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Epoxy compositions with Gypsum, White Cement and $CaCO_3$ as an effective material for self-restoration of carious and traumatic damages of side teeth.

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Abstract: - Firstly in scientific literature, at the level of a popular scientific experimental publication, a theoretical substantiation of the need to introduce preventive and self-restorative methods in dentistry was carried out, thanks to the use of compositions with nano-silica, nano-aluminum oxide and micro-sized mineral plant fillers. Methods for creating tooth powders and epoxy polymer fillings are proposed - from publicly available components, for use by non-specialists in places unsuitable for traditional prevention. All these assumptions and hypotheses were confirmed in the obtained results of observations in the well-being of patients by visual information (photo, x-ray image) of the treated groups of affected teeth.

The experimental part was based on the results of preclinical studies and was carried out on volunteers, with the involvement of consultants from dental clinics. The findings confirm the possibility of effective prevention and self-healing of dental systems through non-operative exposure to special complexes of dental powders, pastes and rinsing systems (subject to the correct mode of dental use). The physical, mechanical and resistance parameters of these epoxy compositions during curing in dry and wet (or underwater) conditions are indicated. Practical examples of fillings and restorations of real teeth are presented. It has been shown that the use of these compositions (subject to curing technology) provides highly effective dental fillings, with a minimal percentage of unsuccessful cases and the absence of post-effects. The proposed method of using ordinary, commonly available epoxy resins allows us to open a new direction in dentistry - self-dental methods. This is very important for the majority of the world's population.

Keywords: highly filled epoxy, self-restoring compositions, without surface-preparation, 85% positive effects, resistance, adhesion, self-installation of a new bite, absence of secondary caries, Possibility of quick multiple reinstallation.

Supplementary information The online version of this article (https://doi.org/xx.xxx/xxx.xx) contains supplementary material,which is available to autho-rized users.

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1. Introduction

1.1. Dental problems: can we help ourselves without dentists and clinics?

It is rare to find a person indifferent to tooth and oral problems. Dental diseases are rarely fatal, but forced attention to them is increased in most patients. This can be explained by both psychological and physiological, as well as evolutionary reasons. Physiologically, dental diseases prevent you from properly chewing and digesting food, which leads to digestive diseases. The ancient human fear of toothache is also connected with this: even today since poor digestion shortens life, and in ancient times this meant quick death. Psychologically, bad teeth poison or eliminate the main means of relaxation and pleasure - the pleasant process of eating. But bad teeth also mean bad appearance. It is not for nothing that the health of horses, cows, and other animals is determined by their teeth - and the assessment of human health is partly done by the condition of the teeth.

Over the past 100 years, a breakthrough has been made in their solution, comparable to space flights and the discovery of vaccinations. Modern dentistry has made it possible not only to pull out teeth, but also to restore them. But even this did not eliminate, but only alleviated, the anxiety and suffering caused by teeth to most people.

Today (despite progress in self-treatment of skin, traumatic and other problems), dental problems are still considered the exclusive prerogative of doctors. This creates great inconvenience for the majority of the population (after all, teeth often deteriorate at any age), and in many regions, dental care is inaccessible or very expensive.

1.2. Self-dentistry – it is really

It is well known that the vast majority of the population experiences dental problems, and from birth. Until recently, these problems were solved like this:

A) by going to the clinic, after which the problem was solved or continued in the form of further treatment (or removal)

B) folk remedies (gargling with herbs, massage, yoga, etc.), with varying success

C) simply were not resolved (and the tooth was destroyed or remained in a metastable state). The most correct thing is still considered to be a quick visit to the dentist. And even more - “take care of your teeth, and visit the dentist every six months,” and if a hole or damage is detected, - go for an appointment as soon as possible. We offer another way –

D) Self-sealing with polyepoxy compounds, with minimal surface preparation. We can say that this method is a continuation of the method of self-healing of teeth established by nature.

If notice the teeth of cows and horses (when can across them on country roads) They had no obvious damages, but were often “multi-layered”: areas of white shiny enamel were replaced by clay-cement areas - hard and almost insoluble analogues of our “harmful tartar”. By keeping them in acids and oxidizing agents, it was possible to partially dissolve these “cemented” areas: underneath there were ordinary carious cavities or chips. Thus, in the process of chewing dusty grass, the animals automatically “chewed” microparticles of minerals into their carious cavities, and the grass resin served as a binder - which in the mouth (i.e. at 40 degrees) was pressed and turned into a hardening putty. If ordinary herbivores have such a simple self-healing mechanism, then why shouldn’t humans adopt it? What is wrong with our civilized food that teeth do not receive proper nutrition and building materials for self-repair of microdamages?

