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Cention-N: A Review

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Abstract

An ideal material used for restoration should be adhesive, tooth coloured, resistant to wear, nontoxic and biocompatible with the tissue. Various direct filling materials are available in dentistry such as amalgam, glass ionomer cement (GIC) and esthetic composite material, each of them having its advantages and disadvantages hence proper selection of restorative materials will help for its clinical success. Cention-N is a new alkasite, bulk filling, basic tooth-coloured, radiopaque material introduced by Ivoclar Vivadent in 2016. It is a self-curing filling material with optimum light curing. It consists of an isofiller which reduces the polymerization shrinkage and utilizes an alkaline filler which is capable of releasing acid-neutralizing ions. It presents with good mechanical properties and long-term stability due to the cross-linking of methacrylates in the final restoration hence it can be used in load-bearing areas. Cention-N can be efficiently used in pediatric patients as it is moisture resistant and releases fluoride which helps in remineralizing teeth thus preventing secondary caries. The use of caution is restricted in the anterior tooth as it is available only in one shade.

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INTRODUCTION

Dental caries is an age-old, most prevalent oral disease among children which has been the blight of illness in the oral cavity. The prevalence of caries is diminishing in developed countries, surging in less developed countries and is an outbreak in countries with emerging economies and if left untreated, dental caries will progress to unnecessary consequences such as pain and infection. Dental restorations have been used to re-establish the tooth structure integrity, reducing aggravated pain in deep dentinal lesions and helping in controlling the caries disease process [1][2][3].

Over the past 100 years, innumerable changes have been developed in the field of restorative dentistry shifting the concept from "extension for prevention" to "restriction with conviction". A plethora of direct filling materials have been introduced in modern dental practice ranging from amalgams to glass-ionomer cement (GIC) and composites [4].

Amalgam introduced in 19th century is an alloy which contains mercury as one of its constituents. In practice, dental amalgam is a technique-insensitive material, and its long-term clinical performance in load bearing situation, strength and low cost makes it exceptional.[5] However, its

relatively high coefficient of thermal expansion, the need for matrix band during condensation, the unesthetic appearance, the concern for mercury toxicity and its inability to bond to tooth structure leading to microleakage led to the development of tooth-coloured restorative materials which can bond to enamel and dentin [5][6][7].

The most frequently used alternative to amalgam is glass ionomer cement (GIC) in modern dentistry [8], with the advantage of chemical and physical bonding to hydrophilic tooth structure, biocompatibility with pulp and gum tissue, superior aesthetics, and long-term fluoride release providing cariostatic effect but has the disadvantage of slow setting rate, low fracture toughness, surface roughness with high erosion, susceptibility to moisture contamination, dehydration during initial phase of setting, and poor wear resistance [9][10][11].

The advent of new composite restorative materials, together with new adhesives has brought humongous benefits–notably in terms of aesthetics and advancement towards minimally invasive dentistry. The reasons for their worldwide acclaim are their excellent esthetic, mechanical and biological properties along with minimal tooth preparation and bonding with the tooth structure. However, resin composite comes with a number of shortcomings such as technique sensitive, polymerization shrinkage leading to marginal discrepancies, secondary caries, postoperative pain and sensitivity [12][13].

The quest for the development of ideal restorative material led to the inception of new alkasite based tooth coloured filling material Cention-N by Ivoclar Vivadent in 2016 (**Figure 1**). Alkasite refers to a new category of restorative material, which like ormocer or compomer materials is fundamentally a subgroup of the composite material class. According to the VITA scale, it is an anticariogenic material in A2 color tone, radiopaque and available in powder and liquid form in the market [14].

Figure 1 Cention-N kit

Composition of Cention-N:

Liquid

The organic monomer part of Cention N is found in liquid. It consists of four different methacrylates namely urethane dimethacrylate (UDMA), Tricyclodecan-dimethanol dimethacrylate (DCP), an aromatic aliphatic UDMA and Polyethylene glycol 400 dimethacrylate (PEG-400 DMA) which represent 21.6wt % of final mixed material (**Table 1**). In addition to dimethacrylates, liquid contains initiators, catalysts and other additives [15].

Powder:

The powder component of Cention N mainly consists of fillers with particle size between 0.1-.35 micrometer (**Table 2**). All the fillers except ytterbium trifluoride are surface modified to ensure wettability by the liquid incorporation into polymer matrix and make them resistant to degradation as well [16].

