The Use of Liquid Amniotic Membrane Allograft in the Revision of First Metatarsal Non-Union in the Surgical Correction of Hallux Valgus Deformity

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LITERATURE REVIEW CONTINUED

Additional etiologies of non-unions encountered by the foot and ankle surgeon include vascular [20], infection, severe trauma, radiation, aseptic necrosis, bone dysplasia, and neuropathy [19]. The use of liquid amniotic fluid allograft was initially reported by Fagerstrom et al [18] in the treatment of non-unions. This treatment modality was selected because amniotic fluid contains numerous growth factors that have anabolic effects on bone and soft tissue, and the allograft’s benefit with soft tissue proliferation and the results of this study demonstrate the use of liquid amniotic fluid allograft’s stimulation of osteogenic activity within bone as an alternative treatment for non-unions.

LITERATURE REVIEW

The adverse effects of cigarette smoking on wound and bone healing have been extensively studied in scientific literature. Studies have shown that cigarette smoking inhibits limbal spiral fusion, and contributes to nonunion in tibia shaft fractures [3, 4]. Kranitz et al in 2009 were able to demonstrate the same adverse effects on bone healing after elective foot surgery by correlating the presence of the patient’s smoking habit with nonunion of metatarsal bone. The authors showed that a smoker’s Austin bunionectomy took 1.7 times longer to reach adequate postoperative tibial union than a non-smoker (p < 0.05). This equated to a 42% increase in time to bone healing in the smoking patient (8). As the data for this evidence-based medicine has become the standard of care, many practitioners have begun incorporating the Fagerstrom test and urine cotinine test in their pre-operative evaluation of surgical candidates for elective foot and ankle procedures.

RESULTS

Both patients were evaluated at intervals of 5 days post-operatively, 12 days post-operatively, and then every 4 weeks until final evaluation at 10 months. The mean post-operative AOAF score at 10 months was 77.5 (SD 15.5). Both patients were able to return to their pre-operative level of function and activity. They were without any infection, inflammatory or auto-immune reactions to the injection. A calcaneal heel bone graft that was required for further surgery was used. Radiographs taken at 6 months post-operatively demonstrated evidence of bony bridging across the site the allograft was injected with, complete obliteration of the osteotomy site.

ANALYSIS & DISCUSSION

The authors report an alternative technique of utilizing a liquid amniotic fluid allograft for the treatment of a non-union providing a less invasive tratamiento. Patients required immobilization in a brace post-operatively. The mean post-operative AOAF score at 10 months was 77.5 (SD 15.5). The results of this study show satisfactory radiographic bone union at 6 months post-operative in both cases.

Limitations of this study included the subjective nature of data collection using the AOAF scoring system, small population size, and the retrospective nature of this study. Although patient information is quite helpful in determining satisfaction levels, many patients may not be forthcoming when the surgeon is soliciting the data. The large variation in this cohort could be due to the subjective nature of the AOAF scoring system. One patient had pain prior to foot surgery caused by idiopathic neuropathy. This appeared to be controllable with procedures performed to avoid or prevent neuropathy due to his constant neuropathic pain. The retrospective design of this study created the potential for bias associated with not having the primary surgeon assess radiographs to determine union or non-union.

A standard protocol for indications on when to use amniotic fluid allograft for non-unions does not exist, there were no guidelines to follow. Further research using patient’s subjective questionnaires in the healing of the non-union is necessary to formulate a proper protocol.

METHODOLOGY & HYPOTHESIS

A retrospective review of 2 patients and 3 procedures was performed with an average follow up of 10 months, respectively. Both patients were diagnosed with a painful, non-union of the osteotomy or fusion site based on the duration of symptoms. The liquid amniotic fluid allograft was obtained using the American Orthopedic Foot and Ankle Society (AOFAS) first ray scoring system. Radiographs were also analyzed at 6 months post-operatively for evidence of bony bridging across the site the allograft was injected.

LEVEL OF EVIDENCE

Level IV

LITERATURE REVIEW CONTINUED

The authors present a series of 2 cases in which this allograft was used in the surgical treatment of non-unions found in a failed metatarsal-cuneiform fusion, and bilateral chevron osteotomies in the treatment of hallux valgus deformity.