However, folk traditions have done something (although not published) in the field of detailed preventive care. For example, there are tips from long-livers like “chew pine needles and plant resin, and you won’t get sick,” or recommendations to rinse your mouth repeatedly with bactericidal decoctions. This probably does not apply to all diseases, but it is obvious that bactericides from pine resins dramatically increase the hygiene and stability of

the oral cavity and nasopharynx. And the teeth probably receive damage sealing with resin, which in a constantly heated mouth will then partially harden into something similar to young amber.

The first experience of our work has already been reflected in earlier publications [1-3]. Here we will present updated statistics with improved understanding of self-restoration techniques and the properties of these materials.

2.1. Experimental and omparative data.

Figures 6 and 7 well reflect the difference in the approaches of traditional and our technique. The question should immediately arise (even among non-specialists) - how dare we exclude the most important stage of cleaning the surface of a damaged tooth, before filling. It should be answered like this. The stage of cleaning the surface (using a drill or other abrasive tool) leads to a strong (often leading to the loss of a nerve and even the entire tooth) cutting of living material. In this case, the relief of the tooth, bite, and the general ecosystem of the oral cavity can be noticeably disturbed. All these troubles are considered by dentists and patients as the inevitability of existing methods. Our method preserves maximum tooth structure. Abrasive-grinding cleaning before filling is replaced by repeated cleaning with a toothbrush and rinsing. The uncleaned fragments remaining on the tooth, being covered with epoxy polymer, are isolated or neutralized by the immune system - just as the skin neutralizes subcutaneous suppurations, or are partially embedded in the polymer. The last property of epoxides, the ability to use pus and carious masses as a hardener for polymerization, requires special attention in further research. Here we have an analogue of modern rust converters, when anti-corrosion treatment does not require preliminary cleaning of the corroded layer.

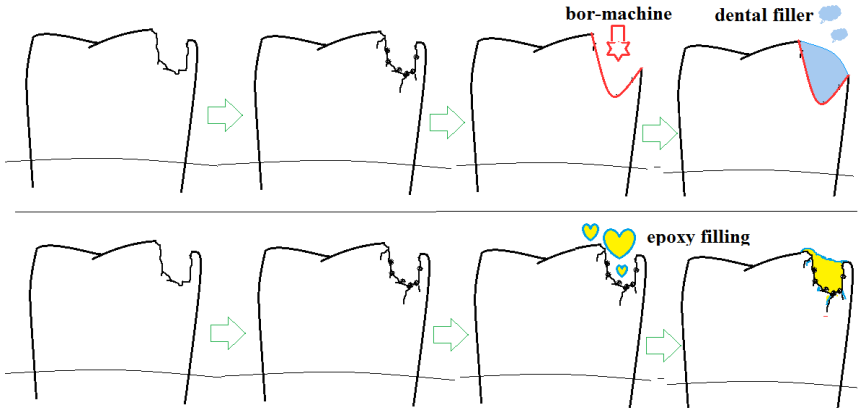


Fig.2. The scheme of traditional and our dental technics .

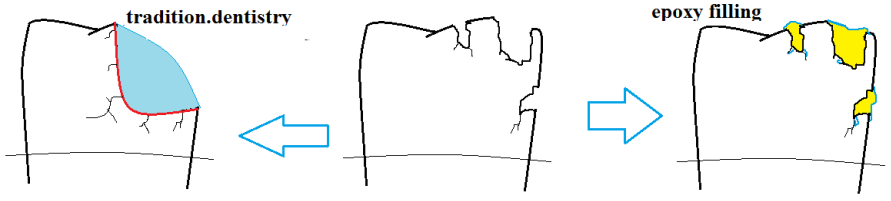


Fig.3. The scheme of result in case of traditional and our dental technics [1]

Fig.5. Effects according to the results of the first out-of-clinical restorations with epoxy composites.