Manipulation:

Cention N is mixed on paper pad with plastic spatula. One scoop of powder is used per 1 drop of liquid, corresponding to a powder/liquid weight ratio of 4.6 to 1. When the powder and liquid are mixed, Cention N constitutes inorganic filler of 78.4% weight and alkaline glass of 24.6% weight in the final material [17].

Cention N, a bulk restorative material can be cured by two mechanisms as discussed below:

Self-cure mechanism [15]: Liquid part of Cention N has hydroperoxide and the standard filler in the powder is coated with the other initiator components. The copper salt accelerates the curing reaction by redox catalysis. An important factor in stability of Cention N is the use of Hydroperoxide rather than Benzoyl peroxide since the former has the property of temperature resistance. Thiocarbamide is used which provide better color stability to the material (**Figure 2**).

Light cure (Dual cure) mechanism: After mixing, self-curing process is initiated by optimal light curing gun. Cention N contains photo initiator Ivocerin® and an acyl phosphine oxide initiator for optional light-curing with a dental polymerization unit. Ivocerin, is a dibenzoyl germanium derivative and amine free, Norrish Type I initiator which requires just one component for radical formation.

Table 1 Cention-n's Liquid Composition

Components	Weight in %	Function
UDMA (Urethane dimethacrylate): main component DCP (Tricyclodecan-dimethanol dimethacrylate) Aromatic aliphatic UDMA (Tetramethylxylylen-diurethane dimethacrylate) PEG-400 DMA (Polyethylene glycol 400 dimethacrylate)	95-97 %	Provides the basic mechanical properties. Improves the mechanical and handling properties of material Increases elasticity and provide colour stability. Maintains consistency of material
Additives	1-2%	--
Initiator (hydroperoxide – self cure)	2-3%	Aids in Self-curing
Stabilizer	<1%	--

Table 2 Cention-n's Powder Composition

Components	Weight (%)	Function
Calcium fluorosilicate glass (alkaline)	25-35	Ion release F^-, Ca^{2+}, OH^-
Ba-Al silicate glass	20-30	Strength
Ca-Ba-Al fluorosilicate glass	10-20	Strength and fluoride release
Ytterbium trifluoride	5-10	Radioopacity
Isofiller (Copolymer prepared with Tetric N ceram technology)	15-25	Shrinkage stress reliever
Initiator (a copper salt & thiocarbamide- self cure) (Ivocerin and acyl phosphine oxidephoto initiator)	<1	Initiator
Pigment	<0.1	

Incoming photons from the curing light are absorbed by the initiator Ivocerin, producing two radicals later which subsequently react with monomer to produce a polymer network. (**Figure 3**).

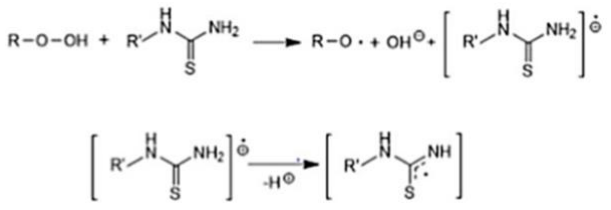

Figure 2 Self-cure mechanism of cention N: Radical formation

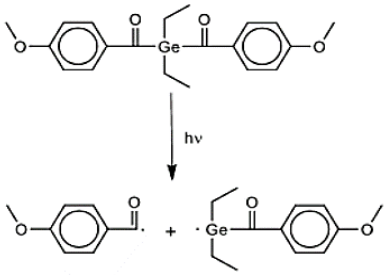

Figure 3 Light-cure mechanism of Cention N with Ivocerin

When light-cured, the light is only able to penetrate layers of up to 4mm in thickness, therefore in cavities deeper than 4mm, Cention N must be self-cured for 4 minutes.

Mixing time: 45-60 seconds

Working time: 2.5 minutes

Overall setting time: 4 minutes

Mechanism of action:

After mixing the final material contains 24.6% weight of alkaline glass and these release fluoride (F-) ions - comparable to those released by traditional glass ionomers. When the final mix of Cention N comes in contact with the tooth surface the hydroxide ion of the hydroxyapatite crystal can be exchanged by the fluoride released from the Cention N thus forming fluorapatite. It also aids in preventing demineralization by releasing hydroxide and calcium (OH- and Ca2+) ions hence creating an environment which reduces excess acidity caused by the cariogenic bacterial activity [18].

