, 3M Dental). To minimize confounding from inter-individual salivary flow and cooperation variability, a collateral split-mouth approach was used in which both sealants were applied within the same participant across the four first molars, thereby controlling for participant-level factors. Teeth were cleaned and polished using non-fluoridated prophylaxis paste prior to sealant application. Isolation was achieved using routine

clinical moisture-control methods appropriate for special-needs care, and materials were applied according to manufacturer-recommended protocols for occlusal sealing.

Clinical outcomes were evaluated at 3 and 6 months using a three-category retention scale: completely present, partially present, or lost. For interpretive analysis aligned with clinical decision-making, outcomes were additionally dichotomized as success (completely present) and failure (partially present or lost). Teeth were also examined for visible cavitated caries at each follow-up visit. Ethical conduct procedures included guardian consent and institutional oversight consistent with clinical research involving vulnerable pediatric populations. Statistical analysis was performed using categorical comparisons between materials at each follow-up time point. Retention distributions (present/partial/lost) were compared using chi-square tests, and binary success proportions were compared using chi-square tests with effect estimation using risk difference (RD) and risk ratio (RR) with 95% confidence intervals (CIs). A two-sided p-value <0.05 was considered statistically significant.

RESULTS

A total of 32 children with disabilities were included. Diagnostic categories comprised autism (n=5), Down syndrome (n=9), cerebral palsy (n=6), and mild-to-moderate intellectual disability (n=12). Most participants reported a normal diet (n=29), while a minority reported a bland diet (n=3). Behavioral management alone was used in 8 children, adjunctive retractor use in 2, physical restraint in 16, and oral benzodiazepines in 6. Across the clinical sealant component, both materials were placed in the same participants across first molars, yielding 64 sealed molars per material (128 total sealed molars).

Table 1. Participant clinical profile (n=32)

Variable	Category	n	%
Disability diagnosis	Autism	5	15.62
	Down syndrome	9	28.12
	Cerebral palsy	6	18.75
	Mild–moderate intellectual disability	12	37.50
Diet pattern	Normal	29	90.62
	Bland	3	9.38
Behavior/adjuncts used	Behavioral management	8	25.00
	Retractor	2	6.25
	Physical restraint	16	50.00
	Oral benzodiazepines	6	18.75

At 3 months, complete retention was numerically higher for Vitremer than Clinpro, with fewer partially retained teeth in the Vitremer group. Specifically, Clinpro showed complete retention in 42/64 molars (65.63%), partial retention in 8/64 (12.50%), and loss in 14/64 (21.88%), whereas Vitremer showed complete retention in 45/64 (70.31%), partial retention in 3/64 (4.69%), and loss in 16/64 (25.00%) (Table 2). When the full three-level retention distribution was compared, the difference between materials was not statistically significant (χ^2 p=0.285).

Table 2. Retention status at 3 months by material (n=64 molars per material)

Retention status	Clinpro resin sealant n (%)	Vitremer RMGIC n (%)
Completely present	42 (65.63)	45 (70.31)
Partially present	8 (12.50)	3 (4.69)
Lost	14 (21.88)	16 (25.00)
Chi-square p-value (3-category distribution)	0.285	

At 6 months, complete retention converged across materials. Clinpro demonstrated complete retention in 34/64 molars (53.12%), partial retention in 12/64 (18.75%), and loss in 18/64 (28.12%). Vitremer demonstrated complete retention in 34/64 (53.12%), partial retention in 6/64 (9.38%), and loss in 24/64 (37.50%) (Table 3). The 3-category retention distribution did not differ significantly at 6 months (χ^2 p=0.240). Notably, despite partial or complete sealant loss in a proportion of teeth, visible cavitated caries was not detected during the 6-month follow-up examinations.

