Review article | *International Journal of Dental Materials 2023;5(1)* | ISSN:2582-2209

An update on Cention N: An aesthetic direct bulk-fill restorative material

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Article History

Received *15th March 2023*

Accepted *5th April 2023*

Available online *10th April 2023*

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DOI: *http://dx.doi.org/10.37983/IJDM.2023.5104*

Abstract

The demand for aesthetic restorative materials has increased in recent years. Glass ionomer cements (GIC), their modifications, and various composite restorative materials have been developed as direct tooth-coloured restorative materials. However, none of these materials can be compared to the properties of amalgam restorative materials. Recently, a new direct tooth-coloured, bulk-fill, and aesthetic restorative material, Cention N, was developed. This material is easy to handle and has properties similar to those of type-IX GIC. This article provides an update on the composition and properties of Cention N restorative material.

Keywords: Alkasite, Cention N, Ion-leachable silicate glass, PEG-400 DMA, Isofiller, Ivocerin.

1. Introduction

Dental composites are replacing mercury-containing dental amalgam restorations as the preferred restorative material, mostly because of their intrinsic aesthetic appeal and long-standing toxicity concerns [1]. Their translucency and polishability rapidly increased in the first decade after their introduction and continued to increase in popularity thereafter [2,3]. However, the strength and wear resistance of these composites are poor compared with those of dental amalgam restorative materials.

Composite resins allow for minimally invasive or even no tooth preparation while still offering excellent possibilities for aesthetics and a reasonable lifespan. They are notable as major breakthroughs in modern biomaterial research. However, earlier versions of these resin composite materials had a few drawbacks, such as poor handling characteristics and polymerization shrinkage [1,4]. This led to experiments with these resins, and various types and volume fractions of filler particles were added. Consequently, macro-filled, small-filled, micro-filled, and hybrid composites have been developed [5]. Even though these materials improved over earlier versions, they did not meet expectations.

Recently developed composite materials include packable composites, organically modified ceramic oligomers (ORMOCER), fiber-reinforced composites (FRC), flowable composites, self-healing or self-repairing composites, stimuli-response materials (Smart Materials), Bell Glass HP, self-adhering composites, art glass, nanocomposites, calcium phosphate nanoparticle-reinforced composites, and bioactive glass nanoparticle composites [5,6]. Newer composite resins have been developed to improve these properties. Cention N is a recently developed, direct restorative material. This article reviews the composition and properties of a recently developed Cention N restorative material.

Cention N was introduced by Ivoclar Vivadent (Schaan, Liechtenstein) in 2016. It is an aesthetic restorative material with high flexural strength. The term Cention was derived from the Latin word “centum” meaning hundred and “cention” which means a hundred ions [7]. As the name implies, this material can release acid-neutralizing ions. Cention N is a member of the alkasite group, which is a subgroup of composites, such as compomers or ormocers. Alkaline fillers have been used in Cention N [7-9]. Cention N has aesthetics equivalent to those of glass ionomer cement (GIC), and its strength is comparable to that of amalgam restoration [8-10].

2. Composition of Cention N

Cention N is available in the form of powder and liquid (Figure 1). Unlike conventional composites, this material does not contain Bis-GMA, HEMA, or TEGDMA [7,8,11,12].

The powder contains ion-leachable glass silicates, including surface-modified calcium-barium-aluminum-fluorosilicate glass filler and an alkaline calcium-fluoro-silicate glass filler with a particle size ranging between 0.1- 35 µm. The liquid mainly contains organic dimethacrylate monomers, including Urethane dimethacrylate (UDMA), etc., along with the catalysts and other additives. The compositions of both the powder and liquid are listed in Table 1.

