



Studies on the use of glassionomer

Adina-Mădălina Gherman¹, Smaranda Dana Buduru¹,
Anca-Ştefania Mesaroş²

1) Prosthetic Dentistry, Iuliu Haţieganu University of Medicine and Pharmacy, Cluj-Napoca, Romania

2) Dental Propedeutics and Esthetics, Iuliu Haţieganu University of Medicine and Pharmacy, Cluj-Napoca, Romania

Abstract

Background and aims. This study is focused on the analysis of the properties of glassionomers following the choice of the type of material by the dentists. The study evaluated the properties of glassionomers used for restorations directly by comparing those prepared manually with those prepared mechanically, to find an “ideal” glassionomer and to counteract the disadvantages of the material.

Method. The study was conducted on the basis of a questionnaire and included 254 dentists from Romania. It took place between April 6 - 24, 2020 and the questionnaire was administered online. The questions focused on: the type of glassionomer chosen by every dentist, the doctor’s opinion about the properties, type and clinical indications of the material.

Results. The results showed that in Romania, the dentists use the glassionomer for a permanent filling in adults because of the financial aspect, as they stated. In their opinion the best advantages are the fluoride release and adhesion to dental tissues and, on the other hand the biggest disadvantage is aesthetics.

Conclusions. Among the conclusions are the following: the glassionomer is frequently used in dental offices, especially the powder-liquid system, as a commercial product; no standard type of glassionomer was found.

Keywords: glass ionomer cement, dental materials, capsules, fluoride

Background and aims

In the last few years the dental materials, techniques and technologies changed to the benefit of clinicians and patients [1]. Dental materials for direct restoration are defined as materials that can be inserted directly into a prepared tooth in a single session [2]. There is a wide variety of materials, but this article will concern the glassionomers.

Glassionomers have become materials often used in dental practice, due to their adhesion to unprepared dental surfaces, fluoride release properties, low infiltration, good chromatic stability and because they do not require absolute isolation from the salivary environment [3,4].

The concept of discovering and using “smart” materials has grown in recent times. The glassionomer is the

only one that meets this quality. It is the only material that currently adheres to unprepared dental surfaces [5].

The main objective of the study was to compare the properties of different glassionomer materials, focusing on the presentation form of powder-liquid system or capsules more frequently used and took as a first criteria the clinical experience of dentists to allow the analysis of the doctor’s needs and the facilitation of dental work, doctor’s preference for a material, and also for determining a material that meets the needs of patients.

Methods

To evaluate the properties of different types of glassionomer, based on the practical experience of dentists, a questionnaire was developed using the application Google Form (<https://docs>.

DOI: 10.15386/mpr-2351

Manuscript received: 06.08.2021

Received in revised form: 22.10.2021

Accepted: 22.06.2022

Address for correspondence:

Adina-Mădălina Gherman
adinag10@yahoo.com

This work is licensed under a Creative Commons Attribution-NonCommercial-NoDerivatives 4.0 International License <https://creativecommons.org/licenses/by-nc-nd/4.0/>

google.com/document/) which was distributed online to the groups of dentists through Facebook and Messenger social media applications.

The study was carried out on a group of 254 dentists of different specialties. The age ranges 24-30, 31-35, 36-40, 41-50 and over 51 years of age were used as selection criteria. Both men and women were included. The study took place in the period 6 - 24 April 2020, during which the questionnaire was distributed on online platforms. Dentists from different regions of the country were targeted, regardless of the urban or rural environment in which they operate.

The questionnaire was anonymous and participation in the study was voluntary, comprising a number of 18 questions.

The results of the questionnaire were collected and graphs were automatically generated using "Google Docs", which led to a faster and better interpretation of the data obtained. The graphs were also processed and analyzed using "Google sheets" and the "Microsoft Excel 2010" package.

Results

One of the questions addressed to the participants was "how do you prefer to use the glassionomer". The options for answering the question were divided as follows: long-term filling for children / adolescents, long-lasting filling in adults, base, temporary material and cementation. The options are correlated with the clinical indications for use of the glassionomer, but the most common uses were given as examples. The conclusion of the answers was analyzed using the graph in figure 1, which suggests that 68.5% prefer to use the glassionomer for cementation, 66.54% apply the material as a long-lasting filling to children / adolescents, followed by 59.45% as basic material in cavities, temporary material 31.5% and as long-term filling in adults 14.17%. It follows that the glassionomer is mostly used for cementing prosthetic works, orthodontic rings, etc. As well as indications for use in the cavities of the temporary teeth of children and adolescents, the vast majority of dentists use glassionomer for this purpose, and it will be used for other indications by practitioners but in a lower percentage. At the same time, as a result of the properties and indications of the material, it is preferred by doctors for cementation purposes.