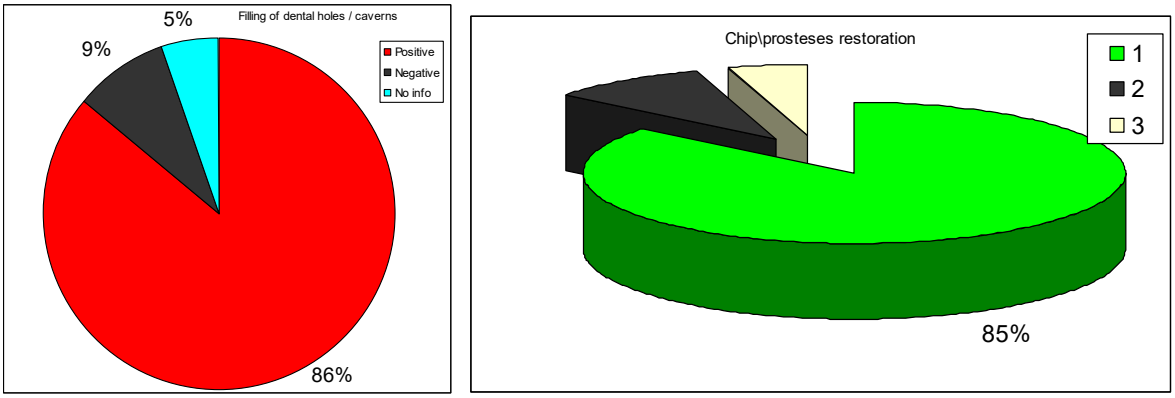


Fig.6. Type of epoxy composites available for dental restorations. Left-to right – compositions and their fillers: 1) Epoxy+SiO2 and Neat epoxy; 2) Epoxy + dentifrice or TiO_2 ; 3) Epoxy + Gypsum; 4) Epoxy + WhiteCement .

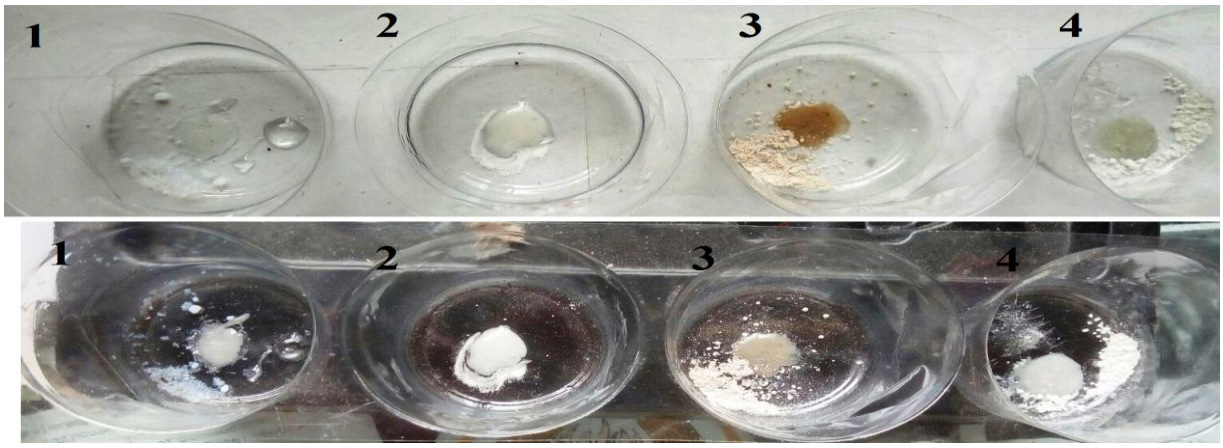


Fig.7. The

Some tests can be successfully carried out on materials simulating dentin and the moist oral environment (fig.7A). arrows indicate places of application

Thus, we can talk about the discovery of a new highly demanded direction in medical materials science and dental technology - self-sealing. This will be very useful both in cases of difficult access to quality treatment, and for the treatment of special groups - for example, nomadic peoples and collectives, poor strata of the population, as well as children (milk teeth) and animals.

Фигура 5 показывает пример быстрого эффективной самореставрации детского зуба (проведенной самим ребенком в домашних условиях, без глубокой зачистки поверхности). Случаи B и C показывают долгосрочность функционирования подобных пломб – к примеру эти пломбы стоят, работают и сохраняют

зуб до сих пор (уже почти 1,5 года). Особо отметим, что данне пломбы пришли на замену установленной до этого по всем правилам композитной акриловой пломбы в коммерческой клинике – единственной ГД взялись ермонтировать 8-й зуб (вместо его удаления). Пломба от профессиональных дантистов простояла менее месяца, после чего пациент (не пожелавший удалять болевший и разваливавшийся зуб) согласился стать волонтером нашей экспериментальной программы.