Figure 1. Cention N powder and liquid

Table 1. Composition of Cention N

Ingredient	Functions
Powder	
Calcium-fluoro-silicate glass	• Acts as a filler • Improves strength • Releases F^-, Ca^{2+}, OH^- ions
Barium-Alumino-silicate glass	• Acts as a filler • Improves strength • Releases fluoride ions
Ytterbium trifluoride	• Acts as a filler • Radiopacifier
Isofiller (Copolymer)	• Acts as a shrinkage stress reliever
A copper salt & thiocarbamide-self cure Initiator or Ivocerin and acyl phosphine oxide-photoinitiator	• Acts as an initiator and helps in the polymerization process
Pigment	• Added to provide appropriate shade
Liquid	
Urethane dimethacrylate (UDMA),	• Main reactive dimethacrylate of the resin matrix • High viscous resin • Exhibits good mechanical properties • Hydrophobic resin and exhibits lower water sorption
Tetramethyl-xylylendiurethane dimethacrylate,	• Hydrophobic in nature • Provides more viscosity to the resin matrix
Tricyclodecan-dimethanol dimethacrylate (DCP),	• Diluent resin added to reduce the viscosity
Polyethylene glycol 400 dimethacrylate (PEG-400 DMA)	• Hydrophilic resin • Improves the flowability of the resin • Also, helps in wetting the natural tooth and adapts well to the smear layer
Initiator (hydroperoxide – self cure)	• Helps in the polymerization process
Stabilizer	

3. Setting reaction

Cention N is a resin material that is formed by both self-cure polymerization and light-cure (dual-cure) polymerization.

In self-curing systems, free-radical formation and redox catalysis with copper ions occur upon mixing the powder and liquid. The initiator and activator systems used in the self-cure mechanism were copper salts, peroxides, and thiocarbamides. Copper salts accelerate the curing reaction via redox catalysis. The Cu ions undergo oxidation with hydroperoxide and reduction with thiocarbamide. An initiator molecule such as hydroperoxide is more stable than benzoyl peroxide, a common initiator in conventional resins, and imparts greater temperature resistance. Thiocarbamide provides more color stability to the resin than the activator present in conventional resins, which use an amine accelerator [7,12].

In the case of the dual-cure mechanism, Cention N powder contains photoinitiators, such as Ivocerin® and acyl phosphine oxide, which are responsible for the light-curing mechanism. Ivocerin® is an amine-free dibenzoyl germanium derivative and Norrish type-I initiator [7]. Norrish Type I initiators require only one component for free-radical formation, unlike in conventional light curing, where camphoroquinine is used as an initiator, which requires two components for free-radical formation. Upon mixing the powder and liquid, a self-curing mechanism was initiated, followed by a light-curing mechanism upon exposure to the appropriate wavelength of the light source [7,12].

4. Properties

4.1 Biological properties

Cention N exhibits cytotoxicity owing to the release of unreacted monomers and various ions and is comparable to that of dental composites [13]. Only unreacted monomers may leach out from dental composites, whereas GIC releases certain ions that are responsible for their cytotoxicity. However, this alkasite material releases both unreacted monomers and ions; therefore, it has a slightly more cytotoxic effect than composites. Capan *et al.* found that alkasite has acceptable cytotoxicity on dental pulp stem cells after 72 hours but was more cytotoxic than high-viscosity GIC and a composite that demonstrated similar cytotoxicity. However, both methyl-thiazole-diphenyl-tetrazolium MTT (Sigma Aldrich) and xCELLigence (RTCA-DP, ACE) cytotoxicity assays yielded similar cytotoxicity results for the three materials [13].

Cention N releases certain ions, which help prevent demineralization of the tooth structure [14]. The release of ions depends primarily on the pH of the oral environment. Cention N, especially self-curing, releases significantly large amounts of ions in acidic environments [14]. Cention N may have reacted more aggressively in an acidic environment, resulting in faster deterioration of the surface-resistant layer compared to other ion-releasing restorative materials, thus exposing the matrix to increased release of fluoride ions [15]. However, Cention N released significantly lower amounts of fluoride ions than GIC at different time intervals at neutral pH. The reason for the decrease in fluoride in Cention N could be the type and amount of the filler loading.

