

Comparative Evaluation of Compressive and Tensile Strength for Glass Ionomer Cement and Cention-N

Research Article

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Abstract

Introduction: The atraumatic restorative technique is considered to be effective in conserving the remaining tooth structure. In that aspect, various materials like nanofilled glass ionomer cement (GIC), composites are used [1-3]. On comparing the compressive strength and tensile strength, till now glass ionomer cement and amalgam is considered to be the best. The aim of the study is to compare the compressive and tensile strength of new alkasite based filling material.

Materials and Methods: Teflon mold of about 20 mm height and 10mm diameter of each group were prepared for two groups, cention-N and GIC, for evaluation of compressive strength. And the samples of about 50mm length and 5mm width were made. Samples were stored in distilled water and evaluated for compressive strength and tensile strength.

Results: Statistical analysis was done with independent tests and results were tabulated.

Keywords: Alkasite; Filling Material; Compressive Strength; Tensile Strength; Cention-N.

Introduction

Atraumatic restorative technique (ART) is a minimally invasive approach where the caries is removed only with the help of hand instruments. It is useful in conserving the remaining healthy tissues, without removing the caries with anesthesia, electrically driven equipment. The restoration is done with the adhesive tooth restorative materials like GIC, composite, compomer etc [4-6].

Various restorative materials are used because of their good physical and chemical properties. The materials like amalgam and GIC are still believed to be best materials because of their compressive and tensile strength.

With the introduction of the new alkasite based restorative material, it is believed that the material Cention-N will replace amalgam and GIC in future. It's the right time for us to shift to new

alkasite based materials. Previously our team has a rich experience in working on various research projects across multiple disciplines [7-21]. Now the growing trend in this area motivated us to pursue this project.

Alkaline filler increases the release of hydroxide ions to regulate the PH value during acid attacks. So, the demineralisation can be prevented. Release of large numbers of fluoride and calcium ions forms a sound basis for the remineralisation of dentin. The aim of this study is to compare the compressive and tensile strength of new alkasite based filling material.

Materials and Methods

Toras FM et al study, compared the microhardness, compressive and tensile strength of nano filled GIC, conventional GIC, resin modified GIC [22-24].

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The materials used in this study were conventional restorative glass ionomer cement.

(Restore Glass, d-tech, India) and self curing alkasite filling material (Cention-N, Ivoclar Vivadent, Liechtenstein).

Compressive strength testing

Group 1 - Cention-N -6 samples

Group 2 – Glass ionomer cement –6 samples

Teflon mold of about 20mm height and 10mm diameter were made ,6 samples in each group . The samples were stored in distilled water for 48 hours. Then the samples were evaluated for compressive strength in a universal testing machine(INSTRON,3382). Each specimen was placed on the flat surface of between the plates of the testing machine and the load was applied . The maximum load at which the fracture of the specimen occurred was recorded in (N) and the compressive strength of each specimen was noted in terms of MPa.

Tensile strength testing

Group 1 – Cention-N – 5 samples

Group 2 – Glass ionomer cement – 5 samples

The samples were made in strips of length 50mm,width 5mm and depth 2mm. Five samples were made in each group and the samples were stored in distilled water for 48 hours(Figure 1&2). Then the specimens were estimated for tensile strength in a universal testing machine, with the crosshead speed of 50mm/min until

fracture. The tensile strength was noted in terms of MPa(Figure 3)

Results and Discussion

Data were collected, tabulated and subjected to statistical analysis using SPSS program(Table 1-4). The statistical analysis was done using an independent t test. The level of significance is considered at $P < 0.05$ (Table 2&4).

Our institution is passionate about high quality evidence based research and has excelled in various fields [11, 25-34].

The results showed that the mean compressive strength is more in group 1 ($1.5083 + 0.26$) when compared to group 2 ($0.2536 + .024$) (Table 4). There is a significant difference in tensile strength of group 1 ($7.9952 + 3.09$) (Table 2) ,when compared to group 2 ($1.1326 + 0.98142$). Thus this study results showed that cention-N is more significant than GIC when comparing the compressive strength and tensile strength.

Atraumatic restorative technique is considered to be less traumatic when compared with conventional techniques with rotary instruments [35-39]. Glass ionomer cement is based on the class of materials known as acid-base cements [40]. Based on the product of reaction of powdered glasses of basic character with weak polymeric acids [41], in the earliest publication ,the term 'glass-ionomer' was applied to them [42]. In the ART technique, the glass ionomers were used for restoration [39-43]. In the setting of glass ionomers, the overall reaction takes place in two steps in a

Figure 1. Group 1- Cention-N.

