published in Plastic and Reconstructive Surgery were reviewed. Changes in tracer data from 2014 to 2019 were compared using a Chi square test, Fisher’s exact test, or Student’s t-test as appropriate.

**Results:** 2,850 cases (1,507 male, 1,343 female) had been entered into the tracer as of September, 2019. The median age of patients operated on was 12 months. 15% of patients had a “previous airway problem”. 3% of patients receiving a two-stage repair. Several significant changes in operative techniques were noted including a decrease in pushback, Von Langenbeck and Furlow palatoplasty. Several additional questions in the ABPS tracer are not addressed in the EBM literature, a few of which provide potential topics for further study. These include use of greater than 24 hours of postoperative antibiotics, and injection of epinephrine, which changed significantly from 2014 to 2019. 94.2% of the 2850 patients reported in the ABPS tracer data experienced no postoperative adverse events. 58 complications, or 34.9% of all complications, did not fit into any of the categories specified in the tracer data.

**Conclusion:** ABPS MOC tracer data enables surgeons to evaluate their outcomes in light of national statistics. We have used these tracer data combined with published evidence-based medicine articles relevant to cleft palate repair to identify trends in cleft palate repair from 2014 to 2019. By providing an overview of areas of focus in the MOC tracer data as well as EBM articles, we hope to provide a venue for surgeons to further evaluate their own practice through review of the literature. We have additionally identified areas of cleft palate research that have not been addressed by the tracer and may be valuable to include in the MOC tracer module in the future. Finally, areas collected in the tracer but not addressed in the literature provide opportunities for further research into aspects of cleft palate repair.

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**Injectable Extended Release Local Anesthetic Drug Delivery System For The Treatment Of Post-operative Pain**

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**Purpose:** The United States is experiencing an opioid crisis, with over 14,000 deaths from prescription opioids annually. Surgery is a critical point where patients are at risk of developing or worsening opioid-misuse disorders with approximately 10% of patients going on to long-term opioid use. Clinicians need safe and effective non-opioid alternative treatment strategies for the management of postoperative pain. The purpose of this study was to perform proof-of-concept testing of a novel sustained release local anesthetic drug delivery system that could be used to control post-operative pain.

**Methods:** Bupivacaine-loaded lipid emulsions were created by admixing 1.5% w/v bupivacaine freebase with off-the-shelf parenteral fat emulsion 15% w/v Intralipid®, and then re-homogenizing by high-speed homogenization for 2 cycles of 5 minutes at 10,000 RPM. The resulting bupivacaine-loaded emulsion was entrapped into a crosslinked-hyaluronic acid hydrogel (HALA) by mixing with 1.33% w/v thiol modified hyaluronic acid and 0.833% w/v thiol reactive crosslinker poly(ethylene glycol) diacrylate. To determine the bupivacaine rate of release from the formulation, 0.5ml (n=6) of the gel was placed into a 10kDa molecular weight cut-off dialysis bags and then submerged in 40ml of phosphate buffered saline (PBS). The PBS was collected and replaced at predetermined time points to be used for UV-Vis spectroscopy. A rat sciatic nerve block model and Hargreaves thermal nociception assay was used to assess the anesthetic efficacy of the HALA formulation. The paw withdrawal latency (PWL) was measured at predetermined time points after injection to the right sciatic nerve of healthy male Sprague Dawley rats. Groups consisted of: 0.2ml 1.5% w/v bupivacaine HALA (n=6), 0.2ml 1.5% w/v bupivacaine-loaded emulsions (n=6), 0.2ml Exparel® (1.33% w/v bupivacaine) (n=6), and 0.2ml 0.25% w/v bupivacaine HCL (n=6).

**Results:** In vitro drug rate of release testing found average bupivacaine cumulative release values of 74.0±2.12% at 20 hours, 90.9±2.5% at 44 hours, and 97.3% at 68 hours. The Hargreaves assay found that HALA group had average PWL above pre-operative baseline values for 4 hours, followed by Exparel® for 3 hours, bupivacaine-loaded emulsions for 2 hours, and 0.25 % bupivacaine HCL for 1 hour. All the groups except Exparel® had PWL values signifying onset of anesthesia at the first time point (1 hour), suggesting a delayed release of bupivacaine from Exparel®. Peak average PWL amplitude of each group was: 15.0 seconds - HALA, 11.1 seconds - bupivacaine-loaded emulsions, 9.17 seconds Exparel®, and 10.0 seconds - 0.25% bupivacaine HCL. Area under the curve (AUC) analysis above baseline...
was performed to quantify the anesthetic effect over the study and found the following: 1174 AUC - HALA, 449 AUC - bupivacaine-loaded emulsions, 264 AUC Exparel®, and 187 AUC - 0.25% bupivacaine HCL.

**Conclusion:** Results of this study indicate that the lipid emulsion-loaded hydrogel delivery system can provide greater and longer duration of anesthesia than current clinically available options. Additionally, the HALA formulation had no delay in onset, but the current clinically available Exparel® did. The HALA formulation has potential to be a new effective alternative to the current clinically available options for prolonged local anesthesia.

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**3D Facial Scanning At The Fingertips Of Patients And Surgeons: Accuracy And Precision Testing Of iPhone X 3D Scanner**

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**Purpose:** The iPhone X is the first smartphone to be released with a high-fidelity 3D scanner. At present, half of all US smartphone users use an iPhone and data suggest that over 230 million individuals will upgrade to the iPhone X within two years. Given this profound expansion in access to 3D scanning technology, the purpose of this study was to compare the iPhone X scanner against a popular, portable 3D camera used in plastic surgery.

**Methods:** Sixteen live subjects (n=16) underwent 3D facial capture with the iPhone X and Canfield Vectra H1. Results were compared using color map analysis and surface distances between key anatomical landmarks. To control for micro-expression, three 3D-printed facial masks were captured with each device and compared (n=3). In addition, to assess reproducibility of the iPhone X, six (n=6) scans of a single participant were obtained and compared using color map analysis.

**Results:** The average difference between the iPhone and 3D camera was 0.44mm following color map analysis, and 0.46mm following surface distance comparison. For the 3D-printed facial mask comparison, average difference was 0.28mm. For reproducibility and precision testing, the difference between scans following color map analysis was 0.35mm.

**Conclusion:** The iPhone X offers 3D scanning that is accurate and precise to within half a millimeter of a professional 3D camera. The iPhone offers advantages with regard to cost, accessibility, and portability when compared to traditional 3D cameras, and may be a new platform for sharing 3D data between patients and surgeons.

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**Neural Networks For Nerve Analysis: Streamlining Axon Histomorphometry Using Machine Learning**

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**Purpose:** Historically, axon histomorphometry has required manual thresholding, segmentation, counting and measuring of axons in representative micrographs. This is a time intensive and subjective process hampered by inter- and intra-rater reliability, with reported variability between observers as high as 9%. Deep learning is a subset of machine learning that uses convolutional neural networks where each network hierarchically defines specific features of images and does not require structured numerical input data. AxonDeepSeg (ADS) is a novel deep learning program trained on transmission electron micrographs that recognizes axons and performs histomorphometry automatically. We tested whether ADS could be used with light micrographs to perform reliable axon histomorphometry comparable to manual analysis.

**Methods:** Two representative slices of adult Lewis rat median nerves were prepared using an osmium stain and imaged at a magnification of 100x. At this magnification, a single nerve produced 12-13 micrographs. For manual