

"A Comparative Evaluation of Effectiveness of Giomer and Alkasite as Restorative Materials in Class II Cavities in Primary Molars – A Clinical Study."

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Abstract

Background: The longevity of Class II restorations in primary molars depends largely on the restorative material used. Giomer and Alkasite (Cention N) are contemporary bioactive restorative materials with favorable mechanical and esthetic properties; however, comparative clinical evidence in primary teeth is limited.

Aim: To evaluate and compare the clinical effectiveness of Giomer and Alkasite (Cention N) as restorative materials in Class II cavities of primary molars.

Materials and Methods: This prospective randomized split-mouth longitudinal clinical study was conducted in 20 children aged 4–7 years. Thirty Class II cavities in primary molars were randomly allocated into two groups: Group I (Giomers, n=15) and Group II (Alkasite/Cention N, n=15). Restorations were evaluated at baseline, 3, 6, 9, and 12 months using Modified United States Public Health Service (USPHS) criteria for colour match, marginal adaptation, marginal discoloration, anatomic form, and secondary caries. Radiographic evaluation was performed to assess secondary caries. Data were analyzed using Cochran's Q test, Chi-square test, and Fisher's exact test, with $p \leq 0.05$ considered statistically significant.

Results: Both restorative materials demonstrated clinically acceptable performance throughout the 12-month follow-up. Giomer exhibited significantly better colour stability at 6 and 9 months ($p < 0.05$) and superior marginal adaptation at 12 months ($p = 0.0067$) compared with Alkasite. No statistically significant differences were observed between the groups for marginal discoloration, anatomic form, or secondary caries ($p > 0.05$). Radiographic evaluation revealed minimal secondary caries in both groups without significant intergroup differences.

Conclusion: Both Giomer and Alkasite (Cention N) were clinically acceptable restorative materials for Class II cavities in primary molars over 12 months. However, Giomer demonstrated superior colour stability and marginal adaptation, suggesting better overall long-term clinical performance.

Keywords: Giomer, Alkasite, Cention N, Primary molars, Class II restoration, Modified USPHS criteria, Pediatric dentistry.

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INTRODUCTION

"A Comparative Evaluation of Effectiveness of Giomer and Alkasite as Restorative Materials in Class II Cavities in Primary Molars – A Clinical Study."

Dental caries remains the most common chronic disease affecting children worldwide and continues to be a major public health concern. Primary molars are particularly susceptible to proximal caries because of their broad contact areas, thinner enamel, and difficulty in maintaining oral hygiene. Untreated proximal lesions may lead to pain, pulpal involvement, premature tooth loss, and disturbances in the eruption of permanent teeth. Therefore, restoring primary molars with durable, esthetic, and biologically compatible restorative materials is essential for maintaining function and arch integrity until natural exfoliation. [1]

The long-term success of restorative treatment in pediatric dentistry depends largely on the properties of the restorative material. An ideal material should possess adequate mechanical strength, good marginal adaptation, wear resistance, esthetics, fluoride release, and ease of handling. With the growing emphasis on minimally invasive dentistry, bioactive restorative materials have gained increasing attention because of their ability to promote remineralization while maintaining satisfactory clinical performance. [2]

Giomer restorative materials are based on surface pre-reacted glass-ionomer (S-PRG) filler technology, combining the esthetic and mechanical advantages of resin composites with the fluoride release and recharge capability of glass-ionomer cements. In addition to fluoride, Gionomers release several beneficial ions that contribute to acid neutralization, antibacterial activity, and remineralization of adjacent tooth structure. [3] Previous laboratory and clinical studies have reported favorable colour stability, marginal adaptation, fluoride release, and long-term clinical performance of Giomer restorations. [4,5]

Alkasite restorative material, represented by Centon N (Ivoclar Vivadent), is a tooth-coloured resin-based material containing alkaline glass fillers capable of releasing calcium, fluoride, and hydroxyl ions. Its bioactive properties, low polymerization shrinkage, high fracture resistance, and acid-neutralizing potential make it a promising material for posterior restorations. Clinical studies have demonstrated satisfactory retention, marginal integrity, and wear resistance of Centon N restorations. [6,7]

Although both Giomer and Alkasite have shown encouraging clinical outcomes individually, comparative evidence regarding their performance in Class II restorations of primary molars remains limited. Therefore, the present prospective longitudinal clinical study was undertaken to compare the clinical effectiveness of Giomer

(Beautifil Bulk) and Alkasite (Cention N) using Modified USPHS criteria. [8] The restorations were evaluated over a 12-month period for colour match, marginal integrity, cavosurface marginal discoloration, anatomic form, and secondary caries to determine their overall clinical performance.