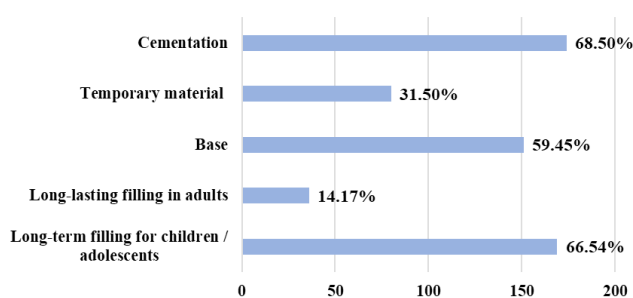


Figure 1. Indications for use of glassionomer.

The glassionomer has low resistance to abrasion and bending, and the indication is for temporary filling for adults. Subjects, on the other hand, were asked whether they applied it as a durable material in the cavities; a relatively insignificant percentage reported using it for this purpose.

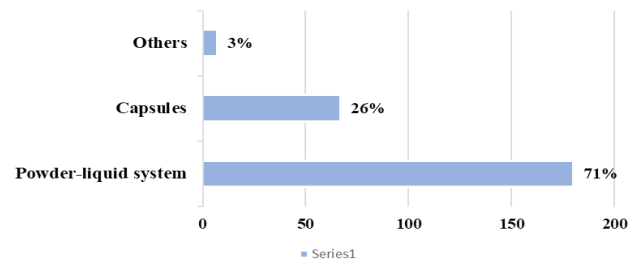


Figure 2. Forms of presentation of the glassionomer and their use by dentists.

The vast majority of the doctors (71%) prefer the classic way of presentation, the powder-liquid system. The capsules are chosen by 26% and paste-paste by 3%.

Although both the encapsulated glassionomer and the paste-paste form have a number of advantages in terms of pre-dosing, handling and application, practitioners opted for the powder-liquid system.

In order to avoid errors that occur during the handling of the material, we wanted to know if the dentists observed the proportions recommended by the manufacturer, performed an empirical dosing, or resorted to pre-dosed capsules.

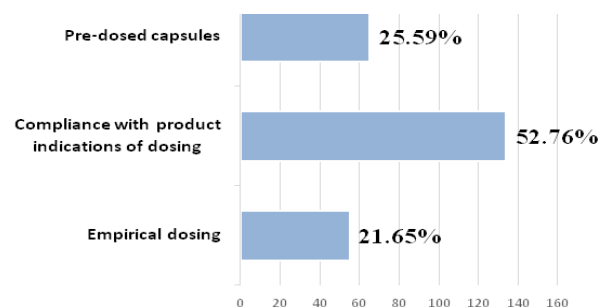


Figure 3. Material preparation.

Figure 3 shows how the manipulation of glassionomer is made: 53% observed the indications of dosing of the producer. Dentists who use glassionomer capsules are represented by a percentage of 25% and empirical dosing is preferred by 22% of the subjects. The handling of the material depends on the practitioner, namely knowledge and skill, skill or care as appropriate, and clinical experience.

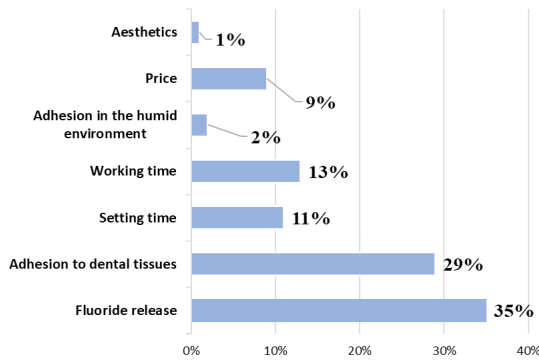


Figure 4. The advantages of the glassionomer from the practitioners' viewpoint.

The properties of the glassionomer include the release of fluoride, considered a major advantage by 35% of doctors. In the next place, 29% subjects appreciate the adhesion of the material to the dental tissues. Working time is seen as an advantage by 13% and the setting time by 11%. As it is well known, the aesthetic criterion is not met with success by glassionomer, therefore a reduced percentage (1%) of the respondents said that aesthetics would be an advantage. Another advantage not to be overlooked is the acceptable price which makes it an affordable material, comprising 9% of responses. The advantage of adhesion in the humid environment was seen as minor, only 2% specifying this fact.

