Comparison of Arthroplasties With or Without Bone Tunnel Creation for Thumb Basal Joint Arthritis: A Randomized Controlled Trial

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Purpose To compare the results for treatment of basal thumb osteoarthritis with and without the use of a bone tunnel at the base of the first metacarpal.

Methods Women aged 40 years or older with stage IV osteoarthritis were randomized to 1 of 2 treatments. Patients were evaluated preoperatively and postoperatively at 3 and 12 months by assessing pain, outcome function measures, range of motion, strength, time to return to work or activities, satisfaction with the results, and complication rate.

Results A total of 79 patients were enrolled in this study. Three months after surgery, Patient-Rated Wrist and Hand Evaluation pain and total scores were significantly improved in the bone tunnel group compared with the tunnel-free group. At 12 months, however, we found no significant differences for all outcome scores between groups. In addition, we observed no significant differences between groups in strength, duration to return to work or activities, patient satisfaction, and complication rates.

Conclusions After the bone tunnel technique, patients have better function and less pain 3 months after surgery than do those in the non–bone tunnel group, which indicates faster recovery. However, 12 months after surgery, the functional outcome was similar. Because of faster recovery, we prefer the bone tunnel technique in the treatment of stage IV osteoarthritis. *(J Hand Surg Am. 2014;39(9):1692–1698. Copyright © 2014 by the American Society for Surgery of the Hand. All rights reserved.)*

Type of study/level of evidence Therapeutic I.

Key words Ligament reconstruction, osteoarthritis, thumb, trapeziectomy, trapeziectomy with LRTI.

OSTEOARTHRITIS (OA) AT THE base of the thumb can result in major impairment.[1,2] Two recent randomized controlled trials (RCT) found no benefit of ligament reconstruction and tendon interposition (LRTI) after trapeziectomy in the long term (> 5 y) compared with trapeziectomy alone.[3,4] However, because only 10% of patients in those studies had scaphotrapeziotrapezoid joint OA (stage IV OA according to the radiographic criteria of Eaton and Glickel[5]), these results primarily apply to stage II and III OA (radiographic OA only at the trapeziometacarpal joint). Because stage IV OA is characterized by more cartilage and ligament damage and metacarpal subluxation, we postulated that the thumb has an increased tendency to collapse in the palm (zigzag deformity). Therefore, LRTI after trapeziectomy could be a valuable treatment option in patients with stage IV OA.

Several ligament reconstructions have been described using different tendon grafts. Some techniques use bone

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tunnels at the base of the first metacarpal whereas others avoid the use of such tunnels. Which kind of ligament reconstruction is superior is an ongoing debate. The drilling process to create a bone tunnel may be associated with severe complications, such as damage of the superficial radial nerve and fragmentation of the first metacarpal. So far, however, different LRTI procedures have not been compared in an RCT. Therefore, we conducted an RCT in women with stage IV OA at the base of the thumb, comparing the Burton–Pellegrini (BP) and Weilby techniques. The BP technique is an LRTI arthroplasty with a bone tunnel at the base of the first metacarpal whereas the Weilby LRTI arthroplasty preserves the structural integrity of the first metacarpal base by not using a bone tunnel. We hypothesized that after the Weilby technique patients would show similar outcomes at 3 and 12 months' follow-up with possibly fewer complications.

PATIENTS AND METHODS

Participants

After we obtained approval from our institutional review board, we enrolled patients with symptomatic OA who failed to improve after nonsurgical treatment and who had stage IV OA of the thumb base[5] in a single-center, single-blind, parallel-group RCT. An independent radiologist used 3 x-rays (posterior-anterior, lateral, and Bett view) to determine the disease stage. To obtain a homogeneous group of primary OA patients, we only included women aged 40 years or older with unilateral or bilateral primary OA. This is a common strategy to increase the homogeneity of a study population.[3] Patients with previous thumb surgery and patients with rheumatoid or posttraumatic OA were excluded. Patients were randomly allocated for treatment with either an LRTI based on the original reports of Burton and Pellegrini[6] or an LRTI based on the original reports of Weilby.[7,8]

Randomization

For equal distribution of patients between type of surgery and surgeon, software randomly assigned patient numbers to a treatment group and a surgeon using balanced block sizes of 20 patients. Sequentially numbered envelopes containing the assignment were used. After inclusion and informed consent, patients were assigned to the next envelope and therefore to a treatment group and a surgeon. Two European board-certified hand surgeons performed all surgeries.

Burton-Pellegrini technique

We made an incision along the radial border of the first metacarpal, after which we removed the trapezium. A tendon graft about 10 cm long and consisting of approximately one-half of the flexor carpi ulnaris (FCR) tendon was dissected and tunneled to its insertion on the second metacarpal. This tendon graft was passed through a bone tunnel perpendicular to the thumbnail made with a 3.5-mm drill bit. The bone tunnel had an oblique orientation and the drill was passed from the radial cortex of the first metacarpal approximately 7 mm distal to the joint surface and dorsal of the abductor pollicis longus (APL) attachment exiting through the center of the joint surface. The graft was passed in the opposite direction and was fixed firmly to the periosteum and back onto itself beneath the APL attachment to resurface the base of the metacarpal. Its remaining length was sutured into a ball and secured in the trapezial space to act as a spacer, after which the joint capsule was closed. All sutures were performed with PDS 3-0 suture (Ethicon, Amersfoort, The Netherlands). The thumb was immobilized in a spica cast for 4 weeks, after which the cast was replaced by a removable protective orthosis and a hand therapist started standardized hand therapy focused on reducing edema and regaining functionality by increasing mobility, stability, and strength of the thumb.

Weilby technique

The trapezium was removed and the FCR tendon was harvested as described above. The tendon graft was then intertwined in a figure-of-8 fashion (at least twice) around the APL tendon and the rest of the FCR tendon, pulling those tendons together into the space created after trapeziectomy. The figure-of-8 configuration was locked by PDS 3-0 sutures. The remaining graft was sutured upon itself and was interposed in the trapezial void and pushed between the base of the first and second metacarpal. The Weilby group received the same immobilization period and standardized hand therapy as the BP group.

Primary outcomes

Our primary outcome measure for pain and physical function was the Patient-Rated Wrist/Hand Evaluation (PRWHE, Dutch language version) questionnaire (0 = no pain and able to perform activities; 100 = worst pain and unable to perform activities).[9] The questionnaire has 2 subscores for pain and function and a total score. The PRWHE is a wrist- and hand-specific questionnaire with items about the affected wrist and hand alone. The more frequently used Disabilities of