3D Printed Osseointegrated Prosthetics

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Technology description

It is estimated that there are two million people in the United States that have lost a limb and another 185,000 each year that will lose a limb. Artificial limbs, or prosthetics, can restore some normal function to those with lost limbs but prosthetics are expensive and a good majority of them are not covered by insurance.

Upper limb prosthetics are commonly attached to the user with a socket and sleeve system due to lowered costs and easier implementation. However, they can cause discomfort from stump swelling, socket shifting and sweat pooling and their attachment strengths are weak. Osseointegrated prosthetics overcome many of these disadvantages by providing direct attachment to skeletal bone, however, they are often created of more than one piece requiring multiple surgeries. Additionally the mismatch between prosthetic materials and bone creates stress shielding and loosening of the attachment system.

Prof. Jeffrey La Belle at Arizona State University has developed novel low-cost, 3D printed osseointegratable prosthetic devices made from FDA compatible materials. These devices are created with a unitary body structure to enable implantation via a one-step surgical process, shortening rehabilitation time. Unique designs in the devices promote bone tissue ingrowth for greater stability and reduced prosthetic loosening. Additionally, because the devices are 3D printed, they can be customized to a user's anatomy for better fit and performance.

These osseointegratable prosthetic devices are low cost, easy to make, require less surgery and are superior in quality than conventional systems, making them a true game changer in the prosthetics industry.

Application area

Upper limb osseointegrated prosthetics

Advantages

Low cost, lightweight but strong materials that can be 3D printed
Materials are FDA compatible
Able to be custom-built for user-specific sizes
Increases bone adhesion – provides greater stability

Unitary body structure – only requires one surgical step
Elastic modulus less than skeletal bone to prevent shielding and prosthetic loosening
Mechanical results of a new prosthetic device included a maximum tensile pullout force of 6568.33N and 5256.37N in bending
The prosthetic could be seated or torqued between 0.50Nm and 4.00Nm before failure occurs for a tight-fitting prosthetic for attachment

Institution

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