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Comparison Of Intradermal And Subcutaneous Tissue Oxygen Tension Monitor To Detect Flap Compromise

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PURPOSE: The ideal monitoring tool to evaluate free flap success should be minimally invasive, continuous, cost-effective and reliable. Our group has previously introduced implantable oxygen sensors as a mean to monitor flaps in the immediate post-operative period and detect acute vascular compromise. The purpose of the current study was to compare and contrast intradermal vs. subcutaneous implantation of the sensors in their ability to detect flap compromise.

METHODS: Experimental sensors were made by incorporating benzo-porphyrin dye into a matrix of biocompatible hydrogel. These sensors were approximately 3mm-long, 1.5mm-wide, and 0.5mm-thick. Two groups of male Sprague-Dawley rats had the skin flap site outlined and three sensors were intradermally (ID) implanted at tip, middle and base of the impending flap of one group, while subcutaneously (SQ) implanted in the second group. Corresponding control sensors were implanted laterally at least 1 cm away from the proposed flap in both groups. One day later, the outlined, caudally-based, full thickness flap was elevated on dorsum of rats. Gross flap viability was assessed with computer planimetric analysis. Inspired oxygen was modulated between 100% and 12%. Real-time tissue oxygen tension (TOT) readings were obtained from the sensors on days 0, 3 and 7.

RESULTS: Oxygen readings by sensors modulated as expected when inspired oxygen was changed, indicating that the sensors are responsive and sensitive within a physiologic range. Gross planimetric analysis of both groups showed that 16% of the flap was necrotic at the tip of the flap as measured on d3 and was more pronounced on d7. Readings from the ID and the SQ sensors have demonstrated statistically significant decreases in oxygenation in all regions of the flap at all time points compared to the control sensors. Overall, SQ implanted sensors showed faster response times than ID implanted sensors. However, ID implantation was less invasive, and makes it easier to localize the sensor for measurement and also avoid migration of the sensor in the SQ plane.

CONCLUSION: Our analysis revealed that even though both methods are efficacious and accurate in determining changes of oxygenation, SQ sensors responded faster that ID sensors, however ID implantation is easier, less invasive and keep the sensor localized in the specific spot where it implanted.

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Autologous Fat Grafting to the Breast: A Review of Safety and Oncological Outcomes

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PURPOSE: Autologous fat grafting has been widely used for more than two decades during breast reconstruction for postmastectomy patients. However, few studies evaluate clinical outcomes in this patient population. The purpose of this study was to assess complications, radiographic changes and locoregional cancer recurrence outcomes in patients undergoing autologous fat grafting after breast reconstruction in postmastectomy patients.

METHODS: We retrospectively reviewed the records of consecutive postmastectomy patients who underwent autologous fat grafting after breast reconstruction at a university center over a 10-year period. Patients with at least 3 months of follow-up were included. Medical records were reviewed for demographics, operative details, complications, incidence of palpable masses, and/or suspicious breast imaging findings, and locoregional cancer recurrence. Descriptive statistics were generated.

RESULTS: The records of 124 patients undergoing lipofilling procedures from January 2006 to January 2016 were reviewed. Their ages ranged from 23 to 79 years (mean, 45.77 years). Fat grafts were harvested, processed, and injected using the Coleman technique. The mean number of fat grafting procedures was 1.50 (range, 1–6) per 85
breast, receiving 97.2 mL of autologous adipose on average during each session. The most common indication for reconstruction in this study was found to be for aesthetic correction following mastectomy (90.6% of patients). Fat grafting was most commonly used as an adjunctive therapy following initial implant (54.9% of patients) and flap (43.4% of patients) reconstruction. The time from first oncological surgery to fat grafting occurred after a mean of 27.51 months and median of 14 months. Following the completion of fat grafting, patients were followed by a plastic surgeon for an average of 1 month. Twenty-six complications were found to have occurred, resulting in a complication rate of 21.3% in this population of patients. The most commonly reported complications were liponecrosis (19.2% of complications) and infection (15.3% of complications). During oncologic follow up, six patients were reported to have experienced breast cancer recurrence following autologous fat grafting for reconstruction resulting in a recurrence rate of 4.8%. Additionally, of the 59 patients with reported radiologic follow up, seven patients exhibited radiological abnormalities in the postoperative period (11.9%).

CONCLUSIONS: In this population of breast cancer patients who had mastectomy with reconstruction, fat transfer was not associated with a higher risk of cancer recurrence. Based on these preliminary findings, autologous fat grafting appears to be a relatively safe procedure for refinement of the reconstructed breast in postmastectomy patients.

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Transcriptional Alterations of Adipose-Derived Stromal Cells in Culture

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PURPOSE: Adipose-derived stromal cells (ASCs) are a valuable source of cells for use in regenerative medicine. Our laboratory has been determining the ideal ASC subpopulation to be used in clinical trials. We have previously identified a subset of ASCs with a favorable gene expression profile that demonstrates improved wound healing in diabetic mice. This subset of cells can be isolated using a unique surface marker combination (CD26+/CD55+). In order to obtain sufficient numbers of these cells for therapeutic purposes, expansion of the cell line is necessary. Therefore, we tested whether expansion would result in changes to their transcriptional profiles.

METHODS: Adipose tissue was surgically extracted from three wild-type mice. The tissue was digested and single cells were subjected to fluorescence-activated cell sorting (FACS). Using this technique, cells were sorted for non-hematopoietic (CD45-), non-endothelial (CD31-) single cells with the progenitor cell marker (CD34+). This marker profile isolates all ASCs. Cells were also sorted for the ASC subpopulation of interest with the additional markers CD26 and CD55. Two sets of cultures were performed, one with parental ASCs and the other with CD26+/CD55+ ASCs. The cells were passaged every five days for a total of three passages (P0 to P3). Cells were trypsinized after each passage and analyzed by FACS to measure absolute cell numbers. Freshly isolated ASCs were subjected to single-cell transcriptional analysis and compared to the same group in culture after passages P0 and P1.

RESULTS: Using the methods described above, three thousand parental ASCs and three thousand CD26+/CD55+ ASCs were isolated. The number of cells from the parental group increased by two-fold in P0, nine-fold in P1, and over one hundred-fold in P2. The cells from the CD26+/CD55+ ASC group proliferated more than those in the parental group after each passage. Single-cell transcriptional analysis revealed a drastic drift in gene expression profiles between freshly isolated ASCs and those cells in culture. There were notable, statistically significant increases in genes VEGF, FGF2, FGF7, TGFß1, FGFR1, FGFR2, EGFR, CCND1, PCNA, ADAM10, and HB-EGF in the sorted ASCs in culture.

CONCLUSION: Through single-cell transcriptional analysis, we have identified an ASC subpopulation that improves wound healing in diabetic mice. This study has offered insight into the changes that occur in ASCs with expansion. CD26+/CD55+ ASCs demonstrate an increased rate of proliferation in culture when compared to parental ASCs. Furthermore, during in vitro proliferation ASCs demonstrate an increase in expression of genes responsible for growth factors, growth factor receptors, proliferation and production of extracellular matrix. These findings continue to suggest that the CD26+/CD55+ ASC cell line is favorable for regenerative purposes and can be expanded in vitro for cell-based therapies.