Journal of Cytology & Histology
ISSN: 2157-7099
Sudeep et al., J Cytol Histol 2016, S5:1
DOI: 10.4172/2157-7099.1000S5-14

Research Article Open Access

Effects of Different Cartilage Sculpting Techniques on Cellular Integrity of Nasal Septal Cartilage

Roy S[1*], Tuluc M[2], Bryant LM[1], O'Hara B[2], Heffelfinger RN[1] and Pribitkin EA[1]

[1]*Thomas Jefferson University Hospitals, Department of Otolaryngology – Head and Neck Surgery; 925 Chestnut Street, 6th Floor, Philadelphia PA 19107, USA*

[2]*Thomas Jefferson University Hospitals, Department of Pathology, Anatomy and Cell Biology; Jefferson Alumni Hall, 1020 Locust Street, Suite 279, Philadelphia, PA 19107, USA*

[*]**Corresponding author**: Sudeep Roy, Thomas Jefferson University Hospital, Otolaryngology/Head and Neck Surgery, 925 Chestnut St. 6th Floor, Philadelphia, PA 19107, USA Tel: 650-814-0291; Fax: 215-923-4532; E-mail: suderoy@gmail.com

Received date: February 06, 2016; **Accepted date:** March 18, 2016; **Published date:** March 28, 2016

Abstract

Study background: Several techniques exist to sculpt nasal septal cartilage grafts for use in functional and cosmetic rhinoplasty, including the use of cold steel, Bovie electrosection and the Sonopet ultrasonic bone aspirator. This is the first investigation on the effects of these disparate tools on gross cellular integrity of sculpted cartilage.

Methods: After IRB approval, extraneous nasal septal cartilage harvested during routine septoplasty and/or rhinoplasty procedures was collected from three patients treated within our institution for use in this study. Cartilage specimens from each patient were divided into four equal segments and a partial thickness trough was sculpted in the center of each piece with one of the three techniques described above. One segment remained free of any additional manipulation and served as a comparative control. Gross cellular architecture and number of viable chondrocytes were assessed with optical microscopy.

Results: Minimal disruption of the cellular integrity of nasal septal cartilage samples sculpted with each of the three techniques was noted compared to control. Average cell counts revealed 96%, 97%, 97% and 97% viable nuclei in the scalpel, electrocautery, ultrasonic bone aspirator and control groups, respectively.

Conclusion: Cartilage sculpting using cold steel, Bovie electrosection and the ultrasonic bone aspirator appear to have minimal effects on cellular integrity of cartilage grafts. This portends a favorable outlook on long term durability of these cartilage grafts and suggests that these three techniques can be used interchangeably for cartilage sculpting needs.

Keywords: Cartilage graft; Cartilage sculpting; Rhinoplasty; Nasal valve repair

Introduction

The use of grafts to provide structural support and improve contour in functional, reconstructive and cosmetic nasal surgery is commonplace. A variety of graft materials have been used with varying success for this purpose, including autografts (i.e., cartilage, fascia), homografts (i.e., irradiated cartilage, acellular dermis) and alloplasts (i.e., polyester, polyethylene plates) [1-6]. Autogenous cartilage when available is preferred given its longer-term survival, lack of immune response, minimal warping potential, flexibility within the nose and ease of harvest in the head and neck. Cartilaginous nasal septum is the natural choice for autogenous cartilage grafts, as it is readily accessible during nasal surgery and is relatively stiff, permitting more extensive and precise sculpting to attain a desired result[7].

Cartilage sculpting with cold steel (scalpel blade) is the default modality and preferred technique for most nasal surgeons given its ubiquitous supply and availability, ease of use and fairly precise maneuverability. Alternative methods for reshaping and contouring cartilage have emerged from versatile utilization of other available technologies, including electrosurgery devices (Bovie electrosection) and the Sonopet ultrasonic bone aspirator (Stryker, Inc., Kalamazoo, MI, USA) [8]. Although clinical experience amongst practitioners does not suggest any long-term adverse outcomes or short-lived effects from such techniques [9], there is nothing in the literature comparing the immediate effects of such technologies on the integrity of the native cartilaginous framework and chondrocyte population.

In this study, we decided to examine cellular viability of nasal septal cartilage after sculpting with cold steel, Bovie electrosection and the ultrasonic bone aspirator.

Materials and Methods

After appropriate IRB approval was attained, a 2 cm × 0.5 cm rectangular segment of nasal septal cartilage was collected from three male patients undergoing routine septorhinoplasty and/or nasal valve repair surgery at our institution by the principal investigator (E.P.) (Figure 1).

