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COMPARATIVE CHARACTERISTICS OF THE PROPERTIES OF DENTAL IMPLANTS DEPENDING ON THE DESIGN, SHAPE AND SURFACE IN THE EXPERIMENT.

Resume.

The diversity and rapid development of modern dental implant systems with different types of surfaces, shapes and design features encourages practitioners to find their optimal mechanical and biological qualities. And the widespread use and availability of this method of restoring lost teeth creates an ever-increasing demand from patients [1,5]. Unfortunately, some manufacturers prioritize the marketing appeal of their implant over research into the feasibility and biological benefits of a particular type of implant design and shape, and often simply duplicate or combine certain implant shape elements in well-known brands without understanding the developers' intent and goals. That is why the question of the optimal shape, the number of turns of the thread, the aggressiveness of the thread, the size of the thread blades, etc. cause a lot of contradictions and discussions and at the same time, remain relevant and little studied in the scientific literature. In this article, we compare popular implants and evaluate them from a new angle.

Keywords: geometry of the shape of the dental implant, the area of the dental implant, the properties of the shape of the implant.

The aim of the study.

Compare the properties of different dental implants depending on the design, shape and surface area of the experiment.

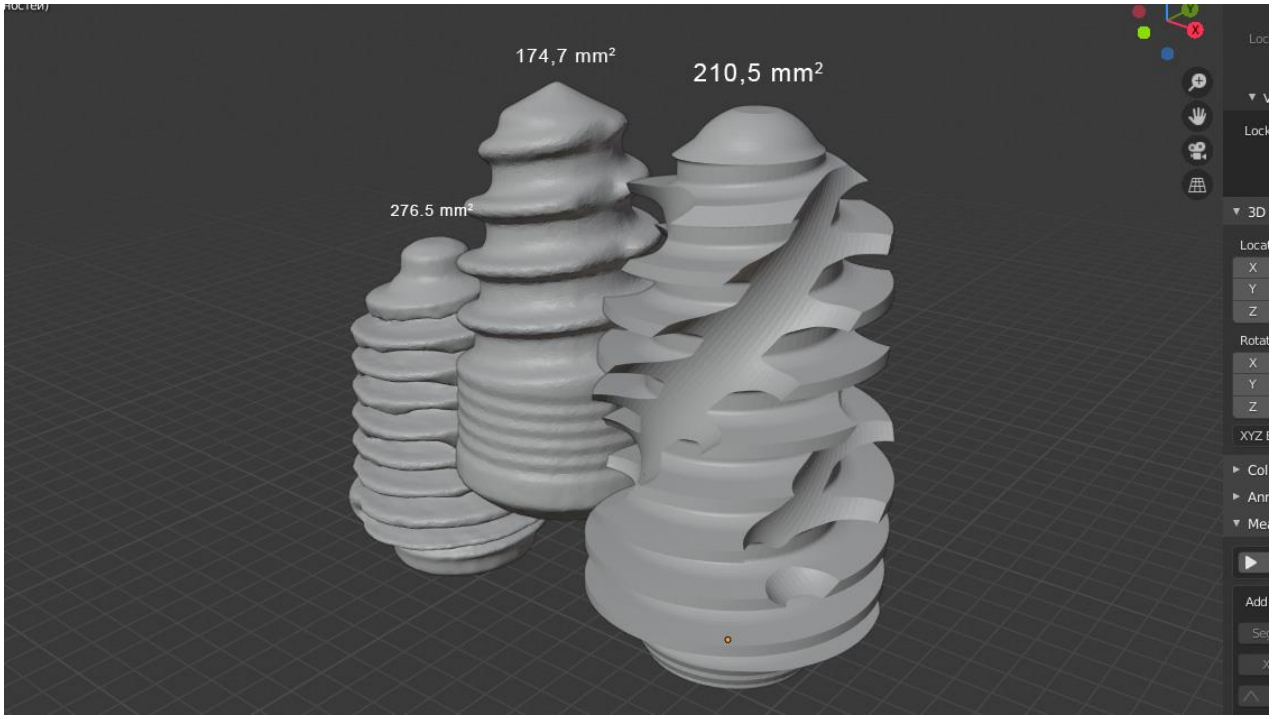
Materials and methods.

For comparison, samples of currently popular in Ukraine dental implants of different manufacturers and price segments of the market but of similar sizes were selected, namely: dental implants Vitaplant VPKS 5.0x10 mm, dental implants Mega Gen AnyRidge 5.5x10 mm and dental implants Alpha Dent Superior Active 5.5x10 mm. These implants are positioned by manufacturers as optimal for single-stage implantation with the possibility of early or immediate loading. The calculation of the total area of the implants was performed by scanning the implants with an optical dental 3-D scanner DOF SWING at maximum resolution and software package Exocad Valletta and Blender. During the experiment, the implants were immersed in a ferromagnetic substance with a constant coefficient of dynamic and kinematic viscosity at the same temperature conditions.

