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Prostheses and Augmentations in the Human Being

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Strangely, but prostheses are connected with humanity through thousands of years. If you ask why, there will be one answer. In each period of humanity people lost their parts and no matter what it was: teeth, fingers, or even arms and legs. No one wants to live with limitations so artisans, scientists and others have tried to create some substitutes. Some of them were primitive like a stick with a rope, or even a cane. In some way, a cane is a prosthesis which is not connected to the body by special means like a rope or belt and you can even say that a sword can be named like an implant too. No, it can't. First of all, implants, prostheses and augmentations are made to replace the less of human organism but implants are only replacement of lost body parts. Cane offsets the poor mobility that can be caused by illness, injury or senility while sword is just a tool of injuries. Also our history is full of examples of implants. Hook arms and wooden legs are the simplest and the most available for almost every human in every period of history [1]. Of course there were more scientific, complicated and expensive prostheses like golden teeth, steel limbs and etc. Let’s briefly run through some types of prostheses.

Anatomic prosthesis. This most widely-used type has a lot of subtypes but they are common. You can substitute your arm, leg, nose, tooth, even mammary gland. Arms and legs are replaced with an imitation or with a real-working implant. The illusive version is needed when patient is scared of his less and modern science doesn't know how to fix or replace his injury

by medicine or augmentations. Also when real-working implant is too expensive for the victim. But imitation and working model are like *exoimplants*. They are worn on the body part. Artificial fingers, ears, feet and brushes are placed on the skin without integrating into the body. Nowadays it is more safe and cheap and the biointegration of such massive implants has just started to develop.

The other type of augmentations are *endoimplants* that are embedded into the human body. The list of examples is very huge and some of them are tooth and mammary gland implantations and of course the plastic surgery. Teeth are implanted by integrating special foundation in the gum. And after that the prosthesis of the tooth is "worn" on this foundation. But there are four types of tooth implants that are different and similar at the same time. The first type is integrated into the bone, the second one is integrated in the bone too but it is used when the quantity of bone is less than needed. The bone is increased by some surgery and only then the implant is integrated. The third type is embedded in the piece of tooth when it exists. And the last type doesn't need the integration to the jaw bones. It builds into the mucous membrane and sits there.

*Endoprostheses***.** One of subtypes of endoprosthesing is the joint implanting. This is needed when your own joints can't make their work of moving the part of your body. The endoprosthetics implanting is used due to various diseases and injuries of the articular apparatus, which have led to a loss of motor functions. Metal endoprostheses are made from various stainless steel alloys. They are fixed to the bone using a special cement, which is acrylic resin and alloys of cobalt and chromium. For the manufacture of sliding components of endoprostheses, for example, the head of the humerus or femur, titanium alloys are used. And for the manufacture of sliding surfaces, heavy-duty polyethylene and alumina ceramics are

used. Due to the good quality of used materials implant's service life is on average 15-20 years, and in many cases patients use them for up to 30 years. When the endoprosthesis is worn out, it is replaced with a new one.

Neuroimplants. The first artificial silicon chip was created in 2003. Silicon has the ability to connect inanimate matter with living neurons, and transistors surrounded by neurons receive signals from nerve cells, while capacitors send signals to them. Each transistor on the chip picks up the slightest, barely noticeable change in electrical charge, which occurs when a neuron is "fired" during the transfer of sodium ions. The new microcircuit is able to receive impulses from 16 thousand brain neurons of biological origin and send back signals to several hundred cells. Since neurons were isolated from the surrounding glial cells during the production of the chip, proteins had to be added that "glue" the neurons in the brain, also forming additional sodium channels. Increasing the number of sodium channels increases the chances that ion transport is converted into electrical signals in the chip.

Cochlear implant. Cochlear implantation is a type of hearing aid that implies the implantation of a system of electrodes into the inner ear, which provides the perception of sound information through electrical stimulation of the auditory nerve. Cochlear implantation is the most effective, safe and reliable method of medical and pedagogical hearing and speech rehabilitation for adults and children with severe hearing impairment and deafness. A prerequisite for performing cochlear implantation is the preservation of the fibers of the auditory nerve, subcortical and cortical centers of hearing, as well as the patency of the cochlear passage. You need special equipment that allows you to accurately determine the level of damage to the auditory nerve [2].

Retina implant. Since the cochlear implant has made it possible to compensate for hearing loss in patients with hearing

loss at the end of the last century, it has become a motivation for research in the field of vision restoration. Since the visual system is much more complex, it was only by this time, thanks to the improvement of electronics, that it became possible to tackle this issue. Fundamentally different structures of the visual system can participate in artificial visual stimulation. However, since the processes in the brain are not well understood, systems at the retinal level currently have the greatest chances of success. It is known roughly which area of the retina needs to be stimulated in order for the resulting image to go further into the brain. At the same time, however, we cannot really predict what kind of visual perception will arise in general. For the introduction of visual stimuli into the retinal region, three different locations are possible: epiretinal, subretinal, and suprachoroidal, which have fundamental differences [3].

So, there exit many various kind of prostheses, each type performing particular functions and implementation mode. But all of them are intended to improve the life quality of any human being which needs a prosthesis.

References:

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