Properties

Shrinkage stress reliever: polymerization shrinkage in Cention N is minimized due to the presence of Isofiller which is partially functionalized by silanes, acts as a unique shrinkage stress reliever. As the elastic modulus of isofiller is low (10Gpa) it acts as spring (expanding slightly as the forces between the fillers grow during polymerisation) amongst the glass fillers which have a higher elastic modulus of 71 GPa. It holds onto the cavity wall and also forms a chemical bond between the fillers and matrix thus eventually reducing both volumetric shrinkage and shrinkage stress .

Radiopacity: Ytterbium fluoride provides high radiopacity to Cention N and is capable of releasing fluoride and also facilitates the diagnosis of secondary caries [19].

Translucency: Cention N is fairly a translucent material with a transparency of 11 % as compared to other glass ionomer products [20].

Flexural strength: Flexural strength is the ability of the material to withstand bending forces applied perpendicular to its longitudinal axis. Mean flexural strength value of 101.7 MPa for self-cured Cention N and 107.4 MPa for dual-cured Cention N .

Compressive strength: Compressive strength is defined as the maximum compressive stress that a plastic specimen can withstand until it ruptures or deforms by a certain percentage. Mean compressive strength value of 151.40 MPa for self-cured Cention N and 157 MPa for dual-cured Cention N [21].

Modulous of elasticity: defined as the ratio of the stress in a body to the corresponding strain. It is also called as coefficient of elasticity, elastic modulus. For Cention N the modulous of elasticity is 13 Gpa.

Clinical Application:

1. Due to the higher flexural strength and minimum polymerization shrinkage, it is an ideal material for higher stress bearing area such as large class I and II [19].
2. Cention N can also be used in Class III, IV, V along with etching and application of universal bonding agent. Cention N require retentive cavity preparation and unlike composite it can be placed in a single increment since it has self-curing property.
3. Cention N can be used as a suitable alternative to GIC for restoring deciduous teeth with or without adhesive depending on the retentive nature of cavity preparation. In pediatric patients or in the patients where isolation is difficult, curing process can be accelerated by using light of 400-500 nm wavelength.

Advantages of Cention N

Cention N, a recently introduced tooth coloured material offers a number of advantages which makes it comparable and better than other material used in restorative dentistry.

It has better marginal integrity, reduced incidence of discolouration, secondary caries, cracking and hypersenstivity due to the presence of isofiller and PEG-400 DMA. The former reduces the polymerization shrinkage and the later enhance the adaptability of Cention N to smear layer thus reducing the gap between tooth and restoration.

Cention presents with good mechanical properties and long-term stability due to the cross linking of dimethacrylates in the final restoration.

Glass fillers present in the powder component of Cention N result in less wear and more favorable polishing properties i.e., low surface roughness and high gloss hence making it an aesthetic restorative material [19].

The final mix of Cention N releases a number of ions such as F-, OH-, Ca2+ when the pH-value is acidic thereby prevent demineralization of the tooth substrate and secondary caries.

Cention N is quick and easy to use without special equipments and is not moisture and technique sensitive which makes it a better choice for pediatric patients.

Disadvantages of Cention N

Although Cention N is packed with a number of benefits, one of the disadvantages of Cention N is that it comes only in one shade which restricts its use as an anterior restorative material.

Conclusion

In the last four decades, there have been tremendous improvements and innovations in the field of restorative dentistry leading to the

introduction of newer restorative materials. One of such recently introduced material is Cention N belonging to alkasite group of restorative material. The supremacy of Cention N lies in its properties such as reduced polymerization shrinkage, strong mechanical properties, aesthetics, good feasibility and its ability to release fluoride. As there is demand in tooth-coloured restorations, this material of choice can be a cost-effective way to deliver a high-quality predictable restoration and consume less time.

Ethical Approval

No ethical approval was necessary for this study.

Author Contribution

All authors made substantial contributions to the conception, design, acquisition, analysis, or interpretation of data for the work. They were involved in drafting the manuscript or revising it critically for important intellectual content. All authors gave final approval of the version to be published and agreed to be accountable for all aspects of the work, ensuring its accuracy and integrity.

Conflict of Interest

The authors declare no conflict of interest, financial or otherwise.

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REFERENCES

[1] Iftikhar N, Srivastava B, Gupta N, Ghambir N. A comparative evaluation of mechanical properties of four different restorative materials: an in vitro study. International Journal of Clinical Pediatric Dentistry. 2019 Jan;12(1):47.

[2] Gift HC, Reisine ST, Larach DC. The social impact of dental problems and visits. American journal of public health. 1992 Dec;82(12):1663-8.

