this system will yield superior therapeutic outcomes with less frequent dosing and an improved margin of safety.

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Modulation of Surface Topography Increases Multilayer Proliferation of Urothelial Cells within Engineered Vascularized Urothelial Constructs

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PURPOSE: There is an increasing need for tissue engineered solutions for urethral repair. While urethral deformations have traditionally resulted from congenital anomalies or from urogenital surgeries, the rapid growth of female-to-male gender affirmation surgeries has led to a more urgent need to improve current approaches to urethral repair. The number of female-to-male procedures increased 289% between 2016 and 2017, with an estimated 7626 procedures in 2019. Phalloplasty uses either pedicled or free flaps to construct a phallus, often using epidermal tissue to extend the urethra. The mismatch of epidermal and urothelial tissue, as well as postoperative inflammation and fibrosis secondary to ischemia, leads to fistula and/or stricture in up to 50% of cases. Tissue-engineered urethral tissue solutions are currently limited by a lack of vascular supply, and creation of multilayer urothelial tissue capable of withstanding urinary flow. Here we present a novel vascularized urethral flap, with a “grooved” topography that fosters increased urothelial cell proliferation.

METHODS: A custom-designed 3D negative mold with a urethral channel and a vascular inlet and outlet channel was prototyped in Adobe Fusion 360 and printed on a Prusa i3 MK3S printer in PLA. One version was printed with a smooth urothelial mold, and the other with undulating features on the negative urothelial mold to create 0.4-mm deep triangular grooves in the collagen. A 2-mm diameter pluronic sacrificial macrofiber was used to connect the channels to form a vascular loop, and 1% type-I collagen containing 106 human foreskin fibroblasts per mL collagen was extruded over the mold. After solidifying, the scaffold was demolded and seeded with grade I urothelial carcinoma (SW780 cells, at 10 × 106 cells/mL) in the urethral channel, and adenovirus-infected E4 endothelial cells (at 3 × 106 cells/mL) in the vascular channel. The scaffolds were cultured up to 28 days and then fixed for histologic analysis.

RESULTS: Collagen scaffolds were fabricated reliably using the custom designed 3D negative molds. Fourteen days after seeding, stable urothelial monolayers were formed in the smooth channels. Multilayers were formed in the smooth channel by 21 days, and the multilayers were maintained up to 28 days. In comparison, the constructs with an undulating lining topography showed robust multilayer urothelial development compared with the smooth lining at 14 days. In addition, the vascular channels supported a healthy endothelial lining at both 7 and 14 days.

CONCLUSIONS: We have developed a novel strategy to engineer vascularized urethral tissue. These constructs can be maintained in culture for at least 28 days. Constructs with grooved topography allowed for increased cell-to-cell contact, which led to increased urothelial proliferation into multilayers by the 14-day time point. These constructs allow for rapid prototyping through 3D design and printing and can be used for autologous cell seeding for patient-specific vascularized urethral flaps. Such constructs may have far reaching applications in phalloplasty, congenital defects such as hypospadias repair, and repair of postoperative urethral injury.

Essential Elements of Surgeon Communication Impacting Patient Satisfaction: A Systematic Review

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PURPOSE: Compassionate and effective communication is critical in fostering the patient-physician relationship, with implications for patient satisfaction, clinical outcomes, medical errors, and litigation. Interpersonal and communication
skills is one of the six ACGME core competencies. Historically, surgeons have a reputation for communicating more hastily and with less empathy than their primary care counterparts. Although prior studies have emphasized the need for additional surgeon training on interpersonal and communication skills, current communication skills curricula are not guided by evidence correlating specific communication skills with patient satisfaction. To inform the maturation of this curricula, we performed a systematic review to examine the aspects of surgeon communication that have a positive impact on patient satisfaction.

METHODS: We searched four major databases (PubMed, Embase, Scopus, and Ovid/Medline) in December 2020, with the search terms “surgeon,” “communication,” “interpersonal skills,” “interpersonal communication,” and “patient satisfaction.” Studies were limited to those published in English, assessing surgeons or surgical residents, evaluating interpersonal skills, and including patient satisfaction as an outcome. We excluded studies published prior to 2000 and those evaluating communication aids given to patients. Manuscripts were reviewed and coded for common themes.

RESULTS: Our initial search retrieved 1470 results. An estimated 679 duplicates were removed, resulting in 791 unique publications. After full-text review, a total of 26 papers met the inclusion criteria. The articles examined a broad range of physician specialties, including urology, otolaryngology, and general, breast, vascular, and orthopedic surgery. Three major communication themes were tied to patient satisfaction: (1) clear communication, (2) involvement of the patient, and (3) demeanor and interpersonal skills. Specific actions that supported clear communication included providing information at an appropriate level, explaining difficult terms and avoiding medical jargon, checking patient understanding throughout the conversation, and discussing crucial topics such as the risks of surgery, alternative treatment options, and postoperative care instructions. Interestingly, time spent showing patients their imaging (eg, CT, angiography) during the informed consent discussion did not result in increased patient satisfaction. When analyzing involvement of the patient, patient satisfaction scores were higher for surgeons who encouraged questions and provided adequate answers, initiated communication by asking the patient their opinion on various aspects of their condition and care, and helped the patient take control of their treatment decisions. Multiple studies found that increased patient involvement in treatment decisions correlated with increased satisfaction with care, even in patients who preferred less decisional control. Finally, with respect to surgeon demeanor and interpersonal skills, increased patient satisfaction occurred when surgeons gave appropriate greetings (eg, handshake, addressing the patient by name), appeared relaxed and not rushed, were attentive and made good eye contact, utilized self-disclosure when appropriate, and demonstrated culturally competent behaviors.

CONCLUSIONS: From this systematic review, clear communication, involvement of the patient, and surgeon demeanor and interpersonal skills are closely associated with patient satisfaction. Our findings inform evidence-based recommendations for areas of improvement for practicing surgeons. Furthermore, surgical residency programs may focus their training efforts on development of these aspects of interpersonal and communication skills that directly impact patient satisfaction.

Caregiver Preferences for Three-dimensional Printed or Augmented Reality Craniosynostosis Skull Models: A Cross-sectional Survey

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BACKGROUND: Achieving caregiver understanding of craniosynostosis is a critical component of surgical care. Caregivers must navigate the emotional challenges of a congenital diagnosis, conceptualize skull anatomy, and make decisions on surgical treatment. Recent advances in three-dimensional (3D) printing and augmented reality (AR) have made medical model creation more accessible to providers. As a result, 3D-printed and AR anatomical models have been shown to improve communication between surgeons and caregivers for a variety of disease processes. Given these technological advancements, this study aims to compare the utility of 3D-printed versus AR models for craniosynostosis caregiver education.

METHODS: Caregiver perspectives on three models were compared in this survey: 3D-printed, AR, and two-dimensional (2D) diagram. 2D diagrams were sourced from schematic diagrams found in the literature. 3D-printed and AR models were generated from preoperative cranial CT scans of patients with bicoronal, sagittal, and unicoronal