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Comparative evaluation of compressive strength of Cention N with Zirconomer: An In vitro study.

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Abstract

AIM:-To Compare Compressive Strength of Cention N with Zirconomer.

Materials and Methods: Two commercially available brands of restorative materials were used i.e. Cention N (Ivoclar Vivadent) and Zirconomer (Shofu) both available as powder and liquid.

Customized cylindrical moulds of dimension: of height 5-7mm and diameter of 3-5mm were used to fabricate 10 samples each of Cention N and Zirconomer. samples were prepared by mixing powder and liquid as per manufacturers instructions and were packed into the moulds until completely filled and tested for evaluation of compressive strength using universal testing machine (UTM).This was connected to a load measuring cell, which continuously recorded the load applied to the samples at a crosshead speed of 0.50-1.00 mm per minute till the samples fractured.

Statistical Analysis: Statistical analysis was done using t-test.

Results: Highest compressive strength was recorded by Cention N as compared to Zirconomer**.**

Conclusion: Within limitations of this studies it can be concluded that Cention N can be used as a superior restorative alternative to Zirconomer for posterior teeth since its compressive strength was found to be significantly higher.

Keywords: Cention N, Zirconomer, compressive strength.

Introduction

Good compressive strength is one of the major properties which a direct posterior restorative material must possess in order to ensure the longevity of the restoration. Dental Amalgam has been used since ages for this purpose, but, its possible toxicity due to mercury release and poor aesthetics are its major drawbacks.

Glass Ionomer Cement (GIC) has wide range of applications in dentistry. But, its relatively high solubility, low abrasion resistance and questionable compressive strength are the major concerns. The restorative material for posterior teeth should have adequate compressive strength to resist intraoral forces. It is said that compressive strength is the most important mechanical property of restorative materials.[1]In last four decades there have been tremendous improvements and innovations in development of more constant composite materials. These developments were mainly focused on reduction of polymerisation shrinkage and improving mechanical properties. But these materials have limitations that they cannot be used as posterior restorative materials where isolation is poor and wear is high.

Cention N (Ivoclar Vivadent) is a recently introduced tooth coloured, restorative filling material for bulk placement in retentive preparations with or without application of adhesive. It is an "Alkasite'' which is a new category of filling material, like compomer and is essentially a subgroup of composite resin. Cention N is a Urethane Dimethacrylate (UDMA) based, self-curing powder/liquid restorative with optional light curing. The light compromises of Dimethacrylates and initiators, while the powder contains various glass fillers capable releasing fluoride, calcium, hydroxide ions.[2]

There are continuous advancements in Glass ionomer cements to fill the gap between traditional glass ionomer cements and traditionally used composite resins. Zirconomer (Shofu) as per manufacturer's are strong and safe replacements imbibing the strength of amalgam and various advantages of glass ionomers. The structural integrity is attributed to inclusion of zirconia fillers in glass components there by imparting better strength, [3] Zirconomer improved developed as a reliable and durable self-adhesive tooth coloured zirconia reinforced posterior bulk fill restorative material comprises of nano- sized zirconia fillers to enhance aesthetic properties and superior handling characteristics.[4]The success of any material is assessed by its longevity and biocompability in oral environment. The objective of this in vitro study was to compare and evaluate the compressive strength of Cention N with Zirconomer.

Materials And Methods

Two commercially available restorative materials were used viz. Cention N (Ivoclar Vivadent) and Zirconomer (Shofu) [Figure 1, 2]. Customized cylindrical moulds of dimension 6±1mm (Height) x 4±1mm (Diameter) [4] were used to fabricate 10 samples each of Cention N (Ivoclar Vivadent) and Zirconomer (Shofu) [Figure 3, 4]. These samples where tested for evaluation of compressive strength using Universal testing machine (UTM) [Figure 5]. This was connected to a load measuring cell which continuously recorded the load applied to the samples at a crosshead speed of 0.75± 0.25 mm per 1_minute till the samples factured [Figure 6].[1]

Fig 1: Cention N (Ivoclar Vivadent)

Fig 2: Zirconomer (Shofu)

Fig 3: Ten samples each of Cention N (Ivoclar Vivadent)

