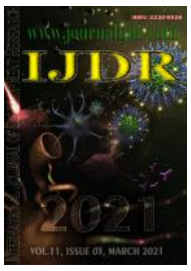
ISSN: 2230-9926

Available online at http://www.journalijdr.com

IJDR

International Journal of Development Research
Vol. 11, Issue, 03, pp.45552-45555, March, 2021
https://doi.org/10.37118/ijdr.21433.03.2021



CASE REPORT **OPEN ACCESS**

ALKASITE: A NEW ALTERNATIVE TO AMALGAM? - CLINICAL CASE REPORT

Kharys Fabíola Azevedo de Oliveira[1], André Luiz Tannus Dutra[2], Adriana Beatriz Silveira Pinto[2] and Álvaro Hafiz Cury[3, *]

[1]Dental Surgeon; [2]University of Amazonas State – UEA; [3] Amazonas Institute of Higher Education – IAES

ARTICLE INFO

Article History:
Received 15th January, 2021
Received in revised form
12th January, 2021
Accepted 08th February, 2021
Published online 29th March, 2021

Key Words:

Cention N, Alkasite, Fillings.

Corresponding author: Álvaro Hafiz Cury

ABSTRACT

Restorative materials have been constantly evolving over the years with the search for physicochemical characteristics that are similar to tooth structures. Ideally, the main characteristics that are expected of a direct restorative material are its ability to withstand masticatory forces, dimensional stability, marginal sealing, biocompatibility, smoothness, aesthetics, the ability to prevent the recurrence of new caries, as well as not presenting postoperative sensitivity. Glass ionomer cements, silver amalgam and resincompositewere the only alternatives for direct restorations until the recent introduction of a group of polymers known as alkasites (or alkenoids). Marketed as CentionN, this material is intended for direct restorations in posterior teeth, has similar colors to teeth, and promises to be able to release calcium ions (ca^{2+}), fluorine (F^-) and hydroxyl (OH^-) in the face of an acid challenge. It is a material with a dual cure reaction, of optional association to the use of adhesive systems, which has good performance in laboratory tests, but still has few reported clinical evaluations.

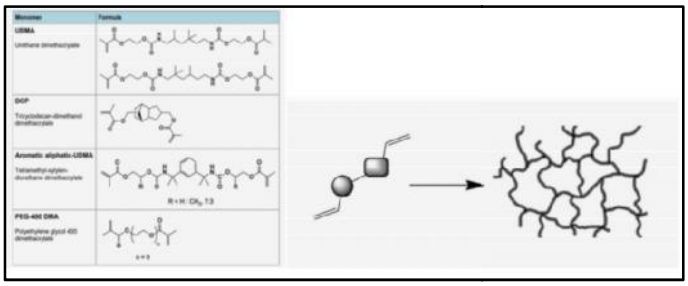
Copyright © 2021, Kharys Fabíola Azevedo de Oliveira et al. *This is an open access article distributed under the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.*

Citation: ***Kharys Fabíola Azevedo de Oliveira, André Luiz Tannus Dutra, Adriana Beatriz Silveira Pinto and Álvaro Hafiz Cury,*** **2021.** "Alkasite: A new alternative to amalgam? - Clinical Case Report", *International Journal of Development Research*, 11, (03), 45552-45555.