Figure 7 shows an example of quick, effective self-restoration of a child's tooth (carried out by the child himself at home, without deep cleaning of the surface). Cases B and C show the long-term functioning of such fillings - for example, these fillings stand, work and preserve the tooth to this day (almost 1.5 years). We especially note that these fillings came to replace the previously installed composite acrylic filling in accordance with all the rules in a commercial clinic - the only GD undertook to fix the 8th tooth (instead of removing it). The filling from professional dentists lasted less than a month, after which the patient (who did not want to remove a painful and decaying tooth) agreed to become a volunteer in our experimental program.

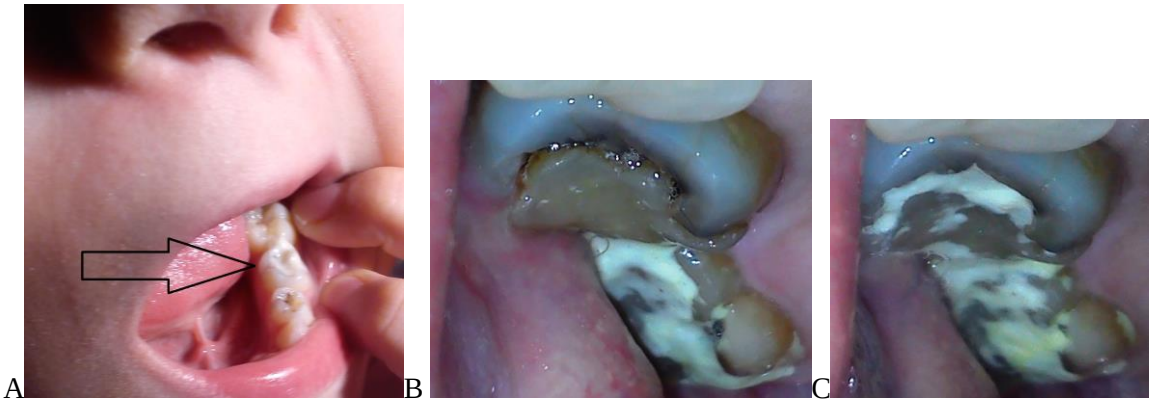


Fig.7. The epoxy refilled (plomed) teeths: A. Molar ; B. 7+8 right, first filling (8.2022) and C. twist filling (10.2022)

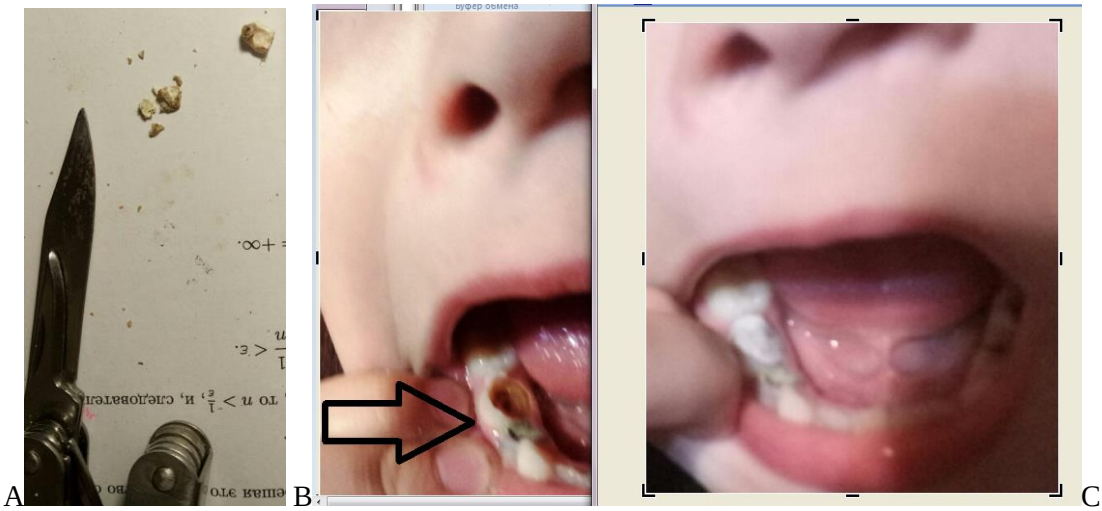


Fig.8. A. Fragments of old (epoxy-gypsum) destructed dental filling; B. Cavity in molar (and caries in righr 4th) after loss of destructed dental filling; C. The same molar (and filled caries in righr 4th) after self-refilling by epoxy-whitecement.