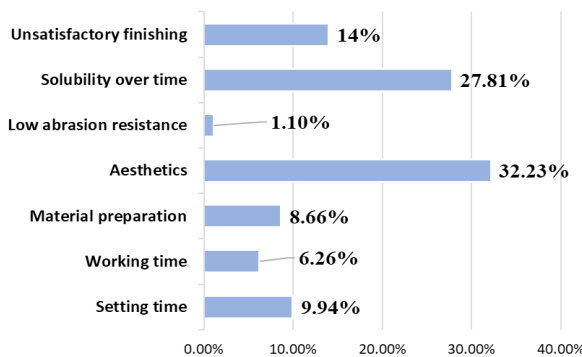


Figure 5. Disadvantages of the glassionomer from the practitioners' viewpoint.

Figure 5 comprises the results as follows: the most important disadvantage taken into account by 32.23% of dentists is improper aesthetics of the material. Solubility over time in the presence of saliva is considered a disadvantage by 27.81% of study participants, followed by the deficient finishing in a percentage of 14%, setting time by 9.94%, glassionomer preparation method by 8.66%, working time by 6.26% and low abrasion resistance 1.1%.

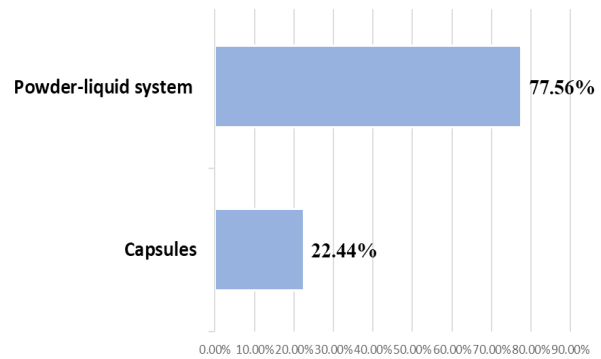


Figure 6. The choice of the glassionomer in terms of reporting clinical yield-price and fee collection.

The participants in the present study chose according to the ratio clinical yield-price and fee collected for the powder-liquid system (77.5%) compared to capsules (22.4%).

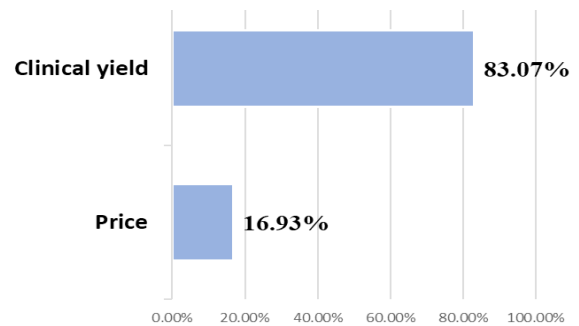


Figure 7. The choice of glassionomer according to the quality-price ratio and the clinical yield.

Subjects responded that the clinical yield of the material weighed more in choosing a capsule or powder-liquid system 83% of respondents, and the price, though an important decision factor in the use of a certain type of material, only influenced 16.9% of the dentists.

Discussion

Glass ionomers are used by a large number of practitioners due to the unique features of dental materials, namely the release of fluoride and physical and chemical adhesion to dental tissues [6]. In order to be able to choose the right materials for each clinical situation, practitioners need to know the properties, how they behave and the handling techniques of the material [7].

The properties and aesthetics make the glassionomer less commonly used for long-lasting permanent dentures. But studies show that it is a good dental substitute, by using it as a base in closed or open sandwich techniques.

Depending on the clinical indication, practitioners choose other materials as an alternative to the detriment of

the glassionomer, due to the properties that are adapted to each therapeutic situation [8].

Composites are preferred for cosmetic restorations, especially in the frontal area but also in the posterior area due to their superior mechanical properties [9]. A 2016 study in New Zealand asked dentists about dental preferences and indications. Different clinical findings have shown that: the use of composite is preferred for extensive direct reconstitutions, glassionomer is chosen over zinc phosphate cement for prosthetic cements, although in the United Kingdom physicians often use zinc phosphate cement in adhesives [10]. Zinc is one of the most commonly used cements with temporary indication because it also has the advantages of low cost, easy handling and application, anti-inflammatory, bacteriostatic and analgesic effect [11]. Zinc phosphate cement has a high compressive strength, low price, low tensile strength, no chemical contact with dental tissue, high solubility and all these disadvantages do not make it a favorite material among dentists. Compomers are a combination of composite and glassionomer materials, combining the properties, advantages and disadvantages of the two materials, but the balance is tilted in favor of the benefits of composites [12]. These arguments support the choice of compomers by the subjects included in the study.

