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Biomaterials for artificial heart implant

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A biomaterial can be defined as a material intended to interface with biological systems to evaluate, treat, augment or replace any tissue, organ or function of the body. Many different biomaterials are used clinically as implants or devices for diagnosis or therapy. Biomaterials for cardiovascular applications are usually prepared using polymers because these are available in a wide variety of compositions with adequate physical and mechanical properties and can be easy manufactured into products with the desired shape. Polyether urethane urea and Polysulfones are the most common polymers which are used for artificial heart components and heart valve. A blood-contacting diaphragm within the pump is made from a special type of polyurethane that is also textured to provide blood cell adherence. Two tubular grafts are made from polyester (which is used to attach the device to the aorta) and the valves are actual heart valves removed from a pig. Other parts that make up the motor are made from titanium or other metals and ceramics. A titanium-aluminum-vanadium alloy is used for the pump because it is biocompatible and has suitable structural properties. In Japan, researchers are developing total artificial hearts based on a silicone ball valve system and a centrifugal pump with a bearing system made from alumina ceramic and polyethylene components. Recent studies reveal the progress in investigation of novel techniques of biomaterials of the artificial heart in terms of longer follow-ups.

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Biomaterials for trapezium bone arthroplasty

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Trapezium bone is located in the base of the thumb. The main goals of a trapezium joint replacement are to eliminate the pain, providing stability, restoring mobility and long implantation time as well. Arthroplasty with silicone rubber implant is mainly used in finger joints, carpal bones and etc. The main advantages of silicon are providing mobility and stability. Silicone rubber implant also has some complications such as implant subluxation and silicone synovitis, which may be avoided by proper techniques. Another material has also been used for the trapezium replacement, such as metallic, Artelon, Acellular deramal allograft and PLDLA. Metallic implant was reported in loosening of the implant and significant forces across the base of the thumb. Artelon is a biodegradable polyurethane implant which is resulted mechanical failure, for this reason other material such as Acellular dermal allograft was tested. This material was followed up for 12 months and larger experiments will be necessary to assess the definitive validity of this method. From the recent studies which were obtain in Tampere Technical University, PLDLA implant did not result in any fractures, however silicone implant can be resulted better palmar arrangement than PLDLA implant. No differences were noted in range of motion and stability between PLDLA and silicone implant and the clinical outcomes were quite similar at 24 months of follow-up. PLDLA implant compared to Artelon implant, had no foreign body reactions. Further studies with larger patients and longer follow-ups are needed for PLDLA implant, before this method can be widely recommended.

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