Table 3. Retention status at 6 months by material (n=64 molars per material)

Retention status	Clinpro resin sealant n (%)	Vitremer RMGIC n (%)
Completely present	34 (53.12)	34 (53.12)
Partially present	12 (18.75)	6 (9.38)
Lost	18 (28.12)	24 (37.50)
Chi-square p-value (3-category distribution)	0.240	

Table 4. Binary retention outcome (Success = completely present; Failure = partial + lost)

Time point	Material	Success n/N (%)	Failure n/N (%)	RR (95% CI)*	RD (95% CI)*	p-value
3 months	Vitremer RMGIC	45/64 (70.31)	19/64 (29.69)	1.07 (0.84–1.36)	+0.0469 (−0.1146 to +0.2083)	0.705
	Clinpro resin	42/64 (65.63)	22/64 (34.37)	Reference	Reference	
6 months	Vitremer RMGIC	34/64 (53.12)	30/64 (46.88)	1.00 (0.72–1.38)	0.0000 (−0.1729 to +0.1729)	1.000
	Clinpro resin	34/64 (53.12)	30/64 (46.88)	Reference	Reference	

*RR and RD are computed comparing Vitremer to Clinpro at each time point.

When retention was dichotomized into clinically interpretable success (completely present) versus failure (partially present or lost), Vitremer showed a modest numerical advantage at 3 months (70.31% vs 65.63%; RD +4.69%), but with wide uncertainty (RD 95% CI −11.46% to +20.83%) and no statistical significance (p=0.705). At 6 months, complete retention was identical in both groups (53.12% each; RD 0.00%), and effect

estimates were consistent with no difference (RR 1.00; 95% CI 0.72 to 1.38; p=1.000) (Table 4). These findings indicate that any early separation in performance was not sustained at 6 months under the observed clinical conditions.

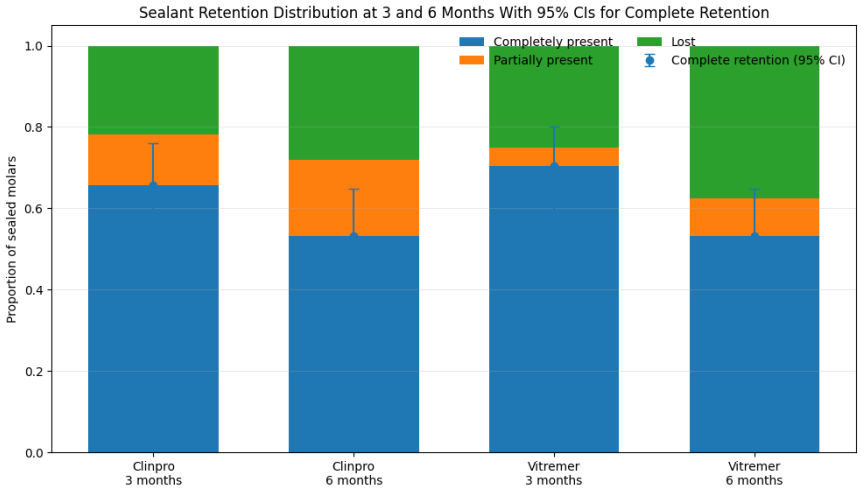

Figure 1 Sealant retention distribution at 3 and 6 months with 95% CIs for complete retention

The stacked distributions show that at 3 months complete retention was 65.63% (42/64) for the resin sealant (Clinpro) versus 70.31% (45/64) for the resin-modified glass ionomer (Vitremer), while complete loss occurred in 21.88% (14/64) and 25.00% (16/64), respectively; partial retention accounted for 12.50% (8/64) for Clinpro and 4.69% (3/64) for Vitremer. By 6 months, complete retention converged to 53.12% (34/64) for both materials, but the failure pattern differed, with Clinpro showing a higher partial-retention component (18.75% [12/64]) and lower complete loss (28.12% [18/64]) compared with Vitremer (9.38% [6/64] partially present; 37.50% [24/64] lost). The overlaid 95% confidence intervals for complete retention indicate modest uncertainty at each time point and visually reinforce that any early numerical separation at 3 months did not persist at 6 months.