Calcium hydroxide has superior antibacterial and neodentinogenesis properties preferable to glassionomer. Clinical indications lead to the use in endodontic treatments and in traumatic pathology of the pulp. Calcium hydroxide cannot be applied in large amounts in cavities due to poor mechanical properties [13]. Consequently it is not the most common material used in the dental office, therefore it is not the first choice for dentists when discussing restorative materials.

Giomers are also a mix between composites and glassionomers. In the case of giomers, studies say that the indication of choice is the application of cervical lesions. Handling is easier than composites, proper adhesion and fluoride release [14].

The presentation forms of the glassionomer material are in correlation with the indications for use. The syringes facilitate application in deep cavities, acting as a liner or base, avoiding touching the walls with material. The capsules offer the most favorable characteristics to the glassionomer material, but practitioners choose the powder-liquid system given that many of them have never or very rarely tried the encapsulated glassionomer.

Commercial glassionomer products are chosen according to the preferences of doctors, based on various criteria.

Other studies referring to different commercial products have shown that there are differences between the release of fluoride, so that the conventional glassionomer releases smaller quantities compared to the modified resin [15].

Glassionomer materials offer multiple advantages, the ones preferred by practitioners are the release of fluoride

and adhesion to the dental tissues. In fact, both conditions were met by a new material on the dental market and the glassionomers were able to meet the requirements [3].

Glass ionomers have an imbalance in terms of advantages and disadvantages. Practitioners claim that the major disadvantages are poor aesthetics and solubility in the salivary environment.

Practitioners have not made any suggestions in facilitating the procedures of use with glassionomers, although tricks are discovered following the experience in offices for different materials.

Restorations, cementation and other clinical indications have an increased durability depending on the manufacturer's instructions on the type of glassionomer. Although there are for powder-liquid systems, measuring spoons and vials for liquid dentists or nurses, at the time of dosing perform the portioning of the elements empirically or following the instructions of the leaflets. Consequently, dosing is considered a very important or important measure by those who observe the doses. A small percentage of practitioners said they did not notice a difference when performing empirical manipulation.

To analyze the effectiveness of different handling systems, the subject's responses also reflected the powder-liquid system to be more useful, as a consequence of very rarely using the capsules. Practitioners take into account the benefits of the resulting yield, ease of handling in relation to the price paid. Only a relatively small proportion of physicians consider the importance of the cost required when compared to the properties of the material.

Conclusions

1. Glassionomer is a material frequently used in dental offices.
2. Practitioners have kept the classic use of powder-liquid systems, but some of them opt for modern capsule techniques or syringe systems.
3. There are dentists who have tried glassionomer capsules or other forms too few times, so their medical knowledge is not updated, or there is a personal reluctance to change.
4. There are no discrepancies between the studies in literature and the opinions of the subjects regarding the properties, advantages and disadvantages of the glassionomer.
5. Classical techniques and known instruments are still used by practitioners, no easier practical method has been discovered to counteract the adherence to the instrumentation of the glassionomer.
6. A standard used by most practitioners was not found for commercial products.
7. It has the clinical efficiency, the ease of handling compared to the costs involved in the material.
8. Dentists prefer the powder-liquid system at the expense of the capsules to meet the clinical return-price ratio and fee collected.

ANNEX

Questionnaire on the use of glassionomer by dentists

1. Your age is between:

- 24-30 years
- 31-35 years
- 36-40 years
- 41-50 years
- > 51 years

2. Select your gender:

- Male
- Female

3. Do you have a specialization?

- General dentist
- Orthodontics
- Pedodontics
- Dento-alveolar surgery
- Endodontics
- Prosthetic dentistry
- Periodontology
- Oral and maxillofacial surgery

4. Do you use glassionomer in your office?

- Yes
- Not

5. How do you prefer to use the glassionomer more often?

- Lasting obturation in children / adolescents
- Long-lasting obturation in adults
- As a base
- Provisional material
- Cementation

6. What alternatives regarding dental materials do you prefer to the detriment of the glassionomer?

- Zinc eugenate
- Zinc phosphate cement
- Composite materials
- Compomers
- Giomeri
- Others:

7. What is the form in which you use the glassionomer?

- Powder-liquid system
- Capsules
- Other: ...

8. How do you prepare the material?

- Empirical dosing
- Compliance with the proportions recommended by the manufacturer

- Pre-dosed capsules

9. How important do you consider compliance with the powder-liquid dosing proportions of glassionomer for therapeutic success?