In Fig.8 can seem, that after loss of destructed dental filling (1 year old), the place of cavity is clean, without without traces of carious and putrefactive manifestations or destruction of the bottom. It show that epoxy materials do not provocate interfacial or bottom secondary caries (despite the fact that surface preparation before filling was not carried out at all).

Compared to traditional fillings (installed according to all the rules and with surface preparation), epoxy ones should be noticeably inferior in strength and durability. It is also clear from Table 1 that epoxy materials, after exposure in water, significantly lose strength and durability. However, the first acrylic dental materials (50 years

ago) were also far from ideal - they turned green, fell out, and poisoned the oral cavity. Further development of epoxy compounds will eliminate this drawback.

Table 1. Comparison of the strength and durability of epoxy composites in their original form and after exposure to a warm aqueous environment. *-Estimated generalized data.

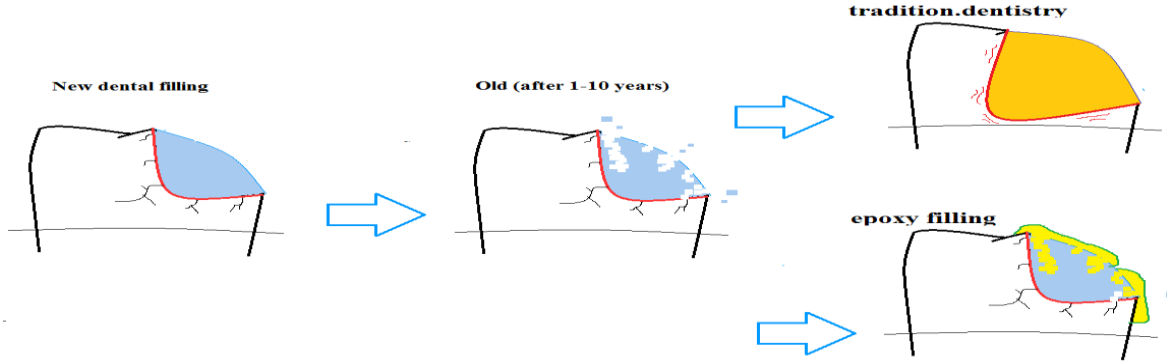
	in dry normal cond.	in H_2O
Compression, МПа	100 +-20	50+-10
Bending, МПа	10 +-2	6+-2
Adhesion to dentine, rel.un.	100%	80%
Adhesion to acrylate, rel.un.	100%	35%
Adhesion to enamel, rel.un.	100%	35%
Adhesion to steel, МПа	4	1
Microhardness, XF	80	40
Wear resistance, rel.un.	100%	50%
Water resist, (swelling), 30 ºC, % \ 3 monts	3%	10%

From Table 2 can see that the service life of epoxy overlays is 10 times lower than for commercial medical fillings. This is also explained by the imperfection of the primary compositions and the lack of a broad base of research on the water resistance and resistance of the composite in the oral cavity. The quality of these compositions is also reduced due to the fact that we showed the possibilities only for ordinary, technical, commercially available polyepoxides and technical or available biocompatible fillers (gypsum, nanosilica, clay). Specially selected epoxy resins and fillers will certainly immediately increase service life, but of course they will become much more expensive and less accessible to the population.

Table. 2. Comparison of traditional and "self-epoxy" methods. * - according to the first tests, with a sample of 15 cases.

	Traditional	Self-epox
The need to visit/consult a doctor	Need obligatory, 1-3 visits	No
Preliminary hard cleaning of the tooth surface	Need obligatory	No
Deep cleaning, with possible removal of nerves	Highly probable	No
Post-operative ailments	Probable	No
Medical correction of a new bite	Probable	No
Payment for dental services	Obligatory	No
Inflammation under/near the plomb filling	Probable	Low probability *
Breaks, falls and chips of a new filling	Low probability	Probable
The need for prompt refilling	Low probability	Probable
Difficulties for prompt refilling	Depends on the doctor	Easy
Possibility of refilling without removing nerves or teeth	1-2 times	Unlimited
Service life (with high-quality installation)	5 - 15 years	0,5 – 1,5 years

Fig.5. [1] the comparative scheme of repeated dental technics, after partially destruction of basic filler.