MATERIALS AND METHODOLOGY

Study Design and Setting

This prospective analytical, randomized, split-mouth, 12-month longitudinal clinical study was conducted in the Department of Pediatric and Preventive Dentistry, Maitri College of Dentistry and Research Centre, Anjora, Durg, Chhattisgarh.

Ethical Approval

Approval was obtained from the Institutional Ethics Committee. Written informed consent was obtained from the parents or guardians of all participating children.

Sample Size and Study Population

The sample size was calculated using Cochran's formula with a prevalence of 98%, 95% confidence level, and 5% allowable error. The estimated sample size was 30 teeth.

A total of 30 primary molars from 20 cooperative children aged 4–7 years with mild to moderate proximal dentinal caries were included.

Inclusion Criteria

Children aged 4–7 years with previously untreated first or second primary molars showing proximal caries involving the outer to middle one-third of dentin were included. Teeth with no root resorption or physiologic resorption not exceeding two-thirds of the root length and children showing positive or definitely positive Frankl behavior were selected.

Exclusion Criteria

Children with special healthcare needs, dental crowding affecting oral hygiene, non-vital teeth, irreversible pulpitis, abscess, mobility, pathological root resorption, or physiologic resorption exceeding two-thirds of the root length were excluded.

Group Allocation

The selected teeth were randomly allocated into two groups:

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- Group I: Giomer restoration, Beautifil Bulk, n=15
- Group II: Alkasite restoration, Centon N, n=15

The children and the investigator assessing the outcomes were blinded to group allocation.

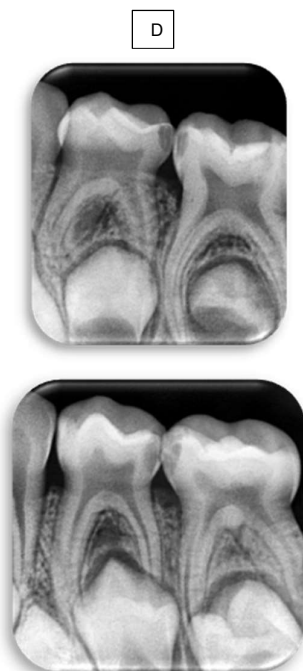


FIGURE 1. (A, B, C) PRE OPERATIVE IMAGE, (D &E) PREOPERATIVE

INTRAORAL RADIOGRAPHS WITH 74 AND 84

Baseline Assessment

Medical and dental history, Frankl behavior rating, and clinical extent of proximal caries were recorded. Intraoral periapical radiographs were obtained to evaluate caries depth and root resorption. Standardized intraoral photographs were also taken.

Oral prophylaxis, dietary counselling, oral hygiene instructions, sealants, and other required restorations were provided when indicated.

Operative Procedure

After rubber dam isolation, caries excavation and conservative Class II cavity preparation were performed. Matrix bands and wedges were placed.

In Group I, the cavity was etched with 37% phosphoric acid, followed by application of a universal bonding agent. Beautifil Bulk was placed, light cured, finished, polished, and checked for occlusion.

In Group II, Centon N was mixed and placed according to the manufacturer's instructions, followed by light curing where indicated, finishing, polishing, and occlusal adjustment.

A

E



74 (GIOMER)

84 (ALKASITE)

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FIGURE 2. PHOTOGRAPH WITH RUBBER DAM

Outcome Evaluation

Restorations were evaluated using Modified USPHS criteria for:

- Color match
- Marginal integrity
- Cavo-surface marginal discoloration
- Anatomic contour
- Secondary caries

Each parameter was graded as Alpha, Bravo, or Charlie.

Follow-up

Clinical, photographic, and radiographic evaluations were performed at 3, 6, 9, and 12 months by a blinded examiner.



FIGURE 3. POST -OPERATIVE IMAGES; 74 (GIOMER) AND 84 (CENTION-N)

Statistical Analysis

Data were analyzed using SPSS software. Frequencies and percentages were calculated, and intergroup comparisons were performed using the Chi-square test. A p-value of ≤ 0.05 was considered statistically significant.

RESULTS

A total of 30 Class II restorations in primary molars were evaluated over a 12-month follow-up period. Fifteen teeth were restored with Giomer in Group I and 15 with Alkasite (Cention N) in Group II.

Clinical performance was assessed at baseline and at 3, 6, 9, and 12 months using Modified USPHS criteria for colour match, marginal adaptation, marginal discoloration, anatomic form, and secondary caries. Radiographic evaluation was also performed to detect secondary caries.

All restorations were available for clinical evaluation throughout the study period. No Charlie scores were recorded for any clinical parameter in either group, indicating that all restorations remained within clinically acceptable limits.