[3] Rodrigues JA, Casagrande L, Araújo FB, Lenzi TL, Mariath AA. Restorative materials in pediatric dentistry. InPediatric Restorative Dentistry 2019 (pp. 161-167). Springer, Cham.

[4] Frencken JE, Peters MC, Manton DJ, Leal SC, Gordan VV, Eden E. Minimal intervention dentistry for managing dental caries–a review: report of a FDI task group. International dental journal. 2012 Oct 1;62(5):223-43.

[5] Anusavice KJA. Harrison RH. Philips' Science of Dental Materials 11th edition. Saunders, Philadelphia, 1992. p. 370-374

[6] AFFAIRS AC. Dental amalgam: Update on safety concerns. The Journal of the American Dental Association. 1998 Apr 1;129(4):494-503.

[7] Bharti R, Wadhwani KK, Tikku AP, Chandra A. Dental amalgam: An update. Journal of conservative dentistry: JCD. 2010 Oct;13(4):204.

[8] Qvist V, Laurberg L, Poulsen A, Teglers PT. Longevity and cariostatic effects of everyday conventional glass-ionomer and amalgam restorations in primary teeth: Three-year results. J Dent Res 1997;76:1387-96.

[9] Hübel S, Mejàre I. Conventional versus resin-modified glass-ionomer cement for Class II restorations in primary molars. A 3-year clinical study. Int J Paediatr Dent 2003;13:2-8

[10] McCaghren RA, Retief DH, Bradley EL, Denys FR. Shear bond strength of light-cured glass ionomer to enamel and dentin. Journal of Dental Research. 1990 Jan;69(1):40-5.

[11] Philips R, Alph W. The glass ionomer cements. Journal of the American Dental Association. 1990;120:19-20.

[12] Parolia A, Adhauliya N, de Moraes Porto IC, Mala K. A comparative evaluation of microleakage around class V cavities restored with different tooth colored restorative materials. Oral Health Dent Manag. 2014 Mar 1;13(1):120-6.

[13] Chan KH, Mai Y, Kim H, Tong KC, Ng D, Hsiao JC. Resin composite filling. Materials. 2010 Feb 19;3(2):1228-43.

[14] Mazumdar P, Das A, Das UK. Comparative evaluation of microleakage of three different direct restorative materials (silver amalgam, glass ionomer cement, Cention N), in class II restorations using stereomicroscope: an in vitro study. Indian Journal of Dental Research. 2019 Mar 1;30(2):277.

[15] Jayaraj D, Simon EP, Kumar MR, Ravi SV. Cention N: A review. Dental Bites. 2018 Oct;5(4):14-21.

[16] Naz F, Khan AS, Kader MA, Al Gelban LO, Mousa NM, Asiri RS, Hakeem AS. Comparative evaluation of mechanical and physical properties of a new bulk-fill alkasite with conventional restorative materials. The Saudi Dental Journal. 2021 Nov 1;33(7):666-73.
[17] Motevasselian F, Kermanshah H, Rasoulkhani E, Özcan M. Comparison of microleakage of an alkasite restorative material, a composite resin and a resin-modified glass ionomer. Brazilian Journal of Oral Sciences. 2021 Jun 18;20:213981
[18] Paul S, Raina A, Kour S, Mishra S, Bansal M, Sengupta A. Comparative evaluation of fluoride release and re-release and recharge potential of Zirconomer Improved and Cention. Journal of Conservative Dentistry: JCD. 2020 Jul;23(4):402.
[19] Mohamed Abubacker MH. Comparison of Clinical Efficiency of Cention-N (With and Without Adhesive) and Composite Resin (Tetric N Ceram Bulk Fill) as Class 1 Restorations: A Randomized Controlled Clinical Trial (Doctoral dissertation, Tamil Nadu Government Dental College and Hospital, Chennai).
[20] Kaul S, Rawal S, Kansal V. Introduction of alkasite restorative in pediatric dentistry: Will it perish or purge?. International Journal of Oral Health Sciences. 2022 Jul 1;12(2):54.
[21] Fousiya K, Balagopal VR, Suresh KJ, Kumaran P, Xavier AM, Menon MM. Comparative Evaluation of Compressive Strength and Flexural Strength of Self-cured Cention N with Dual-cured Cention N: An In Vitro Study. International Journal of Clinical Pediatric Dentistry. 2022 Apr 1;15(2):210-4.