

Efficacy of Thumb Arthroplasty in Carpometacarpal Joint Osteoarthritis: A Long Term Follow-up

Banu Dilek^{1*}, Gokhan Meric², Didem Erdem¹, Gorkem Uz³, Elif Akalin¹ and Kadir A⁴

¹Department of Physical Medicine and Rehabilitation, Faculty of Medicine, Dokuz Eylul University, Izmir, Turkey

²Department of Orthopaedics, Faculty of Medicine, Balikesir University, Balikesir, Turkey

³Department of Radiodiagnosis, Faculty of Medicine, Dokuz Eylul University, Izmir, Turkey

⁴Department of Orthopaedics, Faculty of Medicine, Dokuz Eylul University, Izmir, Turkey

*Corresponding author: Banu Dilek, Department of Physical Medicine and Rehabilitation, Faculty of Medicine, Dokuz Eylul University, Izmir, Turkey, Tel: 900232 4123951; Fax: 90 0232 2792462; E-mail: banu.dilek@deu.edu.tr

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Abstract

Introduction: The purpose of the present study is to evaluate long term functional results and satisfaction following arthroplasty of thumb carpometacarpal joint (CMC) osteoarthritis and compare with controls, who had CMC osteoarthritis (Eaton stages II-III).

Materials and Methods: Ten patients with arthroplasty of thumb CMC joint osteoarthritis (arthroplasty group) and ten patients with the same side thumb CMC joint osteoarthritis without arthroplasty (control group) were enrolled in the study. All patients were evaluated according to Eaton radiologic classification. Outcome measures were included visual analog scale (VAS 0-10 cm) scores for pain, Disabilities of Arm, Shoulder and Hand (DASH) scores for function, abduction of thumb, thumb total active range of motion (TAROM), grip and pinch strength. We also evaluated patients' satisfaction scores with numeric scale (0-10) in arthroplasty group.

Results: Mean age of the arthroplasty group was 66.50 ± 6.90 , control group was 66.70 ± 9.22 . The average duration of after operation was 49.20 ± 24.94 months and patients' satisfaction score was 8.10 ± 1.44 in arthroplasty group. When the groups were compared, DASH scores, pain at activity of daily living and at rest were found significantly in arthroplasty group ($p < 0.05$). TAROM, Grip and pinch strength parameters between the two groups there were no statistically significant difference. ($p > 0.05$).

Discussion: Arthroplasty in CMC osteoarthritis can be effective in terms of improvement of pain, mobility and function. Long term successful results can be achieved in treatment with use the arthroplasty in patient who suffer from moderate or severe CMC osteoarthritis.

Keywords: Osteoarthritis; Thumb; Arthroplasty; Function

Introduction

Thumb carpometacarpal (CMC) joint osteoarthritis is quite common. The prevalence of radiographic osteoarthritis in these joints was reported in women 15%, in men 7%. The prevalence has increased to 28% in population of postmenopausal women [1,2]. Thumb joint has extensive the ability move compared to other hand joints. This large range of motion in the thumb CMC joint contributes to the development of degenerative changes [2]. In addition, acute or chronic trauma, advanced age, hormonal factors, and genetic predisposition are other predisposing factors [3,4]. Clinical symptoms can be form on the radial side of the wrist and hand pain, swelling, stiffness, limitation of motion, weakness, deformity and instability. Treatment of CMC joint osteoarthritis is not only based on radiographic stage but also depending on severity of symptoms. The goal of treatment prevents secondary deformities associated with disability and decrease pain. Conservative treatments are activity modifications, joint protection techniques, medical therapy, corticosteroid injection, splinting and physical therapy [3]. Conservative treatment is successful in 60-70%,

especially in the early stages. Surgical approach is recommended when persistent pain, instability, loss of function and failure of conservative treatment are developed. Many surgical techniques have been used for the treatment of the CMC joint arthritis. Arthroplasty techniques cover a wide area up to partial or complete simple interposition and ligament reconstructions from trapezoidectomy and are also used in the late stages [2]. Several of short and long term studies with arthroplasty procedures had shown that improvement on pain, function and muscle strength after arthroplasty of the thumb CMC joint [5,6]. However, only a few studies have been found in terms of long-term surgical outcomes [7,8]. Also, patient satisfaction is becoming important increasingly in long term. After CMC arthroplasty; pain, muscle strength, range of motion and deterioration in function is likely to affect patient satisfaction [9,10]. The treatment of the early stages of the CMC osteoarthritis can be problematic for the clinicians. If the patients are refractory to the conservative treatment, surgical treatment can be preferred. The purpose of the present study is to evaluate long term functional results and satisfaction following arthroplasty of thumb CMC joint osteoarthritis and compare with controls, who had severe CMC osteoarthritis (Eaton stages II-III).

