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A comparative evaluation of clinical features of a restorative material packed in blisters

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KEYWORDS

restorative materials, modelling, polishing, restorative esthetics, cross-infection control

SUMMARY

Introduction. Vast indications for use of the polymer resins in cavity reconstruction result from a progress in manufacturing process. A new group of cross-infection control restoratives provide sterility of the treatment together with fulfillment of both the patients and the dentists requirements. A disposable packaging enables usage of the material's portion to restore a single lesion and prevents its further re-use.

Aim. The aim of the study was to compare clinical features, such as application, modelling, polishing and esthetics, of a restorative material packed in blisters to other polymer restorative materials.

Material and methods. A survey study was conducted among 56 students of dentistry. They were given a blister of the material and asked to use it for restoration of a chosen cavity. Afterwards, they were asked to fill in a questionnaire concerning the clinical work with the material. All returned data was analyzed with chi-square test at $p < 0.05$.

Results. The overall responsive rate was 44.6%. Taking the material from the blister was comfortable for 84%. The material's application in the cavity was estimated well by 92% of the respondents. 72% believed its application and polishing was significantly easier than the other materials. 72% of the students claimed the material was more esthetic than the other restoratives.

Conclusions. The restorative material packed in blisters is comfortable to apply in the cavity, can be easily modelled and polished. Blisters are comfortable to use by the dentist and the assistant. Due to high esthetics, it is dedicated for esthetic restorations.

INTRODUCTION

Restorative dentistry is based on restorative materials, mainly resin-based polymers built of a matrix, composed of a blend of organic monomers, and an inorganic fillers, which sizes and percentage shares decide upon the material's classification and clinical usage. Diversity and universality of the resin-based materials undoubtedly decide on their usage in both the anterior and posterior areas (1). Vast indications for their use in restorative treatment also result from a technological

development, which is striving to eliminate their drawbacks, such as polymerization shrinkage, bacterial microgap, porosity, cytotoxicity and allergic action (1, 2). Microhybrid polymer resins, which are built of inorganic filler sized 0.4-1 μm (3), are universal restoratives for all lesion types (4). Nanocomposites, which were introduced to a clinical usage in the early XXIst century, contain pre-polymerized nanosized filler particles and their aggregates sized 25-75 nm, whose small dimensions enable an increase of their load in the material up to 79.5% (5). A decrease of the matrix containing

hydrophilic monomers and an increase in the inorganic filler content, are the factors influencing the decrease of the water sorption by the material and, in effect, an increase of its physical endurance (6, 7). Nanocomposites are hence less prone to occlusal wear (3, 8), which makes them specifically dedicated for reconstruction of stress-bearing lesions. Apart from good mechanical features, they are also very esthetic (9). The cross-infection control materials based on a polymer resin are a new group of the restorative materials, whose aim is to provide sterile conditions during treatment and follow both the dentist and the patients requirements. A packaging, which concept is similar to the blisters in which pills are separately kept, decides on their protective action. Different blisters' sizes make it possible for the clinician to use an adequate portion of the material during single reconstruction. During treatment the material must be used shortly, as the opened packaging does not provide a good isolation from the outer environment. A representative of a cross-infection control material is Next (Dental Life Sciences (mfg Ltd., Wigan, UK)), dedicated for reconstruction of all class, both carious and non-carious lesions. Portions of the material set by the manufacturer (0.07 and 0.2 g) are packed in disposable, sterile blisters. The chemical composition of the material is depicted in figure 1.

AIM

The aim of the study was to compare clinical features, such as application in the cavity, modelling, polishing and esthetics, of the restorative material Next to other polymer restorative materials.

MATERIAL AND METHODS

A survey was conducted among 56 students (tab. 1) at the Dentistry Department of the Medical University in Warsaw. Each student was given a 0.07 g blister of the restorative material Next (mfg Ltd., Wigan, United Kingdom; shade A2) for reconstruction of a randomly chosen cavity. After reconstruction, the students were asked to individually and anonymously fill in the survey comprising of 25 questions about the material. The survey's questions were constructed so as to enable the students the comparison of Next with a restorative material they would normally use during clinical classes. An open question about the material was also included in the survey. Filling out the survey took approximately 15 min. The data from all collected surveys were analyzed using chi-square test with SPP 10.0 for Windows (SPSS Inc., Chicago, USA), at a significance level of $p < 0.05$.