A relatively high filler content was observed in GIC (99.9%) [16]. The fillers in Cention N include barium aluminum-silicate glass filler, ytterbium trifluoride, isofiller (Tetric N-Ceram technology), calcium barium aluminum fluorosilicate glass filler, and calcium fluorosilicate (alkaline) glass filler [15]. Among the 78.4% filler content, only 24.6% of the final material was responsible for fluoride ion release [15]. In addition, the fillers in Cention N are surface modified, thus becoming resistant to degradation and may lead to the release of a smaller amount of fluoride ions [14].

Similar to conventional GIC, Cention N also exhibits anticariogenic activity owing to the release of significant amounts of fluoride ions [17], which reduce the solubility of enamel by the formation of fluorapatite crystals [7]. Calcium fluoride layer formation may also be observed over the tooth structure, which helps inhibit caries formation and acts as an ion reservoir [18]. Fluorides also act against certain bacteria, such as Streptococcus mutans, by impairing glucose uptake and glycolysis. Furthermore, alkaline glass in Cention N releases hydroxide and calcium (OH- and Ca2+) ions, which are responsible for preventing the demineralization of natural teeth by neutralizing the acidic environment created by cariogenic bacterial activity [7,18].

4.2 Physical Properties

4.2.1 Marginal leakage and Shrinkage stresses

Cention N is a bulk-fill restorative material that exhibits low curing shrinkage and stress. Curing shrinkage leads to marginal gap formation, which promotes microleakage, marginal discoloration, crazing, and dentin hypersensitivity. Numerous researchers have reported that Cention N demonstrates the lowest microleakage compared to GIC [19, 20] and composites [20].

The organic matrix/inorganic matrix ratio, type of filler, and type of monomer used significantly influenced the volumetric shrinkage. Cention N is composed of a unique isofiller partially functionalized by silanes, which significantly reduces the shrinkage stresses to a greater extent. During polymerization, the polymer chains crosslink with the silane-treated fillers, generating stresses between the filler particles and the cavity walls [15,19,21]. These stresses were influenced by the volumetric shrinkage and elastic modulus of the resin material. However, Cention N has a low elastic modulus (10 GPa) and acts as a shrinkage stress reliever by acting as a spring (slightly expanding as the forces between the fillers increase during polymerization) between filler particles. Therefore, the volumetric shrinkage and shrinkage stress in Cention N are reduced during polymerization, which allows the restoration of the tooth cavity using a bulk-filling technique [7]. Furthermore, Deepak *et al.* (2017) reported no statistically significant difference in the contact tightness between the tooth and restoration with both Cention N and Charisma composites, suggesting that Cention N can be used as an alternative to restore Class II restorations [22].

4.3 Mechanical properties

An ideal direct posterior restorative material should possess adequate compressive strength to improve restoration durability. Cention N exhibits superior compressive strength properties to GIC [12, 23-25] and is comparable to those of dental composites and silver amalgam. Varying compressive strengths have been reported in the literature for Cention N, which are approximately in the range of 133–248 MPa [12, 20, 23,24]. The diametral tensile strength of Cention N is approximately 50–108 MPa [23,24]. The cross-linking methacrylate monomers, along with a stable, efficient self-cure initiator, high polymer network density, and degree of polymerization over the complete depth of the restoration with Cention N, can be attributed to the improved compressive strength. In addition, the presence of a special patented isofiller (partially functionalized by silanes) in Cention N acted as a shrinkage stress reliever that minimized the shrinkage force, which could also be a reason for its improved strength. Furthermore, the organic/inorganic ratio and monomer composition of the material is also responsible for the low volumetric shrinkage, which contributes to the increased strength [12, 26]. In contrast, Mishra et al. (2018) and Sujith *et al.* (2020) reported a lower compressive strength with Cention N than that of the composites [9,20].