- Very important
- Important
- Relative
- Without importance

10. What type of Gis do you prefer to use:

a. GC Fuji Automix LC

GC Fuji® Automix LC
Resin-reinforced Light-cured Glass Ionomer Restorative with Ergonomic Dispenser



b. GC Fuji II

GC Fuji II®
Glass Ionomer Restorative



c. GC Fuji II LC capsule

GC Fuji II LC® CAPSULE
Light-Cured, Resin-Reinforced Restorative



d. GC Fuji IX GP

GC Fuji IX GP®
Packable Posterior Restorative



e. GC Fuji Lining LC

GC Fuji LINING™ LC (Powder-Liquid)

Radiopaque Lining Material: Powder-Liquid



f. Kavitan Plus

Kavitan plus

g. Other: ...

11. What are the most important advantages of the glassionomer from your point of view?

- Fluoride release
- Aesthetics
- The price of the material
- Adhesion to dental tissues
- Setting time
- Working time
- Other: ...

12. What are the most important disadvantages of the glassionomer from your point of view?

- Aesthetics
- Preparation
- Finishing the material
- Solubility over time
- Setting time
- Working time
- Other: ...

13. Have you ever used glassionomer in capsule form?

- Once
- Yes, I have tried several times
- Not
- Yes, I use it frequently

14. Following the practical experience, which of the options do you consider to have reliable results over time?

- Capsules
- Powder-liquid

15. What are the useful tools that you consider and often use for the optimal application and handling of the glassionomer?

- Shutter
- Mouth spatula
- Applicator (microbrush)
- Using the capsule applicator gun
- Other: ...

16. In terms of clinical return-price ratio and fee collected, which option do you consider better?

- Powder-liquid
- Capsules

17. According to the quality-price ratio and clinical yield, what influences you to choose a certain glassionomer?

- The price
- Clinical yield

18. According to the value for money and ease of handling, what influences you to choose a particular glassionomer?

- The price
- Ease of handling

References

1. Vaderhobli RM. Advances in dental materials. *Dent Clin North Am.* 2011;55:619–625.
2. Singh H, Kaur M, Dhillon JS, Mann JS, Kumar A. Evolution of restorative dentistry from past to present. *Indian J Dent Sci.* 2017;9:38-43.
3. Wilson AD. Glass-ionomer cement--origins, development and future. *Clin Mater.* 1991;7:275–282.
4. Miličević A, Goršeta K, van Duinen RN, Glavina D. Surface Roughness of Glass Ionomer Cements after Application of Different Polishing Techniques. *Acta Stomatol Croat.* 2018;52:314-321.
5. Khoroushi M, Keshani F. A review of glass-ionomers: From conventional glass-ionomer to bioactive glass-ionomer. *Dent Res J (Isfahan).* 2013;10:411–420.
6. Ferracane JL. Resin composite--state of the art. *Dent Mater.* 2011;27:29–38.
7. Pitts N. Understanding dental caries - From pathogenesis to prevention and therapy. In: *Understanding Dental Caries: From Pathogenesis to Prevention and Therapy.* Springer International Publishing; 2016. p. 3–9.
8. Piola Rizzante B, Antonio F, Cunali S, Bombonatti S. RSBO Revista Sul-Brasileira de Odontologia. *RSBO Rev Sul-Brasileira Odontol* 2015;12:79-87. Available from: <http://>

www.redalyc.org/articulo.oa?id=153040039010

9. Hervás-García A, Martínez-Lozano MA, Cabanes-Vila J, Barjau-Escribano A, Fos-Galve P. Composite resins. A review of the materials and clinical indications. *Med Oral Patol Oral Cir Bucal*. 2006;11:E215–E220.
10. Brunton PA, Ratnayake J, Loch C, Veerasamy A, Cathro P, Lee R. Indirect Restorations and Fixed Prosthodontics: Materials and Techniques Used by General Dentists of New Zealand. *Int J Dent*. 2019;2019:5210162.
11. Koch T, Peutzfeldt A, Malinovskii V, Flury S, Häner R, Lussi A. Temporary zinc oxide-eugenol cement: eugenol quantity in dentin and bond strength of resin composite. *Eur J Oral Sci*. 2013;121:363–369.
12. Lad PP, Kamath M, Tarale K, Kusugal PB. Practical clinical considerations of luting cements: A review. *J Int Oral Health*. 2014;6:116–120.
13. Mohammadi Z, Dummer PM. Properties and applications of calcium hydroxide in endodontics and dental traumatology. *Int Endod J*. 2011;44:697–730.
14. Rusnac ME, Gasparik C, Irimie AI, Grecu AG, Mesaroş AŞ, Ducea D. Gionomers in dentistry - at the boundary between dental composites and glass-ionomers. *Med Pharm Rep*. 2019;92:123-128.. p. 1–6.
15. Grego E. Simplified method for placing glass ionomer cement bases. *J Prosthet Dent*. 1990;64:740–742.