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Acellular Dermal Matrices in Hand Reconstruction

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Background: The goal of this article is to review the current literature on the use of acellular dermal matrix in forearm, wrist, and hand reconstruction.

Methods: A comprehensive literature search was performed using the Cochrane Database of Systematic Reviews, MEDLINE, PubMed, and Web of Knowledge. Articles were categorized as acellular dermal matrix used in soft-tissue repair and in ligament reconstruction. Search terms included "acellular dermal matrix," "biologic dressing," "skin replacement," "dermal allograft," "AlloDerm," "FlexHD," "Permacol," and "Strattice." These were all cross-referenced with "forearm," "wrist," and "hand." Data extraction focused on indications, surgical techniques, clinical outcomes, and complications. Exclusion criteria included regeneration templates, neonatal foreskin, and review articles.

Results: More than 100 articles published between 1994 and 2011 were identified. Upon final review, five prospective case-control studies, three retrospective case-control studies, three retrospective case-control studies, four case reports, one cross-sectional cohort, one prospective consecutive series, and one study type unknown were evaluated. Matrix was most commonly used in burn reconstruction. It has also been used in ligament and joint reconstruction for first carpometacarpal arthritis. One article illustrated the use of porcine matrix in basal joint arthritis, a practice that was abruptly terminated because of a concern over increased infections.

Conclusions: The clinical indications for acellular dermal matrix have increased throughout the last 15 years. Hand surgeons have been cautious but diligent in developing alternative treatment options in hand reconstruction, with a focused effort to reduce donor-site morbidity. Although acellular dermal matrices continue to find innovative uses to solve upper extremity surgical problems, more comparative prospective trials are needed. (Plast Reconstr Surg 130 [Suppl 2]: 256S, 2012.)

Human acellular dermal matrix was released into the market in 1994 for replacement of inadequate integumental tissue due to burn injury. Since then, upper extremity surgeons have found these allografts useful as skin replacement after radial forearm flap harvest, in basal joint reconstruction, and more recently in rotator cuff repair.1-4 Historically, hand surgeons have used several biologic and nonbiologic products to correct joint deformities in rheumatoid arthritis and as prostheses in functional joint replacement. With the increased popularity of acellular dermal matrix constructs and published clinical indications, we present a review of their use in hand and upper extremity surgery.

A property of acellular dermics that offers advantages in hand surgery is its ability to retain...

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elastin and collagen fibers after undergoing decellularization and sterilization. Histological studies have shown that although human acellular dermal matrices can incite a low-grade host inflammatory response, full immunogenic rejection by the host rarely occurs.1–5 Permacol, a porcine matrix widely used in hernia repair, undergoes chemical collagen cross-linking, which confers strength and resistance to host collagenases. Although this cross-linkage does protect it from immediate enzymatic degradation, it also permits a prolonged chronic inflammatory response at the site of implantation.6–10 We present the most up-to-date published clinical experiences of acellular dermis in forearm, wrist, and hand reconstruction, along with illustrations of specific case examples treated in the senior author’s practice.

METHODS

Literature Search
A literature search using the Cochrane Database of Systematic Reviews, MEDLINE, PubMed, and Web of Knowledge was used for this study. Our search terms included “acellular dermal matrix,” “biologic dressing,” “skin replacement,” “dermal allograft,” “AlloDerm,” “Flex HD,” “Permacol,” and “Strattice.” These were all cross-referenced with the keywords “forearm,” “wrist,” and “hand.” Inclusion criteria were studies published between 1994 and 2011; these selected studies showed a clear use of acellular dermal matrix in the upper extremity in human subjects. Exclusion criteria were articles that used regeneration templates, for example, Integra (Integra LifeSciences Corp., Plainsboro, N.J.), neonatal foreskin, Apligraf (Organogenesis, Inc., Canton, Mass.), and bovine pericardium. Review articles were excluded. Meta-analysis was not used because the sample sizes were small, and there were not enough comparable data.

Data Extraction and Statistical Analysis
On final review, articles were included that clearly described using acellular dermal matrix in the forearm, wrist, and hand (Table 1). Data of interest included surgical technique, indication for use, follow-up, and complications. Given the limited number of patients, case reports, and the retrospective nature of the review, comparable statistical analysis was not pursued. Complications were reported from individual articles. Statistically significant or insignificant differences, if stated, were included in the evaluation of the articles.

RESULTS

A search of MEDLINE, PubMed, and Web of Knowledge databases together yielded over 100 articles in which the search terms “acellular dermal matrix,” “biologic dressing,” “skin replacement,” “dermal allograft,” and trade name products were cross-referenced with “forearm,” “wrist,” and “hand.” When the search was limited to human acellular dermal matrix, English translations, articles published between 1994 and 2011, and queried for specific use, this number was reduced to 15. No studies were found in the Cochrane database. Review articles and articles not clearly identifying (1) the forearm, wrist, and hand as sites of reconstruction, (2) regeneration templates, and (3) nonskin source products were all excluded from this review. In our extensive review, we did not find any randomized controlled trials or large volume patient series. We did find multiple articles where acellular matrix was used to replace forearm skin and fascia, in burn reconstruction, and in joint reconstruction for carpometacarpal arthritis (Table 2).

Forearm Muscle Herniation
The most common cited use of acellular dermal matrix in the forearm has been to replace the deep fascia after muscle herniation and to cover the volar forearm after radial forearm flap harvest. Forearm muscle herniation was first described in 1965, where the use of autogenous tissue was the primary choice of treatment.11–13 In 2010, Kozlos et al. described two patients who had a flexor compartment fascial defect.14 The 5 × 7-cm forearm defect in patient 1 was repaired with AlloDerm (LifeCell Corporation, Branchburg, N.J.) as an inlay graft. The second patient presented with a similar story and was repaired with Flex HD (MTF Ethicon, Edison, N.J.). At 1-year follow-up,