INTRODUCTION

Aesthetic dentistry has shown many advances in the area of dental materials and technology, and has led to an increase in aesthetic procedures, both in anterior and posterior teeth[2,5,9,10]. This search for improvements, and the attempt to develop biocompatible materials that replace the lost dental tissue, has led to the development of materials that present better mechanical characteristics, which when combined with their favorable aesthetic characteristics,can be used in posterior and anterior teeth[9]. Amalgam was first introduced in western dentistry in the nineteenth century and, to this day, it plays an important restorative role, especially in patients who have a high risk of caries[15,16]. Glass ionomer cements (GICs) were introduced in the 70s, thus increasing the collection of restorative materials as an important material for the prevention of caries, by acting as a reservoir of fluoride ions in the oral cavity[14]. However, in the 80s, composite resins emerged as a way to perform direct restorations, meeting the aesthetic requirements of patients and professionals. Compomers or resins modified by ionomers were introduced in the 90s in an attempt to add the important characteristics of glass ionomer cement to those of composite resins. The current decade has also seen the launch of specific resins for large coronary fillings (Bulk fill)[3,4,8], in an attempt to suppress some operational and handling limitations of traditional composite resins. Amalgam is a secular restorative material with scientific evidence of clinical success[16]. To date, it is the material of choice for subsequent restorations in patients at high risk of caries or who, for example, do not meet other requirements for the use of composite resins (e.g., the impossibility of rubberdam isolation). Taking into accountthe darkcolor of the material and observing it from the perspective of the requirements of a preparation with specific characteristics,the restorative technique and the presence of metal in its composition, many questions are made nowadays with the aim of replacing the use of silver amalgam with other materials, with more attractive aesthetic characteristics and with greater simplicity of the operative technique[12]. According to the manufacturers, alkasites (or alkenoids) are a new category of inorganic matrix (Figure 2) that, in addition to an organic matrix (polymerizable monomers with two methacrylate groups in the liquid portion of the material), represent 21.6% by weight of the material, plus chemical polymerization initiators and catalysts, among other additives, which correspond to approximately 12 to 40% of the mass of the final material.A combination of UDMA, DCP, aromatic aliphatic UDMA and PEG-400 DMA, cross-linked during polymerization, help confer mechanical strength and good long-term stability. The material does not contain Bis-GMA, HEMA or TEGDMA, and UDMA isthe main component of the organic matrix. In addition to presenting moderate viscosity, it does not have hydroxyl side groups, giving hydrophobic characteristics to the material, and low water absorption. It has the low viscosity, bifunctional methacrylate DCP monomer, which facilitates handling,and a cyclic aliphatic structure of aromatic UDMA (partially aromatic urethane).According to the manufacturer, dimethacrylate is a high viscosity hydrophobic reticulation agent that combines the properties of aliphatic (low tendency to discoloration) and aromatic (hardness) diisocyanates and, combined with PEG-400

DMA,increases the fluidity of the material and confers the hydrophilicity necessary in order to promote affinity to the wet substrate of the cavity preparation (enamel and dentin), adapting the material to the smear layer.DCP is a low viscosity bifunctional methacrylate monomer, which allows manual mixing of the material. The aromatic aliphatic UDMA is a high viscosity hydrophobic cross-linker that combines the properties of aliphatic (low tendency to discoloration) and aromatic (hardness) diisocyanates.The association of these cross-linked methacrylate monomers with polymerization initiators exhibits a high density of polymeric network, with a high degree of conversion, cross-linking and polymerization throughout the depth of the material in the restoration, which, according to manufacturers, guarantees stability and long duration of the restorations[17].



Source: *Scientific documentation, Ivoclar Vivadent, October 2016.*

Figure 1. Monomers of the organic matrix and their schematic representation (table on the left) and representation of the monomeric crosslinking in a polymer network, after polymerization of the material (representation on the right)

One of the main properties of the material is its flexural strength and hardness[03](greater than 100 MPa, ISO 4049), good behavior in relation to the compressive strength[13], its resistance to abrasion[1,2,4,9,14],which is achieved by the presence of such aninorganic matrix (Figure 2) found in the powder of the material, with particles whosesurface is modified to ensure that the wettability by the liquid and the incorporation into the polymer matrix.This consists of aluminum silicate glass and barium, ytterbiumtrifluoride, isofiller (tetric n-ceramtechnology), a calcium fluorosilicate glass and aluminum, calcium fluorosilicate glass (with alkaline characteristics), with particle sizes between 0.1 µm and 35 µm.

Filler	Function
Barium aluminium silicate glass	Strength
Ytterbium trifluoride	Radiopacity
Isofiller	Shrinkage stress relief
Calcium barium aluminium fluorosilicate glass	Strength, fluoride release
Calcium fluoro silicate glass	Ion release F^-, OH^-, Ca^{2+}

Figure 2. Composition of the inorganic matrix and its functions in the material. Source: Scientific documentation, Ivoclar Vivadent, October 2016

Clinical Case Report: The patient, M. V. P. S., 37 years old, female, sought the ÚnicaCursosAvançados'sclinic of the Dentistry specialization course for dental consultation.

Figure 3. Initial aspect of unsatisfactory restorations

The patient reported dissatisfaction with her existing restorations and inquired about the possibility of replacing these restorations. X-rays were taken of the lower molars, since there were fractured restorations that showed clinical and radiographic signs of marginal infiltration in the elements 48, 47, 46 (Figures 3and 4).

Figure 4. Initial appearance of the elements to be restored

The patient was informed about the possibilities of treatment and materials to be used. With the possibility of using the material Cention N (IvoclarVivadent), the entire procedure that was to be performed was explained to the patient, who signed the informed consent form (ICF), which was filed in her dental records. Dental dam isolation was performed and removal of theunsatisfactory restorations of elements 46, 47 and 48 was performed (Figure 5).