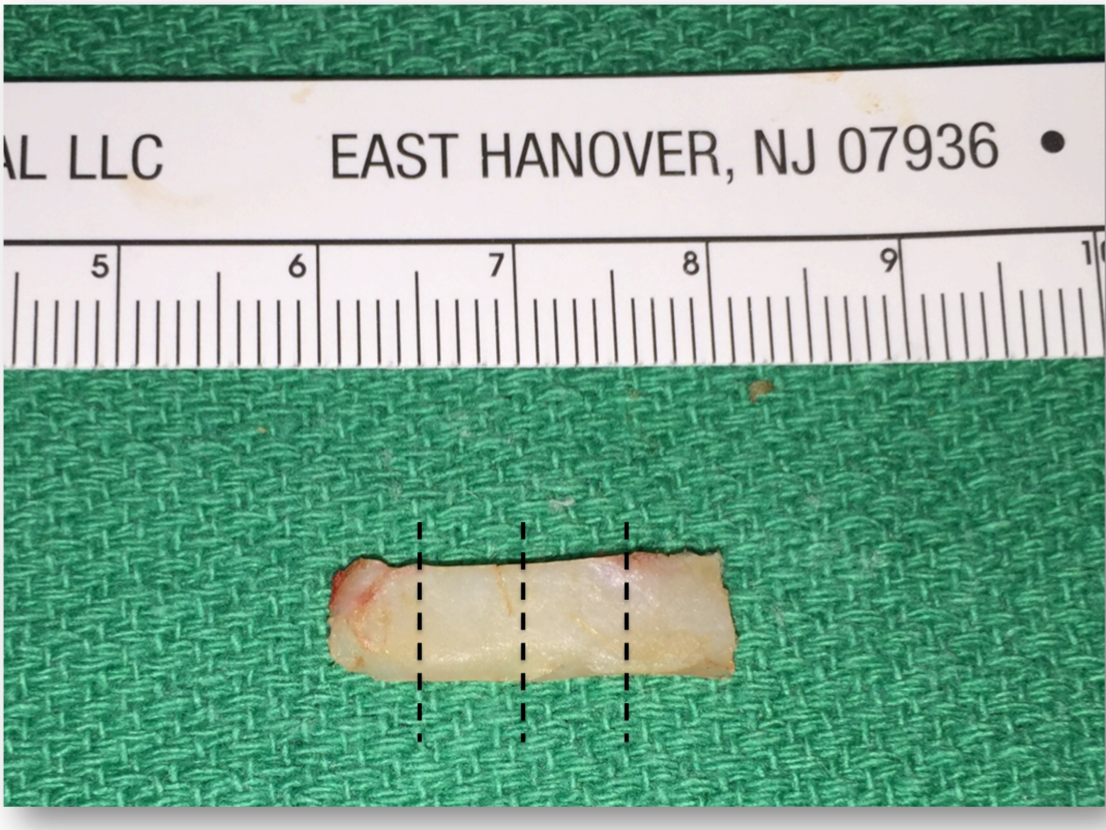

Figure 1: Harvested nasal septal cartilage.*A 2 cm × 0.5 cm rectangular segment of cartilage was harvested, divided into 4 equal blocks 0.5 cm × 0.5cm for carving experiment.

All patients were between the ages of 30-50, with no history of chronic rhinosinusitis, nasal polyposis, allergic rhinitis, septal perforation or intranasal drug use. Cartilage was harvested with the long axis parallel to the bony cartilaginous junction. Each rectangular piece of cartilage was then cut into four identical blocks measuring 0.5 cm × 0.5 cm. A partial thickness strip was sculpted in the center of each piece with a scalpel, Colorado tip Bovie electrosection device (cut setting at 11 Watts; standard setting) and ultrasonic bone aspirator (100% power, 50% suction, 15% irrigation; standard setting) with Payner tip, respectively (Figure 2).

