Abstract

Background
This study investigated the design and osseointegration process of transitive porous implants that can be used in humans and all trabecular and compact bone structure animals. The aim was to find a way of forming a strong and durable tissue bond on the bone–implant interface.

Methods
Massive and transitive porous implants were produced on a direct metal laser sintering machine, surgically implanted into the skulls of sheep and kept in place for 12 weeks. At the end of the 12-week period, the Massive and porous implants removed from the sheep were investigated by scanning electron microscopy (SEM) to monitor the osseointegration process.

Results
In the literature, each study has selected standard sizes for pore diameter in the structures they use. However, none of these involved transitional porous structures. In this study, as opposed to standard pores, there were spherical or elliptical pores at the micro level, development channels and an inner region. Bone cells developed in the inner region. Transitive pores grown gradually in accordance with the natural structure of the bone were modeled in the inner region for cells to develop. Due to this structure, a strong and durable tissue bond could be formed at the bone–implant interface.

Conclusions
Osseointegration processes of Massive vs. porous implants were compared. It was observed that cells were concentrated on the surface of Massive implants. Therefore, osseointegration between implant and bone was less than that of porous implants. In transitive porous implants, as opposed to Massive implants, an outer region was formed in the bone–implant interface that allowed tissue development.