Figure 5. Dental elements under rubber dam isolation

The removal of the old restorations was done with a spherical, diamond tip 1014 (KG Sorensen, Cotia, SP, Brazil). The preparation and finishing of the cavities consisted of the removal of the pre-existing restorative material and the removal of the remaining carious dentin with a multi-laminated spherical drill, at a low rotation (Figure 6).

Figure 6. Removal of restorative material and removal of remaining decayed tissue

As one of the recommendations of the manufacturer is to perform its application without the use of adhesive, after cleaning the cavity with water, the restorative material was spread and applied with precision applicator (Centrix Syringe System for Materials Application - DFL,Rio de Janeiro - RJ, Brazil). Considering the mixing time (45 to 60 sec), working time (2 min 30 sec) and fixing time (4 min), immediately after the application, the anatomy and removal of excess material was performed. Proximal contact between molar and premolar was obtained using a simple metal matrix, stabilized with aTofflemire retainer[6,11]. After restoration of all the elements, carried out one by one,the rubber dam isolation was removed and the contact points checked, and appropriate adjustments were made (Figure 7), without performing light curing[7].

Figure 7. Final aspect of the restorations performed

A new X-ray was done after the checking of proximal and occlusal contacts (Figure 8) andthe patient was then released.

Figure 8. Final radiographic appearance of the restored elements

DISCUSSION

Currently, new bioactive materials have been introduced into the dental market. This designation is due to the fact that they are restorative materials that have particles in their composition that are capable of interacting directly with the dental structure, and releasing and recharging fluorine ions, thus enabling the remineralization of tooth enamel and increasing resistance to bacterial colonization[17]. Cention N is described as a new filler material that belongs to the group of materials known as alkasites. This alkaline particle is patented and proposes to increase the release of hydroxide ions to calcium and fluorine ions, thus helping in the remineralization of tooth enamel, with a low level release of fluorine ions in neutral pH, though in acid pH,the release of fluorine ions is increased[17]. Cention N is a colored restorative material for direct restorations. It is self-curing with optional additional light curing. Cention N is available in tooth color A2 and is radiopaque. As a double polymerization material, it can be used as a full volume (bulk) replacement material[7]. The optional photopolymerization is performed with blue light in the wavelength range of approximately 400-500 nm, extending the versatility of use of the material,since it is associated with the various types of light apparatus. It consists of a separately packaged powder and liquid that are mixed manually before being used. One spoonful of powder is used per 1 drop of liquid, corresponding to a powder weight /liquid ratio of 4.6 to 1. The liquid comprises dimethacrylates and primers, while the powder contains various glass fillers, primers and pigments. It includes a special patented particle (Isofiller). The isofiller acts as a relief from the shrinkage stress of the contraction forces during polymerization. According to the manufacturer, it acts like a slowly expanding spring between the particles as they grow during polymerization. In addition, the organic/inorganic ratio and the monomeric composition of the material account for its low volumetric shrinkage[9,17].

Cention N is intended for the restoration of Class I, II or V cavities in deciduous and permanent teeth. Cention N can be used with or without an adhesive. If it is used withoutan adhesive, then a retentive preparation (with lower cuts) similar to that used with amalgam restorations[15] is required, and the edges of the enamel should not be beveled[12]. If it is used with an adhesive, then the cavity should be prepared according to modern principles of minimally invasive dentistry, that is, preserving as much the natural dental structure as possible, and the corresponding instructions for use should befollowed with regard to storage and application. It consists of four different dimethacrylates that account for 21.6% by weight of the final mixed material. A combination of UDMA, DCP, aromatic aliphatic UDMA and PEG-400 DMA (see Figure 1), interconnects (cross-links) during polymerization, resulting in strong mechanical properties and good long-term stability. Cention N does not contain Bis-GMA, HEMA or TEGDMA. UDMA is the main component of the monomeric Matrix. It features moderate viscosity and strong mechanical properties. UDMA also does not have hydroxyl lateral groups, i.e., it is hydrophobic and exhibits low water absorption. DCP is a low viscosity, difunctional methacrylate monomer that allows for the manual mixing of Cention N. Its cyclic aliphatic structure also ensures strongmechanical properties. Aromatic aliphatic UDMA is a partially aromatic urethane. Dimethacrylate is a high viscosity hydrophobic crosslinking agent that combines the properties of aliphatic (low tendency to discoloration) and aromatic (hardness) diisocyanates[17]. PEG-400 DMA is a liquid monomer that increases the fluidity of Cention N.