Research results and their discussion.

I. Comparative characteristics of the most popular implant systems

The selected models of dental implants have a similar conical shape but differ sharply in the nature of design and surface shape, we have significant experience in the use of these implant systems, which allows us to adequately assess each of them. The Vitaplant implant (Ukraine) has a massive body and 5 equidistant turns of aggressive thread of insignificant length, moderately pronounced anti-rotation slots and the upper part of the body with often cut shallow turns designed for placement in the cortical layer of bone. This implant has all the hallmarks of versatility and is designed with bone types in mind. Aggressive thread, pronounced conicity of the body and pointed end allows you to develop a significant torque when installing the implant and guarantees a confident primary stability.



However, the small number of turns and their small length can not create a large surface area (this size of the implant has an area of 174.7 mm2), which at an early load can cause disintegration of the implant, especially in case of prosthetics of molars. Also one of the debatable design solutions is a wide upper part with a small thread, which sometimes creates significant pressure in the cortical layer of the jaw bone and can provoke cracks and fractures of the walls in thin alveolar processes during implant placement and excessive bone recession in the future [2].

The MegaGen implant (North Korea) is significantly different from the previous implant. On the thin, slightly conical body of the implant, the developer placed 10 turns

of thread with wide blades. Due to the data design features, this implant has the largest surface area (of the implant systems described in this article, and is 276.5 mm2 for this size), which is an advantage in both early and late stages of implant integration. Probably because of this, the manufacturer did not place any anti-rotation elements on this implant. The presence of extremely long threaded blades provides this implant with a number of significant advantages in practical application, and one of which is good primary stability in single-stage implantation, which is realized not by friction of the implant body, but by "cutting" the blades into the bone structure [3]. However, when implanted in a significantly corticalized jaw bone (type I bone) has to significantly expand the bed for the implant, which sometimes leads to a lack of contact of the bone with the body of the implant, may lead to a slight displacement of the implant during the engraftment stage.

Alpha Dent implants (Germany) have significant design differences. The body of this type of implant has a more natural smoothed shape, without sharp transitions, and apically ends with a rounded, the safest of the above, the top. The same number of turns (10) and a very similar frequency bring the Alpha Dent implant closer to the implant described above, but unlike the MegaGen and Vitaplant implants, the design implements an innovative anti-rotation system, which in our clinical experience and the results of the immersion experiment , provides this type of implants with unique opportunities to counteract the masticatory load

without creating excessive pressure on the bone of the alveolar process, which in turn guarantees the prevention of bone recession in the neck in the first years of operation. Also, Due to this special geometry of the surface of this implant, and a well-chosen balance between the length of the blades, the distance between them and the thickness of the implant body, it is possible to successfully use it load [4]. This described implant size has a total surface area of 210.5 mm2.

We deliberately did not evaluate the surface quality of the implants described above, as this was not the purpose of our search, but this topic is of interest to us and may be explored by us in the future. The area of all implants differs slightly from the data stated by the manufacturer. We were able to find out that this is due to the fact that the manufacturer determines the area of the implant by a computer model of the implant, without taking into account the abrasive surface treatment, which in turn reduces -macro area but increases it at -micro level.

Thus, it can be concluded that at the present stage of development of implant systems, the integration of dental implants in bone tissue is obvious and highly predictable, and the demand of doctors and patients to reduce the number of surgical stages and reduce treatment time encourages manufacturers to find the most successful forms of implants. mechanical qualities at the smallest sizes. This circumstance inspired us to experiment with the dependence of the geometric shape of different implant structures and their ability to counteract the forces directed at immersion, ie, those that repeat the vectors of force application during chewing.

II. Experiment of the dependence of the geometric shape of different structures of dental implants and their ability to counteract the forces aimed at immersion.

It is obvious that the rate of immersion of a body in a substance with a constant coefficient of dynamic and kinematic viscosity at the same temperature conditions is equal to the force acting on this body and depends on its total surface area, geometric

features of structure and weight. To objectify the experimental data, we immersed the implants as close as possible to each other in a viscous, elastic ferromagnetic substance, measuring the immersion time, which is a direct indicator of the resistance of gravity acting on them vertically. Obviously, the implant will accurately replicate the resistance while in the bone.

Table 1. The results of measuring the rate of immersion of implants.