Table 1. Intragroup clinical performance of Giomer restorations over 12 months

Parameter	Base line Alpha n (%)	3 months Alpha n (%)	6 months Alpha n (%)	9 months Alpha n (%)	12 months Alpha n (%)	12 months Bravo n (%)	P-value
Colour match	15 (100.0)	15 (100.0)	15 (100.0)	14 (93.3)	6 (40.0)	9 (60.0)	<0.001*
Marginal adaptation	15 (100.0)	15 (100.0)	15 (100.0)	15 (100.0)	14 (93.3)	1 (6.7)	0.406
Marginal discoloration	15 (100.0)	15 (100.0)	15 (100.0)	15 (100.0)	14 (93.3)	1 (6.7)	0.406
Anatomic form	15 (100.0)	15 (100.0)	14 (93.3)	14 (93.3)	13 (86.7)	2 (13.3)	0.231
Secondary caries	15 (100.0)	15 (100.0)	15 (100.0)	15 (100.0)	14 (93.3)	1 (6.7)	0.406

*Cochran's Q test; $p < 0.05$ considered statistically significant.

Giomer restorations showed excellent clinical performance during the initial follow-up period. All restorations received Alpha scores for every parameter at baseline and 3 months. Colour match remained unchanged up to 6 months, but the proportion of Alpha scores declined to 93.3% at 9 months and 40.0% at 12 months. This change was statistically significant ($p < 0.001$).

Marginal adaptation, marginal discoloration, and secondary caries remained stable up to 9 months, with only one restoration receiving a Bravo score at 12 months. These changes were not statistically significant. Anatomic form showed a minor decline,

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with Alpha scores decreasing to 86.7% at 12 months; however, the change was also statistically non-significant.

Table 2. Intragroup clinical performance of Alkasite restorations over 12 months

Parameter	Base line Alpha n (%)	3 months Alpha n (%)	6 months Alpha n (%)	9 months Alpha n (%)	12 months Alpha n (%)	12 months Bravo n (%)	p-value
Colour match	15 (100.0)	13 (86.7)	8 (53.3)	8 (53.3)	2 (13.3)	13 (86.7)	<0.001*
Marginal adaptation	15 (100.0)	14 (93.3)	10 (66.7)	10 (66.7)	6 (40.0)	9 (60.0)	<0.001*
Marginal discoloration	15 (100.0)	14 (93.3)	13 (86.7)	13 (86.7)	10 (66.7)	5 (33.3)	0.013*
Anatomic form	15 (100.0)	14 (93.3)	12 (80.0)	12 (80.0)	10 (66.7)	5 (33.3)	0.013*
Secondary caries	15 (100.0)	15 (100.0)	12 (80.0)	12 (80.0)	11 (73.3)	4 (26.7)	0.013*

*Cochran's Q test; $p < 0.05$ considered statistically significant.

Alkasite restorations demonstrated progressive changes in all clinical parameters. Colour match Alpha scores declined from 100% at baseline to 86.7% at 3 months, 53.3% at 6 and 9 months, and 13.3% at 12 months. The deterioration in colour match was statistically highly significant ($p < 0.001$).

Marginal adaptation also showed a significant decline, with Alpha scores decreasing from 100% at baseline to 40.0% at 12 months ($p < 0.001$). Significant reductions were additionally observed for marginal discoloration, anatomic form, and secondary caries ($p = 0.013$ for each parameter). Nevertheless, no Charlie scores were recorded, indicating that all restorations remained clinically acceptable.

Table 3. Intergroup comparison of Giomer and Alkasite restorations

Parameter	Follow-up interval	Group I: Giomer	Group II: Alkasite	p-value
Colour match	6 months	A: 15, B: 0	A: 8, B: 7	0.0096*
	9 months	A: 14, B: 1	A: 8, B: 7	0.0390*
	12 months	A: 6, B: 9	A: 2, B: 13	0.2155
Marginal adaptation	6 months	A: 15, B: 0	A: 10, B: 5	0.0500*
	9 months	A: 15, B: 0	A: 10, B: 5	0.0500*
	12 months	A: 14, B: 1	A: 6, B: 9	0.0067*
Marginal discoloration	12 months	A: 14, B: 1	A: 10, B: 5	0.1709
Anatomic form	12 months	A: 13, B: 2	A: 10, B: 5	0.3880
Secondary caries	12 months	A: 14, B: 1	A: 11, B: 4	0.3272

Chi-square/Fisher's exact test, as applicable; $p \leq 0.05$ considered statistically significant. A: Alpha; B: Bravo.

No statistically significant differences were found between the groups at baseline or 3 months for any clinical parameter. Giomer demonstrated significantly better colour match at 6 months ($p = 0.0096$) and 9 months ($p = 0.039$). Although Giomer continued to show a higher proportion of Alpha scores at 12 months, the difference was not statistically significant.