Its hydrophilia also promotes the ability of Cention N to an intimate contact with thedamp tooth substrate (enamel and dentin) and adapt to the smear layer, whenit is not used with an adhesive system. Due to the unique use of cross-linked methacrylate monomers in combination with an efficient self-healing primer, Cention N exhibits a highdensity polymeric network and polymerization throughout the depth of the restoration. This is a good basis for a long duration of restorations. Considering all the properties and characteristics proposed by the material, its handling, spreading and the preparation of the material, even if with limited preparation time of up to 2 min, it proved to be simple to use. However,it did present one major problem, which was the time required for spatulation and insertion of the material into the cavity, and

this may be a limitation for the clinical professional.As one of the features of the material is that it can be used without acid and adhesive conditioning, the restorations in this case were made directly and, after the total of 4 min fixing time, a light curing (optional) could have been done.After checking for contact and wear, the material showed a rough appearance, without the necessary smoothness to avoid plaque accumulation and possible development of secondary caries. One could also point out greater color options (range of colors), translucency, or even the most practical packaging option, such as powder and pre-dosed liquid (encapsulated), as in the case of sometypes of GICs made by otherbrands. In the clinical case presented, these aspects were not decisive, but may serve as a guide in the development of new products in the future.

CONCLUSION

Cention N is a new material on the dental market, and may be a good choice since it is economical and easy to handle. Despite its reduced working time, it haspositive characteristics and qualities that are clinically similar to other materials.

Conflicts of interest: The authors declare that there are no conflicts of interest that could constitute an impediment to the publication of this article.

Acknowledgments: The authors would like to thank IvoclarVivadentand its regional representative in Brazil for donating the restorative material in use in this clinical case report.

REFERENCES

Bernardo M, et al. Survival and reasons for failure of amalgam versus composite posterior restorations placed in a randomized clinical Trial. *Journal of the American Dental Association.* 2007.

Chaves A A, et al. Restauração com resina composta pela técnica do índex oclusal – relato de caso clínico. Revista Dentística Online. 2011.

Chole D, et al. In vitro comparision of flexural strength of Cention N, bulk-fill composites, light-cure nanocomposites and resin – modified glass ionomer cement. *Journal of Dental and Medical Sciences.* 2018

Deepak S, et al. Proximal contact tightness between two of different restorative materials – an in vitro study. *Journal of Advanced Pharmacy Education & Research.* 2017.

Ende V A, et al. Bulk-fill composites: A review of the current literature. *J Adhes Dent.* 2017.

Hirani T R, et al. Comparative evaluation of postoperative sensitivity in bulk-fill restoratives: a randomized controlled trial. *Journal of International Society of Preventive &Community Dentistry.* 2018.

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. *MDPI Journals.* 2018.

Kumar A S, et al. Evaluation of compressive strength between Cention N and high copper amalgam – an in vitro study. *Journal of Drug Invention Today.* 2018.

Mann S J, et al. Cention N: a review. *International Journal of Current Research.* 2018.

Mazumdar P, et al. 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*. 6(3), 826-832, 2018.

Mondelli J. O que o cirurgião-dentista que pratica a odontologia deve saber a respeito do amálgama dentário. Full Dentistry in Science – informativo. 2014.

Sahadev C K, et al. An in vitro comparative evaluation of marginal microleakage of Cention N with bulk-fill SDR and ZIRCONOMER: A confocal microscopic study. *International Journal of Science and Research* (IJSR). 2016.

Samanta S, et al. Comparison of microleakage in class V cavity restored with flowable composite resin, glass ionomer cement and Cention N. Imperial Journal of Interdisciplinary Research (IJIR). 2018

Santos D T, et al. Amálgama dental e seu papel na odontologia atual. *Revista Brasileira de Odontologia.* 2016.

Scientific documentation: Cention N by IvoclarVivadent. Ivoclar Vivadent AG Research & Development Scientific Service Bendererstrasse 2 FL – 9494. Schaan Liechtenstein Contents: Joanna-C. Todd Issued: October 2016.

Silva R M. Avaliação clínica randomizada de restaurações de classe II em dentes permanentes de ART e resina composta. Tese (doutorado). *Faculdade de Odontologia de Bauru, Brazil.* 2017.

Vandana S, et al. Alkasiterestorative material: flexural and compressive strength evaluation. Journal of Pharmaceutical, Biological and Chemical Sciences.2018

****