BIOCOMPATIBILITY TESTING OF THE ORTHOPEDIC IMPLANTS MATERIAL WITH USING ATOMIC FORCE MICROSCOPY (AFM)

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Rejection reaction or manifestation of hypersensitivity to the implant material is observed in 6-30% of cases of surgical intervention [1-15]. Immune reaction is one of the causes of complications of bone tissue on implants. The rejection reaction to the body on exogenous materials (implants) is manifested as a local aseptic inflammation with the formation of a fibrous capsule around them, that leading to loss of their functional properties. The recipient organism reaction to foreign body depends on both branches of immune system, and particular importance to them has the absorption of immunoglobulins class G (IgG) and reaction of the body cells to surface of the implants [10].

The purpose of study was to determine the possibility of using Atomic Force Microscope (AFM) to predict the reaction of the organism on the implant (foreign body).

Materials and Methods
AFM studies of the bioadhesive separation force were performed on a scanning probe microscope Dimension 3000 NanoScopeIIIa (Veecocorp.) Both in air and in liquid.

Before surgery, 5 ml of blood were taken from patients, from the serum of which by standard methods total IgG was isolated. After purification and dilution to the appropriate concentration of 2 μg / ml, IgG was applied to the AFM probe, the technology is described in the guideline [13].

Functionalized probes with applied IgG of the patient were tested for compatibility of the implant material with the patient's body. The value of the force of separation of the probe from the IgG of the recipient by the surface of the implant was considered to assess the compatibility of the material with the patient's body. The higher the value of the force of separation, the more likely the development of a reaction of rejection of the implant by the body. The basis for the hip implant was the titanium alloy Ti6Al4V.

Results
According to the results of testing with AFM, it was found that the forces of interaction of IgG on the surface of the prosthesis significantly exceed the force of interaction with the surface without IgG (34-56 nN against 5-8 nN, respectively).
According to hematological studies, it is seen that the tension of the body's immune system is determined after implant placement. According to long-term clinical observations, 8 of 11 (73%) patients complained of implant pain three months later.

**Discussion**

The variety of the reaction of the receptor's tissues to the foreign body that is introduced into the body depends on its immune status and the primary reaction of the cells of the body to the surface of the implants is of particular importance [14].

Scientific evidence suggests that activation of developments in the creation of new and improved known biomaterials for medicine [10, 11, 16, 17]. It should be noted that even a minor modification of the biomaterial (elemental composition, phase state, topography and surface structure, etc.) can significantly alter its properties. Therefore, the medical-biological research of artificial biomaterials remains relevant and significant [15, 17]. An approach developed to solve the problem of individual prediction of the degree of compatibility of implant materials with the recipient organism on the basis of nanobiosensors controlled by the AFM hardware and software system is appropriate and relevant. Today, the development of optimal conditions for nanobiosensory testing of implants with AFM and the study of the effects of reactions of tissues of the recipient on the surface of implants will significantly increase the effectiveness of surgical treatment of diseases of the locomotor system by selecting / selecting optimally compatible implants with the recipient organism [8, 9, 17-19].

**Conclusions**

Development of optimal conditions for testing the implant with the body of the recipient using Atomic Force Microscopy (AFM) will significantly increase the effectiveness of surgical treatment of orthopedic disorders.

The method of testing the compatibility of the implant material with the recipient's body using AFM can allow:

- a. At the preoperative stage, determine the possibility of occurrence of processes of rejection of the implant.
- b. Provide compatibility with body implants and choose the most appropriate and / or to provide drugs to prevent rejection.
- c. Data received through research, allow the doctor to choose the necessary tactics of patients in the postoperative period.

**References:**