Materials and Methods

The institutional ethics committee approved the study design and all participants gave consent for inclusion. We evaluated retrospectively 10 patients (arthroplasty group) who had ligament reconstruction and tendon interposition (LRTI) technique, called suspension arthroplasty with abductor pollicis longus tendon of the thumb CMC joint osteoarthritis and same rehabilitation and compared with similar age and sex 10 patients (control group) who had with thumb CMC osteoarthritis (Eaton stages II-III). All patients were evaluated according to Eaton radiologic classification (GU). The left side in 6 patients, the right side in 4 patients were operated. Dominant side of all patients were right. Mean age of the arthroplasty group (9 Female, 1 Male) was 66.50 ± 6.90 , control group (9 Female, 1 Male) was 66.70 ± 9.22 . Patients have not received any medical or physical therapy program for the last three months and who did not accept the operation were included in the study, Patients who do not accept the assessment, any nerves accompanying, tendon or bone injury, bilateral operation and also noncooperate to tests were excluded from the study. In groups, the CMC joint pain, muscle strength, range of motion and functional assessments were performed. Range of motion of thumb CMC joint was measured with goniometer. Pain at rest and at daily living activity was questioned with visual analog scale (VAS, 0-10 cm). Operated Patient's satisfaction was evaluated with numeric scale. We measured hand grip using a calibrated JAMAR hand dynamometer (Sammons Preston, Inc., Bolingbrook, IL), lateral, chuck and pulp to pulp pinch strength were evaluated with pinchmeter (Sammons Preston, Inc., Bolingbrook, IL). These measurements were done stand art position and measured three times. Also Disabilities of the Arm, Shoulder and Hand Questionnaire (DASH) was used for hand function. All evaluations were performed by same researcher (DE).

Surgical technique (LRTI with APL tendon)

All cases were operated by a single surgeon (KB). A curvilinear incision was made over the trapeziometacarpal joint. The joint was exposed between the abductor pollicis longus and the extensor pollicis brevis. A combination of sharp and blunt dissection was used to identify the CMC joint Also the dorsal branch of the radial artery and radial sensory nerve were protected with a vessel loop. Extensor pollicis brevis muscle was retracted dorsally. The longitudinal incision was made in CMC capsule. The trapezium, bony spurs, and loose bodies were also meticulously excised. A bone tunnel was made in the base of the dorsal cortex of the thumb metacarpal through the

medullary canal into the trapezium fossa. A 2.5 mm drill was used to create a hole at the dorsal base of the thumb. Drill hole was made 1 cm proximal on the dorsal radial aspect in line with thumb nail and exiting the middle of the articular surface. A most superficial slip was harvested from APL tendon. A small transverse incision was made over the APL tendon and then a APL tendon slip is folded to make a loop. The free end of the tendon was passed through the bone tunnel of the metacarpal and then sutured into itself in correct tension with sutures. The remainder of the tendon was inserted into the fossa. The APL tendon was passed back and forward over the needle in accordion fashion and accordion tendon was sutured. A temporary K-wire was used to stabilize the joint in 10° of flexion. Standard skin closure was performed and the thumb was immobilized in a thumb spica cast for 3 weeks. Active and active assistive range of motion exercise was then begun at 6 weeks.

Implantation of the spacer was performed through a dorsal approach, exposing the CMC joint capsular incision. The trapezium and any osteophytes were excised with rongeur. The spacer was inserted part into the joint space. Fixation was achieved with non-resorbable sutures. Standard skin closure was performed and thump immobilized in a thumb cast for 3 weeks. Active range of motion exercise is encouraged after splint removal.

Statistics

SPSS program for statistical analysis of the study (Statistical Package for Social Sciences for Windows 20.0) was used. Data were analyzed using descriptive statistical analysis of mean, standard deviation, and percentage distributions were evaluated at intervals. Mann Whitney-test was performed to compare the groups. All analytical assessment will be taken as $p < 0.05$ significance value.

Results

The average duration of after operation was 49.20 ± 24.94 months and patient's satisfaction score was 8.10 ± 1.44 in arthroplasty group. When the groups were compared, DASH scores, pain at activity of daily living and at rest were found significantly in arthroplasty group ($p < 0.05$). TAROM, Grip and pinch strength parameters between the two groups there were no statistically significant difference ($p > 0.05$) (Table 1). In addition, patients who underwent radiographic evaluation of stability is protected and showed no subluxation.

	Arthroplasty Group	Control Group	p value
Pain at rest(VAS 0-10 cm)	1.30 ± 2.86	5.70 ± 1.15	0.002*
Pain at ADL (VAS 0-10 cm)	2.20 ± 3.22	7.30 ± 1.94	0.004*
TAROM (Degree)	73.50 ± 18.41	80.00 ± 22.23	0.567
Abduction of thumb (Degree)	64.00 ± 15.05	61.00 ± 10.21	0.410
Hand grip strength(kg)	18.46 ± 9.11	18.53 ± 6.80	0.880
Lateral pinch strength (kg)	5.50 ± 1.72	4.51 ± 0.91	0.223
Pulp to pulp pinch strength (kg)	3.74 ± 1.55	3.34 ± 0.73	0.733
Chuck pinch strength (kg)	4.73 ± 1.89	3.49 ± 0.69	0.271

DASH score (0-100)	20.91 ± 25.83	48.19 ± 17.07	0.028*
*p<0.05; TAROM: Total Active Range of Motion; VAS: Visual Analog Scale; DASH: Disabilities of the Arm Shoulder and Hand; ADL: Activity of Daily Living			

Table 1: Comparison of function, ROM, pain and strength between groups.

