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A Preliminary Report of Percutaneous Craniofacial Osteoplasty in a Rat Calvarium

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INTRODUCTION

Objective: To evaluate the potential for injectable, permanent bone augmentation by assessing the biocompatibility and bioactivity of subperiosteal hydroxylapatite (Radiesse) deposition in a rat model.

Methods: Fourteen adult Sprague Dawley rats were injected in the parietal skull with hydroxylapatite (n=10) or a carrier gel control (n=4), using a subperiosteal injection technique on the right and a subcutaneous injection technique on the left. At 13, 6, and 12 months, 3 rats (1 negative control, 2 variables) were sacrificed. Results: The inflammatory response was limited in all specimens. The odds ratio, p values and 95% confidence intervals were calculated using Fisher’s conditional maximum likelihood estimation. The potential for new bone formation was determined by examining and comparing separate samples of the HA and injectable. No statistically significant difference was identified in the rate of bone formation between the two groups. The plane of injection seems to be critical in any effort to induce osteoactivity. New bone formation was seen in all specimens. The marginal effect of HA, however, was not significant.

RESULTS

Histologic data are summarized in Table 1. Multinucleated giant cells were often present (Figure 2), and may have contributed to osteoactivity. No evidence was obtained to support the conclusion that the trauma of periosteal disruption was significant. In an attempt to analyze the effect of the injection plane, subperiosteal injections were compared to all other combinations of injection sites, and subperiosteal injection was more efficacious and associated with significantly higher new bone formation in the rat calvaria than the aggregate of all other combinations of injection sites.

CONCLUSIONS

Minor deformities of the craniofacial skeleton can be quite bothersome aesthetically to patients. Radiesse provides an intriguing solution as it is considered a non-migratory and biocompatible constituent, HA, has been used for over 2 decades in other formulations for open craniofacial reconstruction. It is approved for the treatment of HIV related facial lipoatrophy and moderate to deep nasolabial folds, Radiesse is well-established in facial plastic surgery for soft tissue augmentation. Over the years, various studies have confirmed its safety, longevity and biocompatibility (specifically the degradable, plastic-elastic degradation). This study suggests the potential for new bone formation at the bony interface and the biocompatibility of injectable HA. The potential for injectable HA can be osteointegrated and used to inject the material directly onto the underlying bone. Unfortunately, our technique for periosteal disruption was not optimal, and further study on a larger scale is warranted to better elucidate the stimulus for the new bone formation. Radiesse has been used for over 2 decades in other formulations for open craniofacial reconstruction. It is approved for the treatment of HIV related facial lipoatrophy and moderate to deep nasolabial folds. Radiesse is well-established in facial plastic surgery for soft tissue augmentation. Over the years, various studies have confirmed its safety, longevity and biocompatibility (specifically the degradable, plastic-elastic degradation). This study suggests the potential for new bone formation at the bony interface and the biocompatibility of injectable HA. The potential for injectable HA can be osteointegrated and used to inject the material directly onto the underlying bone. Unfortunately, our technique for periosteal disruption was not optimal, and further study on a larger scale is warranted to better elucidate the stimulus for the new bone formation. Radiesse has been used for over 2 decades in other formulations for open craniofacial reconstruction. It is approved for the treatment of HIV related facial lipoatrophy and moderate to deep nasolabial folds. Radiesse is well-established in facial plastic surgery for soft tissue augmentation. Over the years, various studies have confirmed its safety, longevity and biocompatibility (specifically the degradable, plastic-elastic degradation). This study suggests the potential for new bone formation at the bony interface and the biocompatibility of injectable HA. The potential for injectable HA can be osteointegrated and used to inject the material directly onto the underlying bone. Unfortunately, our technique for periosteal disruption was not optimal, and further study on a larger scale is warranted to better elucidate the stimulus for the new bone formation.