Marginal adaptation was superior in the Giomer group at 6 and 9 months, with differences reaching the threshold of statistical significance ($p = 0.050$ at both intervals). At 12 months, 93.3% of Giomer restorations retained Alpha scores compared with 40.0% of Alkasite restorations, producing a statistically significant difference ($p = 0.0067$).

No significant intergroup differences were detected for marginal discoloration, anatomic form, or clinically detected secondary caries. However, Alkasite showed a greater frequency of Bravo scores at later follow-up intervals.

Table 4. Radiographic evaluation of secondary caries

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Time interval	Group I: Giomer, caries present (%)	Group II: Alkasite, caries present (%)	Intergroup p-value
Baseline	0 (0.0)	0 (0.0)	1.0000
3 months	0 (0.0)	0 (0.0)	1.0000
6 months	0 (0.0)	3 (20.0)	0.2241
9 months	0 (0.0)	3 (21.4)	0.0996
12 months	1 (6.7)	4 (26.7)	0.3295
Intragroup p-value	0.4060	0.0677	—

Intergroup comparison: Fisher's exact test.
Intragroup comparison: Cochran's Q test.

Radiographically, no secondary caries was detected in either group at baseline or 3 months. In the Alkasite group, secondary caries was observed in 20.0% of restorations at 6 months and 26.7% at 12 months. In comparison, the Giomer group remained free of radiographic secondary caries until 9 months, with only one case detected at 12 months.

The intergroup differences were not statistically significant at any follow-up interval. Intragroup changes were also non-significant for both Giomer ($p=0.4060$) and Alkasite ($p=0.0677$), although Alkasite showed a noticeable trend toward increased secondary caries over time.

DISCUSSION

The present prospective clinical study compared the clinical performance of Giomer and Alkasite (Cention N) restorations in Class II cavities of primary molars over a 12-month period using Modified USPHS criteria. Both restorative materials demonstrated acceptable clinical performance throughout the study, as no Charlie scores were observed. However, Giomer showed superior performance in terms of colour match and marginal adaptation.

Colour match remained stable in the Giomer group up to 6 months, whereas Alkasite demonstrated a gradual decline from 3 months onwards. Statistically significant intergroup differences were observed at 6 and 9 months, indicating better colour stability of Giomer. Oz et al. reported that alkasite restorations maintained acceptable esthetics during clinical follow-up despite minor colour changes over time, which is consistent with the present findings.[9] Similarly, Bonchev and Bogovska-Gigova concluded that although alkasites possess favorable mechanical and bioactive properties, their esthetic

performance may be slightly inferior to resin-based restorative materials.[10]

Marginal adaptation was maintained more effectively by Giomer throughout the study. Significant intergroup differences were observed at 12 months, with Giomer exhibiting superior marginal integrity. The improved performance of Giomer may be attributed to its adhesive bonding mechanism and surface pre-reacted glass-ionomer (S-PRG) filler technology, which enhances sealing ability and minimizes marginal deterioration. Laporte et al. reported that alkasite materials demonstrate satisfactory clinical performance but highlighted variability in marginal adaptation among different clinical studies.[11]

Marginal discoloration and anatomic form showed gradual deterioration in both groups; however, the differences between the two restorative materials were not statistically significant. Işıklı et al. similarly reported comparable clinical performance between alkasite, glass hybrid, and resin composite restorations, with only minor changes in esthetic parameters during follow-up.[12]

Secondary caries was infrequent in both groups. Although Alkasite demonstrated an earlier occurrence of secondary caries than Giomer, neither clinical nor radiographic comparisons reached statistical significance. The fluoride-releasing and bioactive properties of both materials may have contributed to their satisfactory resistance against recurrent caries. Meral et al. also demonstrated favorable long-term clinical performance of alkasite restorations in posterior teeth, supporting its use as a reliable restorative material.[13]

The present findings are in agreement with the principles of minimal intervention dentistry described by Frencken et al., who emphasized preservation of tooth structure and use of restorative materials capable of maintaining long-term clinical function.[14] Likewise, Schwendicke et al. highlighted that restoration longevity largely depends on achieving an effective marginal seal and preventing recurrent caries, which may explain the superior performance of Giomer in marginal adaptation.[15]

Overall, both restorative materials were clinically acceptable after 12 months. However, Giomer demonstrated better colour stability and marginal integrity, suggesting superior long-term clinical performance in Class II restorations of primary molars.

CONCLUSION

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Within the limitations of this 12-month clinical study, both Giomer and Alkasite (Cention N) demonstrated satisfactory clinical and radiographic performance for Class II restorations in primary molars. Giomer showed significantly better colour stability and marginal adaptation, while both materials exhibited comparable performance regarding marginal discoloration, anatomic form, and secondary caries. Giomer may therefore be considered a preferable restorative material when superior esthetics and marginal integrity are desired in primary molar restorations.

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