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PURPOSE: Enhanced recovery after surgery protocols have previously demonstrated safety and efficacy following microvascular breast reconstruction. The purpose of this study was to evaluate the effects of implementation of a new enhanced recovery after surgery (ERAS) protocol for patients undergoing microvascular breast reconstruction at a high volume breast reconstruction center.

METHODS: Prior to ERAS protocol implementation, all patients were managed on a traditional pathway following microvascular breast reconstruction at our institution. In April 2019 a new ERAS protocol was developed and implemented for all prospectively enrolled patients including increased use of pre-operative counseling, improved multimodal analgesia including use of NSAIDS, early return to diet, and early mobilization. Data including length of stay, inpatient narcotic use, narcotic prescriptions, and complications was prospectively collected for all patients undergoing microvascular breast reconstruction between April 2019 and July 2021. Traditional pathway patients who underwent reconstruction immediately prior to ERAS implementation were retrospectively reviewed as matched controls.

RESULTS: A total of 101 patients were included in each of the traditional and ERAS cohorts respectively. The traditional and ERAS cohorts were well matched with regards to average age (53.6 vs 51.1 years) and rates of bilateral reconstruction (59.4% vs 60.1%). Average length of stay decreased from 4.13 to 3.03 days with implementation of the ERAS protocol (p<0.005). Inpatient milligram morphine equivalents (MME) were decreased by approximately 50% when comparing traditional (172.73 MME) to ERAS (98.99 MME) Patients (p<0.005). ERAS patients were prescribed significantly less narcotics upon discharge (298.87 MME vs 178.86 MME, p<0.005) and did not require any additional prescription refills. There were no statistically significant differences with regards to complications between the two groups including hematomas, ED readmissions, seroma, or wound healing complications. There were trends towards decreased rates of microvascular takebacks in the ERAS cohort (Traditional 5.9% vs ERAS 0%) and ileus (3.9% vs 0%) however these did not reach statistical significance.

CONCLUSION: Implementation of an ERAS protocol at a high volume microvascular breast reconstruction center resulted in a significant decrease in length of stay and postoperative narcotic usage with no increase in perioperative or postoperative complications. Enhanced recovery after surgery protocols can be implemented safely and effectively resulting in improved recovery for patients undergoing microvascular breast reconstruction.

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TRACK: RESEARCH/TECHNOLOGY PAPER
Exhale and Decell: Environmentally Sustainable Sterilization and Decellularization of Cartilage Grafts via Supercritical Carbon Dioxide

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PURPOSE: Current decellularization techniques have important limitations, including obligatory use of harsh ionized substances or detergents that deplete bioactive cytokines and compromise the physical integrity of the resulting extracellular matrix (ECM) scaffold. Furthermore, the detergents used are increasingly recognized as harmful to the environment and are poised to be restricted from commercial use. Supercritical carbon dioxide (scCO2) is an appealing alternative, applying the principles behind supercritical fluid extraction and sterilization to the removal of immunogenic cellular components. We endeavor to evaluate the efficacy of scCO2 in both sterilization and decellularization of ovine costal cartilage xenograft and human costal cartilage allograft to develop a highly efficacious, environmentally sustainable, and biocompatible alternative to currently available decellularization strategies.

METHODS AND MATERIALS: Xenograft preparation: Racks of lamb were purchased from a local butcher. Floating
ribs were minced into ∼8 mm³ cubes or zested into flakes (1 mm — 1 mm). Allograft harvest: Human costal cartilage was obtained from patients undergoing microsurgical breast reconstruction necessitating partial rib resection and processed via mincing or zested as above. All samples were subjected to: 1) sterilization; 2) sterilization and decellularization; or 3) sterilization, decellularization, and a pretreatment wash. Sterilization: Samples were placed in a NovaSterilis™ Nova2200 unit and subject to standard NovaSterilis™ sterilization parameters. At least 3 samples with biologic indicators were placed within the packaging and processed with each run. Decellularization: Samples were subject to the standard parameters of the Nova2200 system as previously described by NovaSterilis™ with an ethanol to scCO2 volume ratio of 1:3.3. Wash: Samples were serially soaked in saline and agitated with exposure to 16 mL 3% H2O2 and a 30-minute scCO2 run at 35°C and 1,436 psi. Histology: After treatment, H&E, DAPI, and safranin-O staining were performed. DNA Quantification: DNA content was quantified in unprocessed and decellularized graft samples using the DNeasy Blood & Tissue kit (Qiagen Inc.).

RESULTS: Sterilization conditions were sufficient for a 6 log10 sterilization of B. atrophaeus. H&E staining revealed preservation of tissue architecture after both sterilization and decellularization in both allograft and xenograft cartilage. DAPI staining demonstrated depletion of nuclei in the decellularized zested samples, but persistence of visible nuclei in the minced samples. Safranin-O staining revealed immunogenic GAG depletion after decellularization. DNA content in minced and zested samples was 192.2 ng DNA/mg tissue and 321.6 ng DNA/mg tissue, respectively, while DNA content in sterilized and decellularized minced and zested samples were 24.8 ng DNA/mg tissue and 11.6 ng DNA/mg tissue, respectively (industry standard requirement for decellularization <50 ng DNA/mg tissue); after sterilization, decellularization, and the chemical wash, minced and zested samples contained 17.6 ng DNA/mg tissue and 4 ng DNA/mg tissue respectively.

CONCLUSION: These preliminary data suggest that scCO2 sufficiently sterilizes and decellularizes cartilage derived from both human and animal sources, thereby supporting scCO2 as an efficacious, commercially appealing, and ecologically responsible alternative to current decellularization strategies. Biomechanical testing on treated samples, as well as the evaluation of scCO2 as a decellularization agent for human nasal septal cartilage are ongoing.

TRACK: RECONSTRUCTIVE
Free Functional Muscle Transfer Innervated Solely by the Masseteric Nerve – A Longitudinal Analysis of Dynamic Changes in Facial Symmetry in Patients Followed for Up to 10 Years

Presenter: Roshni Thachil

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Objectives: The purpose of this study is to assess the changes over time in facial symmetry in patients reanimated with a free functional muscle transfer (FFMT) innervated solely by a nerve to masseter (NTM) that have been consistently followed for up to 10 years.

Materials and Methods: Facial palsy patients receiving an FFMT innervated solely by the masseteric nerve by the senior author from 2013-2020 were reviewed. Inclusion criteria required a minimum of 2 postoperative photographic and videographic documentation, as well as a minimum of one year of follow up. We obtained objective facial measurements including commissure excursion (CE), commissure height deviation (CHD), smile angle (SA), and upper lip height deviation (ULH) using Emotrics and measured dental show using ImageJ from photos organized into time-based cohorts with an average of 3 months, one year, 3 years, 5 years, and 10 years of follow up as available. Longitudinal results were analyzed using paired sample t-tests.

RESULTS: With closed-mouth smile, masseteric FFMT demonstrated significant differences longitudinally at the one- (average 1.1 years, 26 patients) and three-year (average 2.64 years, 25 patients) timepoints for all smile measurements, as well as significant differences in CHD by 5.6 mm (p=0.01) and ULH by 4.3 mm (p=0.003) at the five-year timepoint (average 5.38 years, 10 patients). There were significant differences in SA by 11.5 degrees (p=0.008) and ULH by 4.1 mm (p=0.04) in the ten-year timepoints (average 9.33 years, 6 patients). During open-mouth smile, all smile measurements were significantly different than pre-op at the one-year timepoint. The three-year timepoint revealed significant differences in CE by 7.88 mm (p<0.001), CHD by...