Discussion

In this study, in patients treated with arthroplasty were shown significant improvement in pain, ROM and function compared to nonoperative patients. For painful CMC osteoarthritis of the thumb the main treatment goals are to restore thumb function; provide a painfree, stable, and mobile joint; and preserve strength [11]. All patients, regardless of their initial staging, require a trial of conservative therapy before any operative consideration [12]. When conservative treatment modalities such as the use of orthotics, thenar strengthening exercises, nonsteroidal anti-inflammatory medications, and steroid or viscosupplementation injections into the joint fail to control the pain and improve the limitation of function associated with radiographic deterioration of this disease, surgical treatment may be indicated [13-15]. Indications for surgical intervention in first CMC arthritis are similar to the indications for arthroplasty of most joints: persistent pain, decreased function, instability, and failure of conservative management. Patients with advanced cases of CMC osteoarthritis of the thumb often require surgical intervention to reduce pain and restore function [16]. A recent Cochrane review [17] evaluated studies with different surgical strategies and patients with varying grades of osteoarthritis. According to the review, patients with Eaton grade I osteoarthritis are likely to benefit from nonsurgical interventions. The choice of treatment for patients with Eaton grade II to grade IV osteoarthritis will be influenced by the severity of their symptoms and their functional demands. For each of these stages, the Cochrane review concluded that numerous surgical procedures were appropriate. No procedure demonstrated any superiority over another in terms of pain, physical function, patient global assessment, range of motion or strength in that review. Likewise, in our study, Unresponsive to conservative treatments in patients with Eaton stage 2 and 3 symptomatic CMC osteoarthritis had operated with interposition arthroplasty with APL compared to control group with similar Eaton stage, we concluded that arthroplasty in CMC osteoarthritis had better on patient satisfaction, function, pain and range of motion whereas grip and pinch strength did not differ in the long term [8]. Long-term outcome in patients after arthroplasty in thumb CMC osteoarthritis have been reported in a few studies and has been shown as an effective functional method [7-9]. In these studies; operated side and contralateral side or preoperative-postoperative same side were compared in terms of range of motion and muscle strength. In a controlled study, a significant loss of pinch strength and a significant higher DASH score were detected for the patient group in comparison to the controls, whereas grip strength did not differ significantly [18]. Another study, a total of 16 patients with unilateral symptomatic thumb CMC osteoarthritis and 16 healthy sex- and age-matched controls were recruited. Patients with thumb CMC osteoarthritis also exhibited a bilateral reduction in pinch and grip strength than controls in that study [19]. Different procedures have been described for CMC osteoarthritis in literature. LRTI is the most commonly performed procedure for this problem. Effectiveness of the surgery of LRTI with the subjective and objective outcomes has been reported in multiple studies [13,14,20-22]. Similarly LRTI with APL had performed in our patients and the results can be satisfied compare to controls. On the

other hand, we found that grip and pinch strength parameters between the two groups there were no statistically significant difference. Few authors state that to evaluate the strength of a diseased hand the most accurate reference is the strength of the other hand [23]. This statement cannot be completely transferred for cases of trapeziometacarpal osteoarthritis, since bilateral affection may compromise a precise comparison [23-25]. A relatively high incidence of bilateral trapeziometacarpal osteoarthritis is quite common [26,27]. Also, studies identified differences in sides and hand preference concerning grip and pinch strength. Intra-individual and inter-individual variations of key pinch strength had analysed in a standardised manner for healthy adults. Since the correlation between age and key pinch was similar in both genders, showing a continuous decrease of strength from the fifth decade of life on key pinch seems independent from gender-specific hormonal changes [28-30]. The main sign of the disease is pain that is exacerbated with daily living activities. The current study's results, with regard to patient satisfaction measures, are also comparable with literature-based controls. Our patient satisfaction rate with LRTI is comparable with 95% satisfaction and excellent relief of pain with an LRTI procedure reported by Tomaino et al. [9]. Likewise, Lins et al. also reported that 85% of patients would undergo surgery again if they could make their decisions a second time, compared with 95% (21 of 22) in the current series [30].

We reported the postoperative results in perspective to a nonoperated CMC osteoarthritis population of equal age and sex. This comparison may show the real benefit or disadvantage of the surgical technique, since the postoperative functional status is related to the physiological one. Limitation of this study first, it is clear that the need for larger studies because of the study group was small sample size. Second, In this study results are only for LRTI with APL procedure, thus other procedures should compare with this procedure.

In conclusion, Arthroplasty for moderate or severe thumb CMC osteoarthritis can be satisfied and effective in terms of pain, range of motion and function significantly following long term.

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