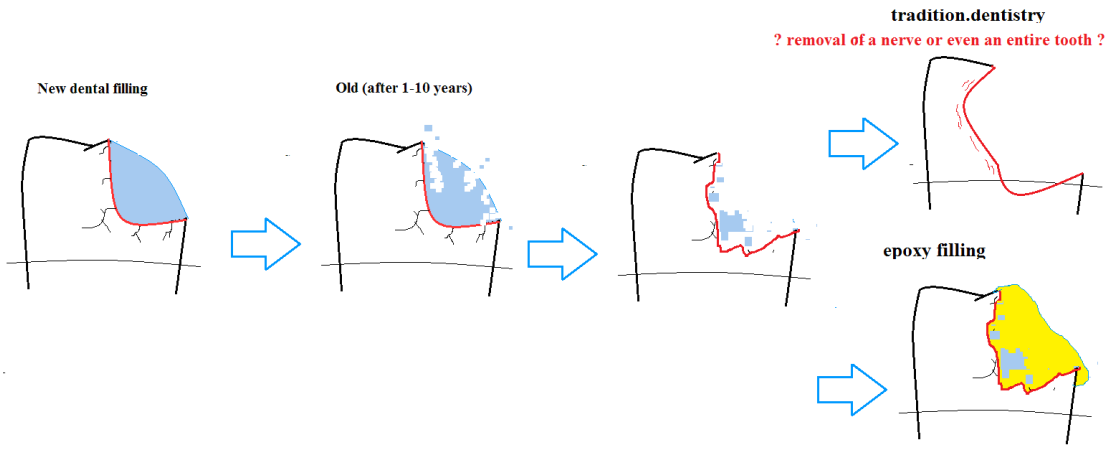


Fig.6. [1] the comparative scheme of repeated dental technics, after full destruction of basic filler.

Conclution:

1. It is It is stated that that even imperfect self-dental compositions will significantly help humanity in solving the problems of prevention and treatment of dental diseases (especially in regions with weak or inaccessible expensive medicine).

2. Our first experimental practical works proves the possibility of the existence of highly filled epoxy-mineral compositions capable of filling and restoring lesions and mechanical damage to teeth, independently and outside of clinical conditions, is shown. Disadvantages and possibilities of ordinary cheap epoxy compositions based on are shown. A comparison of their efficiency parameters with acrylic composites currently accepted in dental practice was carried out.

3. Based on the experimental results, the main limitations and disadvantages of these compositions are shown. Ways to overcome them are indicated.

4. These results will be useful for people and communities who, for various reasons (remoteness from cities, business travel, poverty, workload) are temporarily or constantly lacks access to quality dental care.

Refrences:

1.D Starokadomsky, Mr Reshetnyk and Nd. Starokadomska. Epoxy Compositions as a Material for Effective Self-Restoration of Carious and Traumatic Damage to Teeth and Strengthening of Old Fillings. First Experience. *Biomed J. Sci & Tech Res* . V.53(2). P.44518-44525. – DOI: 10.26717/BJSTR.2023.53.008373 - https://biomedres.us/pdfs/BJSTR.MS.ID.008373.pdf

2.D. Starokadomsky, M. Reshetnyk.*;* “Compositions "Nanosilica – Mineral Fillers – Epoxy Resin" For Out-Clinical Dental Prevention and Self-Treatment of Carious and Traumatic Dental Damages”. *Middle East Res J. Dent.*, Nov-Dec. 2022. V. 2(1), P.1-3. -DOI: 10.36348/merjd.2022.v02i01.001

3. D. Starokadomsky, M.Reshetnyk. Water-Polymerisable Compositions "Epoxy Resin - Nanosilica – Mineral Fillers" for Out-Clinical Dental Prevention, and Self-Treatment of Carious and Traumatic Dental Damages. *International J.of Health & Medical Res.* – December 2022, V. 01, Is. 05, P. 69-73 - https://ijhmr.com/december-2022/ISSN(online): 2833-2148