According to ISO 4049 standards, the flexural strength of a definitive restorative material that should be used in high-stress-bearing areas (occlusal posterior regions) must be at least 80 MPa [27]. Both the self-cure and light-cure Cention N materials (84-87 MPa) satisfy the minimum flexural strength recommended by ISO 4049 [9,11]. Cention N exhibits a relatively low modulus of elasticity of approximately in the range of 10-13 GPa.

The microhardness of Cention N was higher than that of counter-esthetic restorative materials [28]. Mazumdar *et al.* (2017) reported better microhardness with Cention N than with nanohybrid composite resin, silver amalgam, and type II GIC Materials. They concluded that the microhardness of restorative materials can withstand masticatory forces in a clinical context. They also suggested that Cention N is a more clinically suitable material for minimally invasive treatment [29]. Numerous studies have demonstrated greater fracture resistance with Cention N than with GIC, composites, and amalgam restorations [25,30].

Cention N reported a higher shear bond strength, usually in the range of 14 – 17 MPa, compared to counterpart composites and GIC [31,32]. However, pretreatment is necessary to improve the shear bond strength with dentin [31]. Naz F *et al.* (2021) [32] reported that Cention N (14.38±3.88 MPa) displayed more shear bond strength after 14 days compared to the GIC Fuji IX (5.96 ± 0.91 MPa). The increased bond strength with Cention N can be attributed to its unique composition, as it contains a hydrophilic dimethacrylate resin, such as PEG-400 DMA, in the liquid [33]. This dimethacrylate resin could have played a significant role in increasing bond strength [34]. In addition, as a shrinkage stress reliever, it might help reduce shrinkage stresses on the tooth-restorative interface.

The surface roughness of Cention N was poor compared to that of the nanohybrid composites after polishing. The filler particle size plays an important role in surface roughness. The average filler particle size of the nanohybrid composite is around 0.1–1.0 mm [35], which is much smaller than the filler particle size used in Cention N (0.1–35 mm) [36]. However, the chewing simulation studies reported that the Cention N (442.98 ± 62.45 nm) showed a better smoother surface compared to the nanohybrid composites (503.66 ± 134.0 nm) and GIC (550.10 ± 132.39 nm) after chewing simulation (50,000 cycles). In SEM investigations, GIC and composites showed a greater number of pits and valleys than Cention N after chewing simulation [32]. In addition to filler type and size, other factors, including the composition of the resin matrix, degree of cure, bonding between the resin matrix and filler phases, and loading of the matrix by the filler, contribute to the fatigue resistance of resin restorative materials [37]. Although a smaller particle size improved the fatigue resistance of the nanohybrid composites, Cention N reported smoother surfaces. The crosslinking ability of the polymer chains with the silane-treated filler particles and the degree of cure was greater in Cention N than in the nanohybrid composites. Hence, lower surface roughness was reported for Cention N [32].

4.4 Optical properties

Cention N is a relatively translucent material (transparency of 11%) compared to other glass-based restorative materials [7] and is also a radiopaque material because of the presence of ytterbium fluoride filler [7]. The surface roughness of the restorations significantly influences their esthetic quality. However, Cention N has been reported to be more resistant to surface roughness after chewing simulation, and therefore, it exhibits superior esthetics. This new material is expected to have the potential to be used for long periods in clinical settings [32]. Thermocycling improves the color stability of Cention N [38].

5. Manipulation

Cention N is available in powder and liquid forms. The powder and liquid were dispensed onto an oil-impervious paper mixing pad, as per the manufacturer's recommendations, and mixed using a plastic spatula. One scoop of powder was used per drop of liquid, corresponding to a powder/liquid weight ratio of 4.6 to 1 [7, 39, 40].