№ n \ n	Vitaplant, sec	MegaGen, sec	Alpha Dent, sec
1	2.18	3.23	4.22
2	1.24	4.05	3.04
3	2.07	4.22	3.09
4	2.02	3.61	4.02
5	1.94	3.12	3.34
6	1.49	4.22	3.03
7	1.85	4.52	3.42
Average value	**1.83**	**3.85**	**3.45**

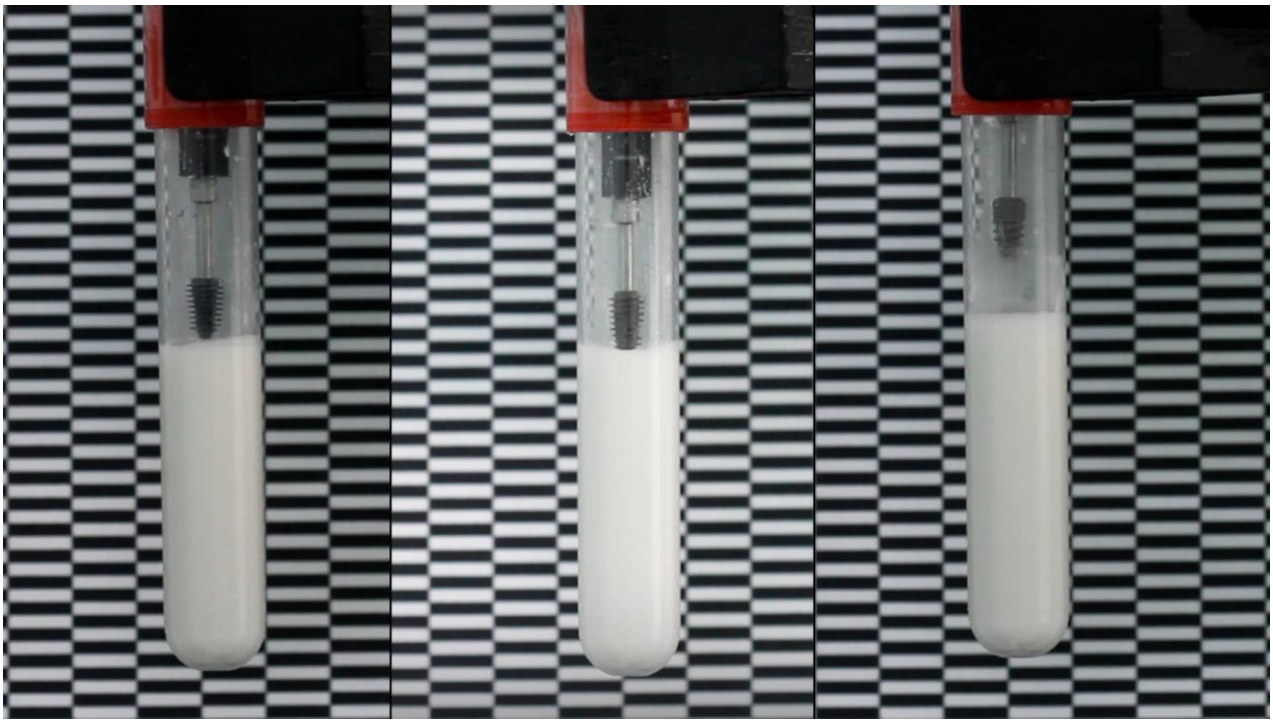


Table 1 shows that implants with a larger surface area sink more slowly and this is obvious, but in order to distinguish from this experiment the role of surface geometry, we compared the data on the rate of immersion with the surface area of the implant and obtained the results in table 2.

Table 2. Comparison of data on the immersion rate with the surface area of the implant.

	Vitaplant	Alpha Dent	MegaGen
Surface area, mm2	174.7	210.5	276.5
Average immersion speed, sec	1.83	3.45	3.85
The ratio of area to velocity	95.46	61.01	81.81
The efficiency of the geometry of the implant shape	**100%**	**136,09%**	**114.3%**

Conclusions.

Based on the analysis of the data presented for comparison of implants and objective experimental data, the following conclusions can be reached:

- when choosing the size of the implant it is necessary to take into account not only the actual length and diameter, but also the surface area of the implant, which will be in contact with the receiving bed, so using this data can be used equally effectively smaller in size but the same size;

- the shape of the geometry of the implant affects the effectiveness of counteracting the masticatory load more than its surface area, so for the correct choice of the implant system it is necessary to have knowledge about the effectiveness of the geometry of the shape.

- when comparing the three implants of the above implant systems, with their approximate sizes, the implant Vitaplant VPKS 5.0x10mm is inferior in efficiency of the geometry of the implant Mega Gen AnyRidge 5.5x10mm by 14.3%, and the implant

Alpha Dent Superior Active 5.5x10mm in turn ahead of the efficiency of the representative of the Korean company by 21.79%.

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