Bridging the osteochondral gap in mandibular condyle reconstruction with multiphasic 3D printing

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Individuals afflicted with temporomandibular joint disorders experience a reduced ability to perform the most basic human functions such as chewing and talking. In advanced disease states, total joint replacement is often necessary to improve range of motion and minimize pain. Current surgical treatments use either autogenous grafts or alloplastic implants to replace the condyle and ramus of the mandible. Although these interventions aid in improving joint function, a tissue-engineering strategy may be useful to expand the range of treatment options and offer an approach that not only restores functionality but also facilitates regeneration of the diseased tissue [1]. Toward this objective, 3D printing technology was used to fabricate patient-specific constructs with precise osteo- and chondroinductive regions to facilitate the formation of osteochondral tissue similar to that found in the mandibular condyle. The osseous region of the scaffold was composed of polycaprolactone and hydroxyapatite nanoparticles to promote bone formation and was manufactured via fused deposition modeling, while an extrusion-based method was used to print the chondral region, which was composed of hyaluronic acid hydrogel and decellularized cartilage. Patient data were obtained from computed tomography images to create implants with correct anatomical shapes, and pore architectures were designed with solid modeling software. Future work will be performed to observe the efficacy of the implants to promote osteochondral differentiation of human bone marrow stem cells *in vitro*.

References:

1. Detamore et al., Annals of Biomedical Engineering, 2007.

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