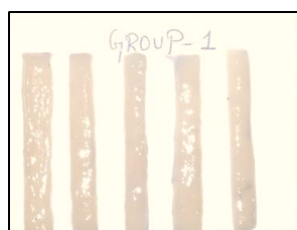


Figure 2. Group 2- Glass ionomer cement.

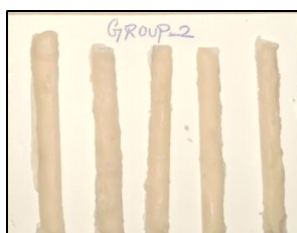


Figure 3. Evaluation of tensile strength in universal testing machine.



Table 1. Comparative results of tensile strength between the groups.

Group Statistics- T-Test

	group	N	Mean	Std. Deviation	Std. Error Mean
Tensile	centration	5	7.995	3.091	1.382
Strength	GIC	5	1.133	0.981	0.439

Table 2. Statistical analysis of Tensile strength.

Independent Samples Test

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Com-pressive strength	Equal variances assumed	8.954	0.017	4.731	8	0.001	6.863	1.450	3.518	10.207
	Equal variances not assumed			4.731	4.798	0.006	6.863	1.450	3.086	10.639

Table 3. Compressive strength analysis - T-Test.

Group Statistics

	group	N	Mean	Std. Deviation	Std. Error Mean
Compressive	centration	6	1.5083	.26947	.11001
Strength	GIC	6	.2536	.02420	.00988

Table 4. Compressive strength statistical analysis- Independent samples test.

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	T	Df	Sig. (2-tailed)	Mean Dif-ference	Std. Error Difference	95% Confidence Interval of the Dif-ference	
									Lower	Upper
Com-pressive strength	Equal variances assumed	42.135	0	11.36	10	0	1.255	0.110	1.009	1.501
	Equal vari-ances not assumed			11.36	5.081	0	1.255	0.110	0.972	1.537

diffusion- controlled process [44].

Highest compressive strength is seen in glass ionomers containing 3 wt% of fluoro apatite nanoparticles [23]. Properties of glass ionomer cement are influenced by the concentration of the poly-acid, powder liquid ratio, age of the specimen and particle size of glass powder [40]. The main advantage of glass ionomer cement is fluoride release, for a longer period of time by initial rapid release and lower level diffusion based release [2, 45].

The addition of bioactive glass to the glass ionomer improved the

biocompatibility of glass ionomer to fibroblasts [46]. The quality of glass ionomer increases with time and adhesion of glass ionomer to tooth structure is not technique sensitive [47].

Glass ionomer and amalgam have been used as a filling material, even though there is a high demand for other new alternative material because of few disadvantages [48]. There are few disadvantages of glass ionomers like low resistance to abrasion and wear, lack of strength, low flexural strength, very brittle and prone to bulk fracture [49]. Dental amalgam also has disadvantages like unaesthetic, mercury toxicity, mercury vapour release etc [50].

Cention-N belongs to the material group of Alkasilites and it is a tooth colored filling material. During acid attacks, the alkaline filler increases the release of hydroxide ions to regulate the PH. The release of fluoride and calcium ions help in remineralization of dental enamel. The initiator system enables good chemical self-curing [51].

Few of the filler content of this material such as barium aluminium silicate glass, calcium barium aluminium fluorosilicate glass and calcium fluoro silicate glass are responsible for the strength and fluoride calcium ion release during acid attacks.

Advantages of this material are, stronger than glass ionomer cement, more esthetic than amalgam and glass ionomer cement. It is indicated in class 1, class 2 cavity. This material can be used in two ways either with optional light curing with 400-500 nm, with or without an adhesive. For atraumatic restorative technique, it can be used with adhesive.

Toras FM et al study stated that the GC Fuji II LC have the highest diametral tensile and compressive strength values when compared with nano filled glass ionomer and conventional glass ionomer cement [23]. Sri Chandana et al study stated that when conventional glass ionomers are added with antibiotics, the compressive strength is decreased [52]. McCabe et al study stated that the glass ionomer cements can be mechanically evaluated by compressive strength [53].

Mallmann et al study stated that compressive strength is higher in larger specimens of resin modified glass ionomer cement [54]. Garcia et al said that the type of nano filled particle influences the compressive strength [55]. Higher diametral tensile strength is seen in nano filled GIC than conventional GIC while resin modified GIC is scored better than both nano filled and conventional materials [56]. Cention-N is found to have least microleakage when compared with flowable composite and GIC [57].

Conclusion

Within the limitations of the study, the Cention showed better compressive and tensile strength. Hence Cention -N can be used as a restorative material for better clinical outcome and longevity of the restoration.

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