Cention N can fill the tooth cavity with or without an adhesive. If used without adhesive, retentive preparation (with undercuts) similar to that used with amalgam fillings is required without enamel margin bevelling and etching with phosphoric acid. If it is used with an adhesive, the cavity is prepared according to the modern principles of minimally invasive dentistry, that is, by preserving as much of the natural tooth structure as possible and requiring phosphoric acid etching. The cavity was filled with a single increment of Cention N material and allowed to polymerize. Cention N also contains photoinitiators; therefore, additional light-curing can be performed using blue light with an approximate wavelength of 400 – 500 nm. After curing, the material can be polished and finished, similar to conventional composites.

8. Conclusion

The popularity of amalgam restorations has declined because of mercury toxicity and aesthetic issues. Researchers have attempted to find an alternative to amalgam restorative materials, resulting in the development of numerous tooth-coloured restorations with varying results that do not meet the amalgam's standard in terms of mechanical qualities, such as Cention N, a resin-based bulk-fill, and a tooth-coloured direct restorative material that is simple to use clinically. Owing to the biological, mechanical, and chemical qualities of the alkasite restorative material, it is clinically appropriate for the treatment of cavities that are not adjacent to the tooth pulp. The biological, physical, and mechanical properties of Cention N were similar to those of GIC-IX; however, their mechanical properties were inferior to those of amalgam and composite materials.

Conflicts of interest: Authors declared no conflicts of interest.
Financial support: None

References

1. Ravi RK, Alla RK, Shammas M, Devarhubli A. Dental Composites-A Versatile Restorative Material: An Overview. Indian J of Dent Sci 2013;5(5):111-5.
2. Ferracane JL. Current trends in dental composites. Crit Rev Oral Biol Med 1995;6:302-18. https://doi.org/10.1177/10454411950060040301
3. Fleisch AF, Sheffield PE, Chinn C, Edelstein BL, Landrigan PJ. Bisphenol A and Related Compounds in Dental Materials. Pediatrics 2010;126:760–8. https://doi.org/10.1542/peds.2009-2693
4. Alla RK. Restorative Materials: Composite Resins, (In) Dental Materials Science. Jaypee Brothers Medical Publishers (P) Ltd., New Delhi, India 2013: p.130-48.
5. Dara L, Buchi D, Mantena SR, Varma M, Rao D, Chandrappa V. Recent advances in dental composites: an overview. Int J Dent Mater 2019;1(2):48-54. https://doi.org/10.37983/IJDM.2019.1202
6. Alla RK, Guduri V, Rao SP, Sajjan MCS, Ramaraju AV. Self-sealing resin fixators in dentistry. Int J Dent Mater 2021;2(2):60-8. https://doi.org/10.37983/IJDM.2020.2205
7. Jayaraj D, Simon EP, Kumar MR, Ravi SV. Cention N: A review. Dental Bites 2018;5(4):14-21.
8. Scientific Documentation: Cention N: Ivoclar Vivadent AG Research and Development Scientific Service, October 2016.
9. Mishra A, Singh G, Singh SK, Agarwal M, Qureshi R, Khurana N. Comparative Evaluation of Mechanical Properties of Cention N with Conventionally used Restorative Materials: An In Vitro Study. Int J Prosthodont Restor Dent 2018;8(4):120-4. https://doi.org/10.5005/jp-journals-10019-1219
10. Meshram P, Meshram V, Palve D, Patil S, Gade V, Raut A. Comparative evaluation of microleakage around Class V cavities restored with Alkasite restorative material with and without bonding agent and flowable composite resin: An in vitro study. Indian J Dent Res 2019;30(3):403-7. https://doi.org/10.4103/ijdr.IJDR_767_17
11. François P, Remadi A, Le Goff S, Abdel-Gawad S, Attal JP, Dursun E. Flexural properties and dentin adhesion in recently developed self-adhesive bulk-fill materials. J Oral Sci 2021;63(2):139-44. https://doi.org/10.2334/josnusd.20-0448
12. Kaur M, Mann NS, Jhamb A, Batra D. A comparative evaluation of compressive strength of Cention N with glass ionomer cement: An in-vitro study. Int J Appl Dent Sci 2019;5(1):5-9.
13. Capan BS, Duman C, Ordueri NE, Elgun T. In Vitro Examination of the Cytotoxicity of Alkasite Restorative Material on Dental Pulp Stem Cells. 2022, 1-15. PREPRINT (Version 1) https://doi.org/10.21203/rs.3.rs-1317815/v1
14. Gupta N, Jaiswal S, Nikhil V, Gupta S, Jha P, Bansal P. Comparison of fluoride ion release and alkalizing potential of a new bulk-fill alkasite. J Conserv Dent 2019;22(3):296-9. https://doi.org/10.4103/JCD.JCD_74_19
15. Todd JC. Scientific documentation: Cention N. Schaan, Liechtenstein: Ivoclar Vivadent Press; 2016.