Figure 2: Sculpting instruments.*From left to right: #15 scalpel, Colorado tip Bovie electrosection, and Sonopet ultrasonic bone aspirator.*

The fourth segment was not manipulated, serving as our control. Cartilage samples were fixed immediately thereafter and brought to the Department of Pathology, Anatomy and Cell Biology for processing and staining with Hematoxylin and Eosin (H&E). Two senior clinical Pathologists (BOH and MT), blinded to the specimens, then assessed cartilage integrity around the site of sculpting with a 100 chondrocyte cell count as well as gross observation with optical microscopy. For the cell count, empty lacunae were not included as non-viable cells as nuclei may not have been in the plane of sectioning. Only definitive non-viable chondrocyte nuclei were included in the cell count. Of note, additional immune histochemical staining to assess collagen, elastic fibers and proteoglycan content within the matrix were deemed unnecessary and superfluous given the comprehensive nature of H&E analysis and interpretation by our senior Pathologists. One-way Anova for four independent samples was used to determine whether or not any differences between the groups were statistically significant.

Results

Overall, minimal disruption of the cellular integrity of nasal septal cartilage samples sculpted with each of the three techniques was noted when compared to the control (Figure 3).

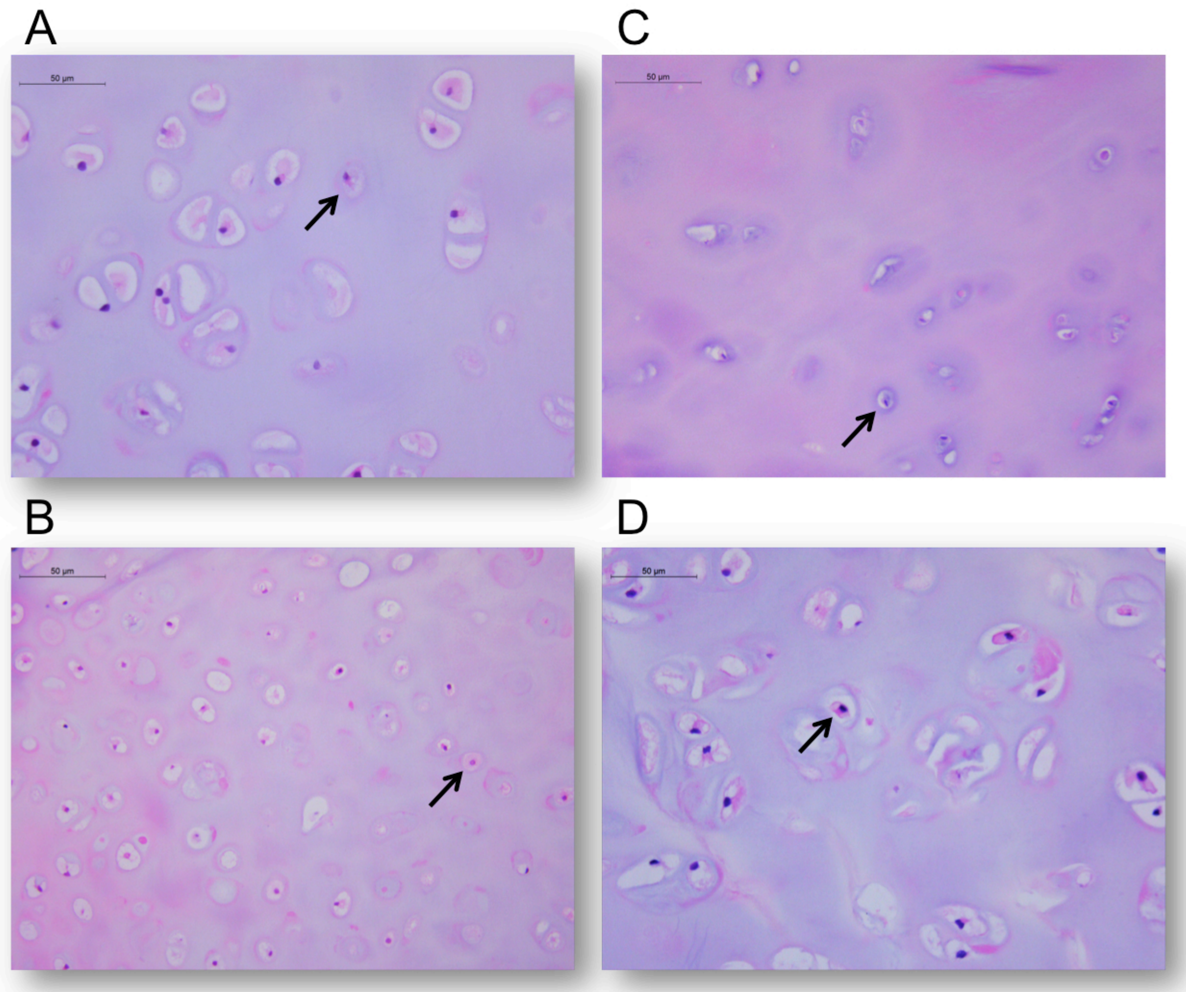

Figure 3: Optical light microscopy of sculpted cartilage.*High-power, H&E stain showing representative sample of cartilaginous architecture and chondrocyte population in (A) Scalpel, (B) Bovie, (C) Ultrasonic Bone Aspirator and (D) Control groups. Similar density and distribution of viable chondrocytes were noted in all samples. Arrows indicate normal chondrocytes.