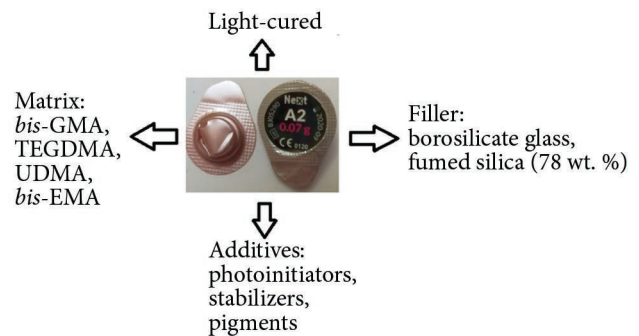


Fig. 1. Chemical composition of restorative material Next

Tab. 1. Distribution of the response rates according to the year of study and the overall response rate

Academic year	Gender	n (%)	Amount of handed surveys	Amount of returned surveys (%)
3 rd year	female	3 (30)	28	10 (35.7)
	male	7 (70)		
4 th year	female	5 (62.5)	21	8 (38.1)
	male	3 (37.5)		
5 th year	female	7 (100)	7	7 (100)
	male	0		
Total count			Total amount of handed surveys	Total amount of returned surveys (%)
females		15 (60)	56	25 (44.6)
males		10 (40)		

RESULTS

The survey was returned by 25 students (15 females (60%) and 10 males (40%)). The response rates of the study were 37.5% (third year), 38.1% (fourth year) and 100% (fifth year). The overall response rate was 44.6% (tab. 1). Statistically relevant results of the study are presented in table 2. As much as 82% of the students compared Next to microhybrid polymer restorative Charisma Classic (CC; Heraeus Kultzer GmbH, Hanau, Germany), while the rest (8%) compared it to microhybrid polymer restorative Gradia Direct (GD; GC Europe N.V., Leuven, Belgium) and nanohybrid polymer restorative Filtek™ Ultimate (FU; 3M ESPE, Seefeld, Germany). Taking the material from blisters was considered comfortable (84%; confidence interval 63.9-95.5% at $\alpha = 0.05$; $p < 0.001$). Application of Next to the cavity was rated well by 92% of the students (confidence interval 74.0-99.0% at $\alpha = 0.05$; $p < 0.001$). As much as 72% of them stated that Next was significantly easier to apply and model compared to other materials (confidence interval 50.6-87.9% at $\alpha = 0.05$; $p = 0.043$). The remaining 20% stated that application and modelling of Next was comparable to CC, while 8% claimed it was harder to work with compared to CC and GD. The consistency of Next was softer than other materials (64%; confidence interval 42.5-82.0% at $\alpha = 0.05$; $p = 0.230$). Only 36% of the students found their routinely used material to be esthetic (24% CC; 8% GD; 4% FU), while 72% pointed Next to be relevantly more esthetic (confidence interval 50.6-87.9% at $\alpha = 0.05$; $p = 0.004$). Statistically relevant majority of the students (88%) judged Next as easy to polish (confidence interval 68.8-97.5% at $\alpha = 0.05$; $p = 0.001$), while only 36% of them claimed it was easier to polish than CC and FU (confidence interval 18.0-57.5% at $\alpha = 0.05$; $p = 0.946$). For the remaining 12%, polishing of Next was similar to CC and GD. 68% of the

students believed that packing it in blisters may facilitate dentist's independent work with the patient (confidence interval 46.5-85.1% at $\alpha = 0.05$; $p = 0.108$). Only 8% of the students claimed that packing of the restorative materials in blisters constricts (confidence interval 4.5-36.1% at $\alpha = 0.05$; $p = 0.108$) or brings chaos during treatment (confidence interval 1.0-26.0% at $\alpha = 0.05$; $p = 0.999$).

DISCUSSION

New concepts of restorative materials are emerging in the restorative dentistry. The development in this area is enormous and multirange. An increase in patients' needs concerning the quality and sterility of the treatment enhance the idea of production of sterile, disposable restorative materials. A choice of a proper material for a specific case proves to be difficult due to the variety of available products. The clinician must follow different criteria when restoring cavities in the esthetic zone, where color and great optical parameters, such as fluorescence and translucence, color stability, feasible polishing and luster are decisive (10), while reconstructions in the stress-bearing sites require physical features and radiopacity, providing further radiological control (1). Cross-infection materials are the answer to growing needs of both the patients and the dentists. Their aim is to fulfill patients' esthetic requirements and provide comfort and sterility of the treatment. They also give dentists a choice of the material's color and may potentially influence the treatment's cost. Thanks to portioning and separate, hermetic packaging, the dentist does not need to possess multi-gram syringe of a restorative material of a rarely used color, which potentially decreases the loss caused by its aging. However, the revolution in the material's packaging enforces the presence of a dental assistant during treatment,

Tab. 2. Statistically significant ($p < 0.05$) study results

Survey question	Percentage (%) share of the positive responses	Percentage (%) share of the negative responses
Is retrieving the material Next from blister comfortable during clinical work?	84*	16
Is the material Next easy to apply in the cavity?	92*	8
Is the material Next easier to apply and shape in the cavity than the material you use on a routine basis?	72*	28
Is the material Next more esthetic than the material you use on a routine basis?	72*	28
Is the material Next easy to polish?	88*	12

*statistically relevant data for $p < 0.05$

who would pick the right color from the available blisters, open it and handle to the operator.