16. Sidhu SK, Nicholson JW. A Review of Glass-Ionomer Cements for Clinical Dentistry. J Funct Biomater 2016;7(3):16. https://doi.org/10.3390/jfb7030016
17. Singbal K Shan M. K. W, Dutta S, Kacharaju K. R. Cention N Compared to Other Contemporary Tooth-Colored Restorative Materials in Terms of Fluoride Ion Releasing Efficacy: Validation of a Novel Caries-Prevention-Initiative by the Ministry of Health, Malaysia. Biomed Pharmacol J 2022;15(2):669-76. https://doi.org/10.13005/bpj/2406
18. Neti B, Sayana G, Muddala L, Mantena SR, Yarram A, Harsha GVD. Fluoride releasing restorative materials: a review. Int J Dent Mater 2020;2(1):19-23. https://doi.org/10.37983/IJDM.2020.2104
19. Samanta S, Das UK, Mitra A. Comparison of microleakage in Class V cavity restored with flowable composite resin, glass ionomer cement and Cention N. Imperial J Interdis Res 2017;3(8):180-3.
20. Sujith R, Yadav TG, Pitalia D, Babaji P, Apoorva K, Sharma A. Comparative evaluation of mechanical and microleakage properties of Cention N, composite, and glass ionomer cement restorative materials. J Contemp Dent Pract 2020;21(6):691-5. https://doi.org/10.5005/jp-journals-10024-2837
21. Pai S, Naik N, Patil V, Kaur J, Awasti S, Nayak N. Evaluation and comparison of stress distribution in restored cervical lesions of mandibular premolars: Three-dimensional finite element analysis. J Int Soc Prevent Communit Dent 2019;9:605-11.
22. Deepak S, Nivedhitha MS. Proximal contact tightness between two different restorative materials–An in vitro study. J Advanced Pharmacy Education & Research| 2017;7(2):153-6.
23. Paul U, Selvan AS, Revankar VD, Ravikumar K, Ganapathy A, Mohammed Noon A, Manoharan S. An in vitro Evaluation of Mechanical Properties of GIC, Cention N and Composite Restorative Materials. Int J Cur Res Rev 2021;13(05):S92-S95. https://doi.org/10.31782/IJCRR.2021.SP159
24. Iftikhar N, Srivastava B, Gupta N, Ghambir N. A comparative evaluation of mechanical properties of four different restorative materials: an in vitro study. Int J Clin Pediatr 2019;12(1):47-9. https://doi.org/10.5005/jp-journals-10005-1592
25. Kaur G, Shetty C, Hegde MN. Comparative evaluation of compressive strength and fracture resistance of posterior restorative materials alkasite and newer glass ionomers with amalgam: An in vitro study. J Int Oral Health 2022;14:566-73. https://doi.org/10.4103/jioh.jioh_95_22
26. Schenck L, Burtscher P, Vogel K, Weinhold HC. Major breakthrough in the field of direct posterior composite resins-thanks to the combined use of Tetric Evo Ceram Bulk Fill and Bluephase Style. Special Feature DZW. 2011;38(11):3-15.
27. International Organization for Standardization (2009) Dentistry-polymer based restorative materials. ISO 4049, 2009, Geneve.
28. Verma V, Mathur S, Sachdev V, Singh D. Evaluation of compressive strength, shear bond strength, and microhardness values of glass-ionomer cement Type IX and Cention N. J Conserv Dent 2020;23:550-3. https://doi.org/10.4103/JCD.JCD_109_19
