

# Engineering a New Era: Will Autogenous Tissue Remain the Gold Standard for Head and Neck Reconstruction?

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Q4 The evolution of head and neck reconstruction dates to approximately 1000 BC, when Sushruta, the father of Indian surgery, introduced the theory for arguably the first regional pedicled flap in rhinoplasty. Ancient Egyptian, Greek, Persian, and Indian civilizations expanded on this medical marvel by contributing to discoveries in human anatomy, whereas Roman physicians described possibilities for local tissue rearrangements for nearly all segments of the face. After centuries of advancements through different eras with varying types of tissue transfer, the pioneering of free flap surgery dominated the 1960s and 1970s, most notably the fibular osseous and iliac osteocutaneous flaps.<sup>1</sup> Although the history of head and neck reconstructive surgery is rich and extensive, the surgical community may have reason to believe that methodologic change is on the horizon.

Three-dimensional bioprinting has been around for slightly over a decade; over this time, its applications have been profound in multiple medical and surgical disciplines. Its advantage over autogenous tissue transfer is its ability to reproduce 3-dimensionally correct constructs to fit the patient-specific defect and prevent donor-site morbidity. Several materials have been used in this novel practice, but ideally, the type of scaffold that should be used clinically has properties of biodegradability, bioactivity, and biocompatibility. In vitro and in vivo experiments have shown promise and may potentially pave the way for a future abundance of clinical trials in surgery.<sup>2-4</sup> Although

academic efforts to expand on the strides made in regenerative medicine have been widespread, funding is absolutely critical to maintain this progress. For the field of reconstructive surgery, Osteo Science Foundation serves this exact purpose.

For 5 years, Osteo Science Foundation has distributed grants to oral and maxillofacial surgery (OMS) residents and fellows to conduct tissue engineering and bioprinting research related to the craniomaxillofacial complex. The foundation provides travel awards for the purpose of attending the annual American Association of Oral and Maxillofacial Surgeons meeting. The funding comes at a time at which the science of bioprinting has already been implemented in the innovation of life-saving tissue replacements. Certain surgical training programs have had tissue engineering research laboratories in the past, but the advent of Osteo Science Foundation provides an opportunity for the surgical community to take advantage of an available funding stream to advance head and neck reconstruction.

In reconstructive plastic surgery, 3-dimensional printing has been used to achieve phenomenal ends in patient care, such as the printing of a portion of a mandible for reconstructive surgery after tumor resection, craniofacial defects caused by traumatic injury or congenital abnormalities, temporomandibular joint replacement, and even airway reconstruction.<sup>5</sup> Even though the repair of tissue has been realized with the breakthroughs in bioengineering and medicine,

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Conflict of Interest Disclosures: None of the authors have any relevant financial relationship(s) with a commercial interest.

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Received June 2 2018

Accepted June 4 2018

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0278-2391/18/30573-1

<https://doi.org/10.1016/j.joms.2018.06.016>

113 whole-organ printing has not yet been standardized.  
 114 Imagine what kind of untapped potential the funding  
 115 of this organization has in store for future trainees  
 116 in OMS.

117 The value of basic science research cannot be  
 118 emphasized enough, especially in reconstructive  
 119 surgery. Translating bench work to clinical medicine  
 120 and surgery is paramount to the progress of a specialty.  
 121 However, the scarcity of time during residency  
 122 training serves as an immense obstacle to yielding  
 123 this kind of change. Several OMS residency programs  
 124 do, in fact, offer opportunities to extend the length  
 125 of training to dedicate time toward research, like other  
 126 surgical residency programs, but very few candidates  
 127 embark on this endeavor. There are many aspects of  
 128 tissue engineering that have not yet been perfected,  
 129 including biomaterial science, vascularization of  
 130 scaffolds, and stem cell seeding. In lieu of the ongoing  
 131 debate that regenerative medicine will soon become  
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the gold standard of patient care, the arrival of Osteo  
 Science Foundation comes at an opportune time for  
 trainees to delve into its application in traditional  
 head and neck reconstruction.

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