No zonal or peripheral necrosis was identified in any of the specimens. Cell counts revealed 96%, 97%, 97% and 97% viable nuclei in the Scalpel, Bovie electrosection, Ultrasonic Bone Aspirator and Control groups, respectively. One-way Anova for four independent samples showed no significant difference between the groups ($p=0.44$). Viable chondrocytes in all specimens were scattered throughout the tissue as is seen in normal hyaline cartilage.

Discussion

Cartilage grafting remains a crucial skill for nasal surgeons as it allows for reconstitution of structural support and contour to the weakened or asymmetric nose. Although cold steel sculpting of autologous cartilage grafts remains the most common technique among nasal surgeons, alternative tools such as Bovie electrosection and the ultrasonic bone aspirator have been gaining popularity for their ability to rapidly create smoother, more contoured solid cartilage grafts in aesthetic and functional rhinoplasty. Clinical experience among practitioners does not suggest any long-term adverse outcomes or short-lived effects on the integrity of the native cartilaginous framework and chondrocyte population from such techniques. We publish the first study comparing the effects of these techniques on gross cellular integrity of sculpted cartilage.

Both Bovie electrosection and ultrasonic sculpting are comparable to cold steel sculpting in terms of preservation of cartilage integrity and chondrocyte viability and density. Bovie electrosection for cartilage contouring is readily available and requires little advanced training. Cartilage contouring with the ultrasonic bone aspirator can be undertaken during dorsal hump reduction, septoplasty and septal cartilage graft sculpting with histologic effects equivalent to those of cold steel contouring. Proponents contend that the technique's flexibility and precision outweighs its additional cost. Our histologic studies indicate that all three techniques should produce viable cartilage grafts and suggest that the techniques can be used interchangeably for cartilage sculpting needs. Future studies should aim to investigate any long-term sequelae such as graft life span and warping to ensure a reliable and long-lasting treatment effect.

Acknowledgement

We acknowledge Elizabeth Duddy for her instrumental role in facilitating IRB application and approval.

Funding: Funding for the project was provided internally by the Department of Otolaryngology- Head and Neck Surgery, Thomas Jefferson University. No other external sources of funding were used. All authors have read the journal's authorship agreement and policy on disclosure of potential conflicts of interest.

References

1. Becker DG, Becker SS, Saad AA (2003) Auricular cartilage in revision rhinoplasty. Facial plastic surgery : FPS 19: 41-52.
2. Berghaus A, Stelter K (2006) Alloplastic materials in rhinoplasty. Current opinion in otolaryngology and head and neck surgery 14: 270-277.
3. Cakmak O, Ergin T (2002) The versatile autogenous costal cartilage graft in septorhinoplasty. Archives of facial plastic surgery 4: 172-176.
4. Guerrerosantos J (1991) Nose and paranasal augmentation: autogenous, fascia, and cartilage. Clinics in plastic surgery 18: 65-86.
5. Kridel RW, Ashoori F, Liu ES et al. (2009) Long-term use and follow-up of irradiated homologous costal cartilage grafts in the nose. Archives of facial plastic surgery 11: 378-394.
6. Lovice DB, Mingrone MD, Toriumi DM (1999) Grafts amd implants in rhinoplasty and nasal reconstruction. Otolaryngologic clinics of North America 32: 113-141.
7. Immerman S, White WM, Constantinides M (2011) Cartilage grafting in nasal reconstruction. Facial plastic surgery clinics of North America 19: 175-182.
8. Pribitkin E, Greywoode JD (2013) Sonic rhinoplasty: innovative applications. Facial plastic surgery : FPS 29: 127-132.
9. Greywoode JD, Pribitkin EA (2011) Sonic rhinoplasty: histologic correlates and technical refinements using the ultrasonic bone aspirator. Archives of facial plastic surgery 13: 316-321.

This article was originally published in a special issue, entitled: **"Fine Needle Aspiration Cytology in Disease Diagnosis"**, Edited by Borislav A. Alexiev