29. Mazumdar P, Das A, Guha C. Comparative evaluation of hardness of different restorative materials (Restorative GIC, Cention N, Nanohybrid Composite Resin and Silver Amalgam) – An in vitro study. Int J Adv Res. 2017;6(3):826-32. https://doi.org/10.21474/IJAR01/6737
30. Biswas I, Shil R, Mazumdar P, Desai P. Comparative evaluation of fracture resistance of dental amalgam, Dyract-Xp Composite Resin and Cention N restoration in Class I cavity. Int J Innov Res Dent Sci 2018;3(2):384-93.
31. Sadeghyar A, Lettner S, Watts DC, Schedle A. Alternatives to amalgam: Is pretreatment necessary for effective bonding to dentin? Dent Mater 2022;38(11):1703-9. https://doi.org/10.1016/j.dental.2022.08.011
32. 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. Saudi Dent J 2021;33(7):666-73. https://doi.org/10.1016/j.sdentj.2020.04.012
33. Navarro L, Minari RJ, Vaillard SE. Photo-curable poly-(ethylene glycol)–fumarate elastomers with controlled structural composition and their evaluation as eluting systems. RSC Adv. 2019;9(1):482-90. https://doi.org/10.1039/C8RA09336A
34. Seker A, Arslan B, Chen S. Recovery of Polyphenols from Grape Pomace Using Polyethylene Glycol (PEG)-Grafted Silica Particles and PEG-Assisted Cosolvent Elution. Molecules 2019;24(12):2199. https://doi.org/10.3390/molecules24122199
35. Heintze, S, Eser, A, Monreal, D, Rousson, V. Using a chewing simulator for fatigue testing of metal ceramic crowns. J Mech Behav Biomed Mater 2017;5:770–80. https://doi.org/10.1016/j.jmbbm.2016.09.002
36. Ilie N. Comparative Effect of Self- or Dual-Curing on Polymerization Kinetics and Mechanical Properties in a Novel, Dental-Resin-Based Composite with Alkaline Filler. Materials (Basel) 2018;11(1):108. https://doi.org/10.3390/ma11010108
37. Krithika A, Kandaswamy D, Sathish, ES. Wear analysis of nano ceramic composites against a ceramic antagonist. J Conserv Dent 2006;9(4):152-8. https://doi.org/10.4103/0972-0707.42318
38. Kishore RNA, Ganesh SB, Jayalakshmi S. Effect of Thermocycling on Colour Stability of Alkasite Restorative Material (Cention N)-An In Vitro Study. J Pharma Res Int. 2022;34(6B):52-7. https://doi.org/10.9734/jpri/2022/v34i6B35437
39. Dhingra A, Sharma S, Singhal P. Can we replace amalgam with Cention N? Endodontics in Guident. Available from: https://www.guident.net/articles/endodontics/CAN-WE-REPLACE-AMALGAM-WITH-CENTION_N?.html= Accessed on March 1, 2023.
40. Derchi G, Marchio V, Giuca MR, Lardani L. Clinical Performance of Cention™ Alkasite Restorative Material vs. Glass Ionomer Cement Used in Deciduous Teeth: One-Year Evaluation. *Appl Sci* 2022;12(21):10845. https://doi.org/10.3390/app122110845

How to cite this article: Alla RK, Medicharla UD, Mohammed S, Abusua, Arun Bhupathi P, Madhu Varma K. An update on Cention N: An aesthetic direct bulk-fill restorative material. Int J Dent Mater. 2023;5(1):17-21. DOI:*http://dx.doi.org/10.37983/IJDM.2023.5104*