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COMPARATIVE ANALYSIS OF MECHANICAL PROPERTIES OF FIBER REINFORCING SYSTEMS FOR ADHESIVE SPLINTING

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The relevance of the research. Data from special scientific literature indicate that there is no single standardized approach to conservative treatment, and there are no recommendations for choosing orthopedic structures with a minimum number of retention points to restore the anatomical and functional properties of the dental system [1; 2].

With a pronounced degree of bone resorption and tooth mobility, splinting is necessary. By redistributing stress from an individual tooth to a group of teeth, splinting can reduce periodontal overload and thereby eliminate traumatic occlusion, normalize the direction of load, and prevent secondary displacement of teeth [3, 5].

The main requirements for splints are the strength and reliable fixation of mobile teeth, the absence of negative effects, and the possibility of unhindered hygienic and therapeutic manipulations [4].

To date, the widespread introduction of adhesive technologies in dental practice has led to the use of fiber materials and light-curing fluid composites as fittings.

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In modern practice, two types of non-metallic reinforcing systems are used as reinforcing composite materials, which are divided depending on the chemical composition of the matrix:

1) based on an inorganic matrix: ceramics, fiberglass systems (Glasspan, Fiber-Splint, EverStick C&B, Glass Chords, Construct, FibreKor);

2) based on organic matrix-polyethylene fiber systems, polyamide – Ribbond ("Ribbond", USA), Connect ("Kerr", USA), DVA (Dental Ventures of America), Fiberflex [6]

The choice of material for temporary splinting of teeth is of great practical importance in modern dentistry and determines the success of treatment of periodontal diseases. The comparative effectiveness and strength characteristics of reinforcing systems for splinting are poorly understood. Therefore, the purpose of our study was to study the strength characteristics of fiber reinforcing systems of various composite splinting materials and their degree of adhesion to tooth tissues (Ribbond, Fiber-Splint).

The aim was to study the mechanical properties of fiber reinforcing systems for adhesive splinting.

Research materials and methods. For the study, we selected reinforcing fibers from different classes of Ribbond and Fiber-Splint, which differ in chemical composition.

Ribbond – polyethylene in chemical composition, has a low level of modulus of deformation. The fibers are subjected to plasma treatment, which significantly improves their impregnation with the composite and leads to the creation of a strong block. The presence of a nodular cross-weave in the Ribbond allows achieving exceptional flexibility, which prevents the formation of cracks in the dental polymer. Due to the blocking of the fibers at each node crossing, the tape does not unravel when cutting with scissors.

The Fiber-Splint system is based on a 4 mm wide, 0.06 mm thick microfibre quartz tape and light-cured unfilled bonding. Thanks to the microfibre structure, Fiber-Splint, impregnated with light-curing bonding, after being illuminated with a halogen lamp for polymerization, forms a solid structure with an internal spatial frame. Does not unravel when cutting, does not unravel when modeling.

Models of splinting structures were made from Ribbond and Fiber-Splint materials. Splinting was performed on extracted teeth using tapes, EsFlow (Spident) liquid-flow composite, and EsBond (Spident) adhesive system. The splint fiber was positioned in the open state so that the separation occurred in the middle of the sample during the test. Thus, 10 samples were made from the tires taken for the study.

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The tests were performed on the Instron 1112 device (England) at room temperature. Blanks were fixed between the traverse of the device. According to the standard program, the maximum threshold of the tensile and separation forces was measured with a gradual divergence of the traverse at a speed of 0.01 mm/s. We got a programmed gap in the middle of the sample.

Research results and their discussion. Based on the data obtained during the tests, a table of numerical values was compiled and a comparative analysis of strength characteristics was performed (Table 1).

Table 1

Values of forces (N) applied to the workpieces for separation.

Vaterial	**№ of blanks**									
	1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Fiber-Splint (N)	110	89	83	117	94	89	78	112	107	93
Ribbond (N)	61	79	72	65	73	80	62	85	81	77

It was found that Fiber-Splint's plastic properties are more pronounced and deformation occurs under the influence of a higher force index. Data on the strength of adhesion of each tire to hard tooth tissues and strength characteristics were also obtained. The average value for Fiber-Splint is 96.75±11.31 N, and for Ribbond – 73.88±10.21 N.

Conclusions.

None of the materials for splinting teeth is ideal, but the task of the dentist is to select the most optimal for a particular clinical case. In the study, we studied materials that perform an identical function, but different in chemical composition.

As a result of testing, it was found that each of the materials for splinting has certain advantages in terms of mechanical properties and adhesion. The presence of a nodular cross-weave in the Ribbond allows achieving exceptional flexibility, which prevents the formation of cracks in the dental polymer. And fiberglass, the basis of Fiber-Splint, itself demonstrates unexpected properties: it does not break, does not break and bends without destruction. Fiber-Splint is very hard and does not adapt well to the surface of the teeth.

The use of materials from an organic matrix can improve the efficiency of splinting, significantly reduce the risk of rebonding and tire breakage, which is due to greater plasticity. This also allows achieving a good level of side load compensation.

The results indicate that the problem of studying the properties of splinting materials is not fully understood and requires further research. These studies are necessary for the development of tactics and criteria for selecting splinting structures for immobilization of mobile teeth based on a specific clinical situation.

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