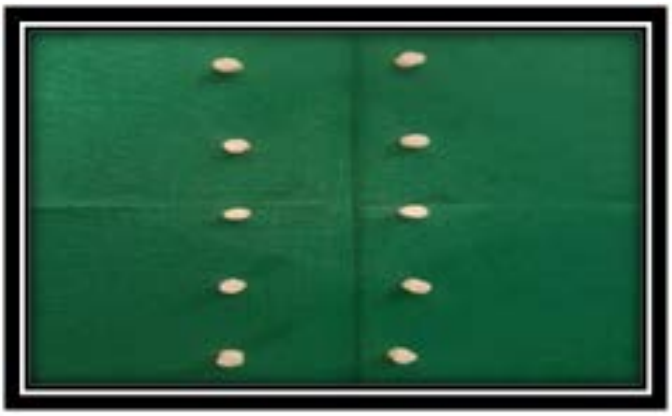

Fig 4: Ten samples each of Zirconomer (Shofu)

Fig 5: Universal testing machine (UTM)

Fig 6: Samples subjected to load in UTM

Results

The values were recorded and subjected to statistical analysis for comparison of compressive strength (Mpa) between two materials using SPSS software [Table 1, 2]. The Null hypothesis is that there is no significant difference in compressive strength (Mpa) of two materials. Alternate hypothesis was that there was significant difference in mean compressive strength (Mpa) of two materials, Independent T-test was used. The P value was compared with level of significance. If P<0..5, The alternate hypothesis was accepted and concluded that there is significant difference in mmean compressive strength between two materials was found to be significant (P<0.001) [Figure 7].

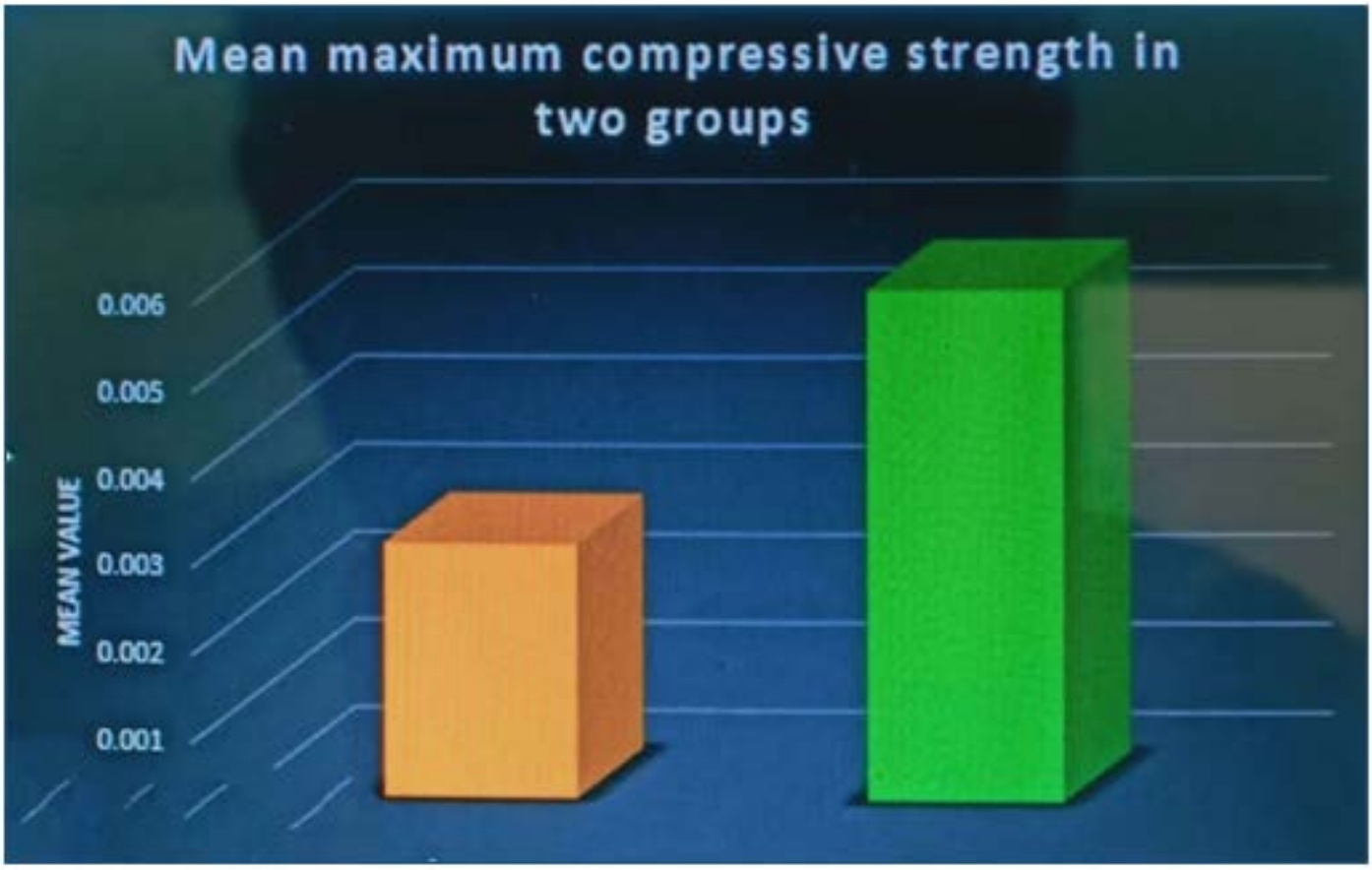

Fig 7: Comparison of compressive strength (MPa) between two materials orange bar indicating Zirconomer and green bar indicating Cention N.