DISCUSSION

This split-mouth clinical comparison evaluated short-term sealant retention in a special-needs pediatric population, where behavioral limitations and moisture-control challenges can compromise technique-sensitive preventive care. At 3 months, the resin-modified glass ionomer (Vitremer) demonstrated a modest numerical advantage in complete retention compared with the resin-based sealant (Clinpro), while at 6 months complete retention converged to an identical proportion in both materials. This pattern suggests that any early handling or adhesion advantage potentially conferred by the resin-modified glass ionomer in difficult isolation conditions may not translate into sustained superiority over six months, at least under the clinical constraints observed in this cohort. These findings are clinically relevant because pit-and-fissure sealants remain a cornerstone of occlusal caries prevention, yet their success depends on maintaining an effective barrier at the fissure system, which is inherently susceptible to failure when moisture control is suboptimal (3).

Prior evidence generally supports higher retention for resin-based sealants, largely attributable to micromechanical bonding after enamel etching, but also highlights the heightened sensitivity of resin materials to contamination during placement (3). Conversely, glass ionomer-based materials—particularly in contexts where isolation is challenging—offer practical advantages including chemical interaction with enamel and fluoride release with potential anti-demineralization effects (11,15). The current results align with literature indicating that glass ionomer sealants may exhibit comparatively lower or variable retention than resin sealants, while still offering preventive benefit through fluoride-mediated mechanisms (12,13,16). Importantly, the absence of clinically detected cavitated caries over six months in this study, even among teeth with partial or complete sealant loss, is consistent with the broader concept that fluoride-releasing materials can contribute to caries suppression beyond purely mechanical retention, though the short follow-up duration and the clinical detection approach limit definitive inference on caries outcomes (14–16).

The distribution of retention categories at both follow-up points also provides nuance beyond binary “success/failure” reporting. At 6 months, the resin-modified glass ionomer showed fewer partially retained sealants but a higher proportion of complete losses than the resin-based sealant, whereas complete retention was identical. Clinically, this may reflect different failure modes: resin-based sealants may degrade or chip into partial retention states, while glass ionomer-based sealants may detach more completely under functional or moisture-related stresses. Such differences warrant longer follow-up and standardized, calibrated scoring because partial retention can still convey clinical benefit if fissure coverage is maintained in critical areas, while complete loss may warrant earlier resealing strategies (3,11).

Several limitations constrain interpretation. The follow-up window was limited to six months, which is insufficient to characterize longer-term retention trajectories that are clinically meaningful for sealant programs (13,16). Although the split-mouth approach reduces participant-level confounding, the analysis did not explicitly model within-child clustering and repeated measurements across time, which can underestimate uncertainty and should be addressed in future work using methods appropriate for paired or clustered data. Additionally, the study did not quantify isolation difficulty, salivary flow, eruption stage variation within the ≤2-year criterion, or operator-level variability—factors known to influence sealant performance and which are particularly salient in special-needs settings (1,3). Despite these constraints, the study provides pragmatic evidence that, under routine special-needs clinical conditions, resin-modified glass ionomer and resin-based sealants achieved comparable complete retention at six months, supporting flexibility in material selection based on chairside feasibility, fluoride-release preference, and patient cooperation constraints (11,15,16).

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CONCLUSION

In this split-mouth clinical study of special-needs children, the resin-modified glass ionomer sealant and the resin-based sealant demonstrated similar complete retention at six months, with only a small and statistically non-significant numerical advantage for the resin-modified glass ionomer at three months; these findings support the use of either material for fissure sealing in challenging clinical environments, with material choice guided by isolation feasibility, procedural efficiency, and preventive strategy considerations, while longer follow-up and appropriately clustered analyses are recommended to clarify durability and caries-preventive effects over time (3,11,12,16).

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