The students of dentistry were invited to this survey study due to their impartiality towards dental materials' manufacturers and lack of experience concerning the economic aspects of a restorative treatment. The young dentists are eagerly taking up new solutions and are sensitive to differences between novel restoratives and those, which they know from clinical classes. Unfortunately, low responsive rate indicates that our students suffered from a blockage to express their opinions. Cieszko-Buk et al. (11) has conducted a similar study, which included a clinical evaluation of a restorative material. Unfortunately, the authors did not provide details neither on how many students were involved in their study nor on its response rate. The students of dentistry were given the material and were asked to anonymously fill in a questionnaire on its usage, like in this study. Features such as application, modelling, polishing and esthetics were evaluated in both studies. However, they cannot be compared due to the lack of data on the respondents. In the global literature, there are no studies in which students of dentistry would evaluate restorative materials, which may result from a different way of study mode. The restorative material Next was well appraised by the students, both in working with the packaging and in clinical aspects, such as application, modelling and polishing. Its consistency estimated to vary between flowable and solid material. The material proved to be softer than microhybrid CC and GD and nanohybrid FU restorative resins used by the students. As a result, some students considered Next to be more difficult in a clinical work, compared to other materials. Surprisingly, only 36% of the respondents claimed the routinely used restorative

to be esthetic, regardless of their classification. In their opinion, the esthetics of Next was better and the material could be easily polished. Its consistency enabled faster, easier polishing than of the traditional microhybrid CC and nanohybrid FU. In their free opinions, the students complained about small amount of the material in the blister, which proved to be too little for a vast restoration. A 0.07 g blister was sufficient to restore a small and medium cavity. An interesting postulate of some students was a higher cost of a restoration done with Next, compared to the cost of a restoration from a syringed polymer resin. A study by Gourville and Dilip (12) indicated that, from a psychological point of view, a product's consumption is not driven by its actual cost, but an ostensible cost, meaning the one regarded by the potential clients. A perception of the product's cost may therefore influence its sales (12). In reference to Next, the opinion on its high cost may result from its packing in portions, which may be regarded costly by the majority of dentists. In the dentist point of view, a syringe containing 5 g of the material is more beneficial to purchase, as the overall material's cost would be divided into multiple restorations. The literature provides no data on other representatives of the cross-infection restorative materials, thus this theme require more research.

CONCLUSIONS

Restorative material Next is easy to apply, model and polish in the cavity. Blisters are comfortable to use by both the dentist and the assistant, which may possibly facilitate their clinical work. A blister of 0.07 g is sufficient for a small and medium cavity restoration. Due to very high esthetics it may be especially recommended for esthetic restorations.

CONFLICT OF INTEREST

None

CORRESPONDENCE

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REFERENCES

1. Kobińska-Brzoza JM, Dobrzyński M, Fita KA et al.: Aktualnie zalecane materiały odtwórcze w nowoczesnej stomatologii zachowawczej. *Polim Med* 2015; 45(1): 37-43.
2. Yih-Dean J, Bor-Shiunn L, Chun-Pin L, Wan-Yu T: Biocompatibility and cytotoxicity of two novel low-shrinkage dental resin matrices. *J Formos Med Assoc* 2014; 113: 349-355.
3. Tuncer S, Demirci M, Öztaş E et al.: Microhybrid versus nanofill composite in combination with a three step etch and rinse adhesive in occlusal cavities: five year results. *Restor Dent Endod* 2017; 42(2): 253-263.
4. Zimmerli B, Strub M, Jeger F et al.: Composite materials: composition, properties and clinical applications. *Schweiz Monatsschr Zahnmed* 2010; 120(11): 972-979.
5. Hervás-García A, Martínez-Lozano MA, Cabanes-Vila J et al.: Composite resins. A review of the materials and clinical indications. *Med Oral Patol Oral Cir Bucal* 2006; 11(2): E215-E220.
6. Gonulol N, Ozer S, Sen Tunc E: Water sorption, solubility, and color stability of giomer restoratives. *J Esthet Restor Dent* 2015; 27(5): 300-306.

7. Harhash AY, ElSayad II, Zaghoul AGS: A comparative *in vitro* study on fluoride release and water sorption of different flowable esthetic restorative materials. *Eur J Dent* 2017; 11(2): 174-179.
8. Pieniak D, Walczak A, Niewczas AM: Comparative study of wear resistance of the composite with microhybrid structure and nanocomposite. *Acta Mech Automat* 2016; 10(4): 306-309.
9. Sachdeva S, Kapoor P, Tamrakar AK, Noor R: Nano-composite dental resins: an overview. *Annals of Dental Specialty* 2015; 3(2): 52-55.
10. Gouveia THN, Theobaldo JD, Vieira-Junior WF et al.: Esthetic smile rehabilitation of anterior teeth by treatment with biomimetic restorative materials: a case report. *Clin Cosmet Investig Dent* 2017; 11(9): 27-31.
11. Cieszko-Buk M, Kamińska K, Klichowska-Palonka M et al.: Ocena kliniczna materiału ELS w opinii studentów i lekarzy. *Nowa Stomatol* 2005; 1: 18-20.
12. Gourville J, Dilip S: Pricing and the Psychology of Consumption. *Harv Bus Rev* 2002; 80(9): 90-96.

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