Table 1: Mean compressive strength of two materials.

	N	Mean	Std. Deviation	Std. Error	95% confidence interval for mean		Minimum	Maximum
					Lower bound	Upper bound		
1	10	390	99.44	27.88	328.36	451.63	300.66	480.86
2	10	790	391.43	123.7890.308	547.38	1032.61	530.62	1022.60
Total	20	1180	403.87		1003	1357	300.66	1022.60

Table 2: Difference in mean compressive strength of two materials.

Group	N	Range	Mean ±SD	SEM	't'value	P value
Zirconomer	10	300.66 – 480.86	390 ± 61.63	27.88	1.734	<0.001**
Cention N	10	530.62 – 1032.61	790 ± 242.61	123.78		
**p<0.001;highly significant						

Discussion

Zirconomer defines a new class of restorative glass ionomer that promises strength and durability of amalgam with protective benefits of glass ionomer while completely eliminating hazards of mercury.

The inclusion of Zirconia fillers in the glass component of Zirconomer reinforces the structural integrity of the restoration and imparts superior mechanical properties for the restoration of posterior load bearing area where conventional restorative of choice is amalgam.

Combination of outstanding strength, durability and sustained fluoride protection deems it ideal for permanent posterior restoration in patients with caries incidence.

Glass component of this high strength glass ionomer undergoes finely controlled micronization to achieve optimum particle size and characteristics. The homogenous incorporation of zirconia particlesin the glass component further reinforces the material for lasting durability and high tolerance to occlusal load. The polyalkenoic acid and the glass component have been specially processed to impart superior mechanical and handling qualities to this high strength glass ionomer.

Cention N is an "alkasite" restorative. Alkasite refers to a new category of filling material which utilizes an alkaline filler, capable of releasing acid-neutralizing ions. Cention N is a tooth-coloured, resin based, self-curing, basic (alkaline) filling material for direct restorations with optional additional light-curing property. Cention N is available in the tooth shade A2.

Composition of Cention N: available as powder and liquid. POWDER – consists of filler particles and other initiator components.

LIQUID – consists of four different dimethacrylates monomers and initiators.

- Urethane dimethacrylate (UDMA) - main component of monomer matrix and has no hydroxyl side groups i.e. its hydrophobic and exhibits low water absorption.
- Tricyclodecan-dimethanol dimethacrylate (DCP) - low viscosity, difunctional monomer which initiates hand mixing of Cention N.
- Tetramethyl-xylylen-diurethane dimethacrylate

(Aromatic aliphatic-UDMA) - partially aromatic urethane dimethacrylate is a hydrophobic, high-viscosity crosslinker which combines the favourable properties of aliphatic (low tendency to discolour) and aromatic (stiffness) diisocyanates.

- Polyethylene glycol 400 dimethacrylate (PEG-400 DMA) - enhances the flowability of Cention N.

Polymerization technology in Cention N

Self-cure mechanism – liquid part of Cention N has hydroperoxide and the standard filler in the powder is coated with the other initiator components. Hydroperoxide rather than conventional benzoyl peroxide imparts greater temperature-resistance i.e. it is less sensitive to heat, which is an important factor regarding storage stability. Thiocarbamide rather than amine also improves the colour stability of the product.as colour stability of a material decreases with increasing amine content.

Light-cure (dual-cure) mechanism – it has photoinitiator Ivocerin and an acyl phosphine oxide initiator for optional light-curing. Ivocerin, a dibenzoyl germanium derivative is an amine free initiator.

This *in vitro* study was done to evaluate the compressive strength of Zirconomer and a newer material i.e. Cention N. Both the materials are esthetically appealing in nature with Cention N manufacturers claiming it to have high compressive strength, so can be used as a posterior restorative material. This is the reason that Zirconomer indicated for posterior restorations was used in comparison to Cention N in this study.

Conclusion

Within the limitations of study it can be concluded that Cention N can be used as a superior alternative to Zirconomer for posterior restoration since its compressive strength was found to be significantly superior.

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