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Cementless Reverse Shoulder Arthroplasty Technique to Maximize Press-Fit Fixation with Humeral Matchstick Bone Grafts

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Published outcomes of this procedure can be found at: *J Shoulder Elbow Surg*. 2021 Aug;30(8):1949-56, *Tech Shoulder Elb Surg*. 2018 Jun;19(2):67-74, and *J Shoulder Elbow Surg*. 2016 Nov;25(11):1787-94

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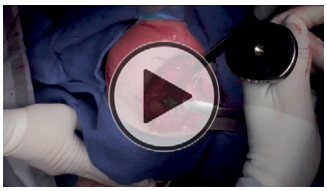

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Abstract

Background: Cementless reverse shoulder arthroplasty has become increasingly popular because of the improved implant design, porous ingrowth surface, and surgical techniques. When avoiding the risks of cement use, a press-fit arthroplasty stem that has been implanted may not feel immediately stable, especially if the medullary canal size is in between standard stem diameters. To help surgeons improve fixation and avoid overstuffing the medullary canal, we present the matchstick autograft augmentation technique. The use of humeral autograft, analogous to impaction grafting in hip arthroplasty, has been reported to have promising short-term outcomes[2,3]. This technique of using humeral autograft material, dubbed matchstick autografts because of their shape and size, allows for optimization of humeral stem stability with the option of smaller cementless humeral implants. By avoiding overstuffing of the medullary canal, this technique aims to reduce the incidences of intraoperative fracture, postoperative stress shielding, and potential implant loosening[4-6].

Description: Cementless reverse total shoulder arthroplasty is routinely performed via the anterosuperior approach[7]; however, a deltopectoral approach can be utilized if desired. The canal is sequentially broached with implant trials until the tactile feedback demonstrates axial and rotational stability. In cases in which tactile feedback during implantation demonstrates slight movement, the smaller implant size can be selected and augmented with matchstick autograft. An oscillating saw is utilized to cut the edges of the previously resected humeral head in order to expose the subchondral bone surface. Graft sticks about 20 mm in length and 1 to 3 mm in width are then fashioned. Humeral trials are then implanted with the matchstick grafts placed lengthwise alongside the humeral stem. Axial and rotational press-fit is again assessed. If adequate, the formal humeral implant is selected and implanted in position. As in conventional impaction grafting, the grafts are compressed to the side of the humeral canal, but they offer more corticocancellous structure than bone chips. This technique is applicable even in some fracture scenarios.

Disclosure: The **Disclosure of Potential Conflicts of Interest** forms are provided with the online version of the article (http://links.lww.com/JBJSEST/A466).

Alternatives: When a specific press-fit humeral stem size does not achieve adequate stability, there are typically 3 surgical alternatives. First, a larger stem size can be selected. Second, the implant can be inserted deeper to achieve press-fit stability. Third, cement can be added to fill the medullary canal and create immediate stability.

Rationale: When implanting the humeral prosthesis, the operating surgeon's primary goal is stem stability. When faced with lack of stability, the surgeon can select a larger humeral stem, risking stress shielding; implant the stem deeper, compromising length and risking humeral fracture; or consider a cemented implant. In order to minimize the risk of intraoperative cardiopulmonary events and complicated subsequent revision surgeries[8], the use of cement should be avoided if at all possible. Shoulder surgeons have reported grafting techniques, analogous to hip impaction grafting, that have yielded good success[3]. The technique that we describe utilizes a matchstick structural autograft that helps improve cementless fixation in primary humeral implantation cases and allows for the use of a smaller stem. The structural shape of the graft allows this technique to be utilized even in selected proximal humeral fractures.

Expected Outcomes: Other studies have reported on the use of softer cancellous autografts to stabilize humeral implants in shoulder arthroplasty. In a study of 286 arthroplasties with a minimum follow-up of 2 years, Lucas et al. reported that 267 humeral stems (93.3%) had not subsided[3]. Humphrey and Bravman used cancellous autograft to achieve metaphyseal centering of the humeral component in 53 patients, with no cases of humeral implant loosening at 12 months[2]. Lo et al. reported 91% tuberosity healing in their series of cementless reverse total shoulder arthroplasties augmented with matchstick autografts[1], with no cases of aseptic humeral stem loosening. Montemaggi et al. used matchstick autografts to augment 46 primary cementless reverse total shoulder arthroplasties and found zero instances of humeral loosening at 1-year follow-up[9].

Important Tips:

- The strongest humeral matchstick grafts come from the subchondral surface.
- After creating the graft, it is palpated for structural integrity. A stiffer or softer graft can be chosen, depending on surgeon preference.
- Surgeons can try impacting the graft with humeral trials to assess the stem stability prior to final implantation.

Acronyms and Abbreviations:

- RTSA = reverse total shoulder arthroplasty
- FX = fracture
- 3D CT = 3-dimensional computed tomography
- XR = x-ray
- FU = follow-up

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