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MINIREVIEWS

Current review of trapeziometacarpal osteoarthritis (rhizarthrosis)

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Abstract

Trapeziometacarpal (TMC) joint is the secondly affected joint for osteoarthritis in the hand. TMC joint arthritis affects most commonly postmenopausal women after the fifth decade of life, due to hormonal and structural factors. Rhizarthrosis may lead to a clinical spectrum from subtle symptoms to advanced symptoms such as; severe pain, limitation of range of motion, muscular weakness, bony deformities, and end up ultimately with disability. Regardless of the etiopathogenesis; a variety of non-surgical and surgical methods have been used for the treatment of rhizarthrosis, depending on the age of the patient, symptomatology and the stage of the disease. The main goals of the treatments are as follows; relief of pain, conservation or restoration the stability and mobility of the TMC joint with the optimal preservation of the strength of surrounding musculature. In this article, the current methods, which have been used for the treatment of TMC joint osteoarthritis, will be mainly reviewed, together with concise up-to-date information on both its diagnosis and the anatomy of the TMC joint.

Key words: Osteoarthritis; Thumb; Trapeziometacarpal joint; Rhizarthrosis

Core tip: The trapeziometacarpal joint is a common region in the body, where osteoarthritis is encountered, especially in the postmenopausal women. Although the exact etiology is not still certain, ligamentous laxity is a common finding in most of the cases. Regarding to the existing literature, the most commonly used treatment methods are conservative measures and trapeziectomy with ligament reconstruction tendon interposition. Moreover newer treatment methods have emerged in the recent years. In conclusion, if long-term prospective, randomized, comparative studies are performed, there will be an appropriate answer to choose the optimal treatment methods for each stage of rhizarthrosis.

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INTRODUCTION

Trapeziometacarpal (TMC) joint is the secondly affected joint for osteoarthritis (OA) in the hand[1]. TMC OA or rhizarthrosis affects most commonly postmenopausal women after the fifth decade of life, due to hormonal and structural factors[2-4]. Rhizarthrosis may lead to a clinical spectrum from subtle symptoms to advanced symptoms such as; severe pain, limitation of range of motion, muscular weakness, bony deformities, and end up ultimately with disability.

Although the exact etiology of rhizarthrosis has not been clearly evidenced yet, most postulated theories related this entity with the surrounding ligamentous laxity or weakness of this joint, leading to the disturbed congruency between the trapezium and the basis of first metacarpus[5-9]. The incongruence and increased contact stresses end up eventually with rhizarthrosis.

Regardless of the etiopathogenesis; a variety of non-surgical and surgical methods have been used for the treatment of rhizarthrosis, depending on the age of the patient, symptomatology and the stage of the disease. The main goals of the treatments are as follows; relief of pain, conservation or restoration the stability and mobility of the TMC joint with the optimal preservation of the strength of surrounding musculature.

In this article, the current methods, which have been used for the treatment of rhizarthrosis, will be mainly reviewed, together with concise up-to-date information on both its diagnosis and the anatomy of the TMC joint.

LIGAMENTOUS ANATOMY OF THE TMC JOINT

The TMC joint of the thumb has a vital function nearly for all functions of the thumb, mainly by opposition. It is a combination of "saddle" and "universal" types of joint with confronting biconcave-convex shapes of trapezium and the basis of the first metacarpal bone. Its stability mostly depends on the ligaments, which support this joint mostly around the dorsal and volar regions. The understanding of this complex ligamentous anatomy is highly important for the stability of this joint, and its osteoarthritic process. This joint and its supporting ligamentous structures have been studied extensively in terms of anatomy, histopathology or biomechanics[5,9-18].

In general, 6 main ligaments of the TMC joint were consistently identified in the literature. These are as follows: dorsoradial ligament (DRL), anterior oblique ligaments (AOL, superficial and deep), intermetacarpal ligament, ulnar collateral ligament and posterior oblique ligament. The functions of these stabilizing ligaments are summarized in Table 1[19].

Among these ligaments, AOL was shown to be the primary stabilizer of the TMC joint by Eaton, Littler and Pellegrini[7,8,20]. But, this information has been challenged by many recent studies, in such a way that the DRL is the primary stabilizer against dorsal translation of the TMC joint[9,15,18,21-25]. It seems that this controversial debate on the main stabilizing ligaments of the TMC joint will continue over the coming years by ending up with an ultimate prospective conclusion.

DIAGNOSIS

In general, patients with rhizarthrosis have a spectrum of symptomatology. On one hand a patient may be asymptomatic or may have subtle symptoms despite pantrapezial arthritis, on the other hand another patient may have severe symptoms despite a lower radiological stage. Although this disease interferes with recreational and professional activities and performances, most patients live by adapting themselves to this situation with the avoidance of some thumb movements, such as abduction and key pinch. So, the symptomatology may not correlate with the radiology in most of the times[26].

Symptomatic patients usually present with a pain located at the base of the thumb, which may radiate to the thenar region or metacarpophalangeal joint. It is usually worsened by some unique movements of the thumb (pinch or grip during turning a key, sewing, writing, opening a jar, *etc.*). As the disease progresses, the position of the thumb shifts from an adducted but lax position to a more ankylosed position, and the previously lax joint becomes stiffer. The final position of the deformity is defined as "pollux addustus" (adducted metacarpal shaft with metacarpophalangeal hyperextension).

In physical examination, tenderness and some provocative tests help to the establishment of the diagnosis. The tenderness is usually at the radiopalmar surface of the TMC joint, especially coexisting with inflammation at earlier stages. The provocative tests, which include the grind test and Glickel test, aim to reproduce pain at the TMC joint level[27,28].

In practice, radiography should at least include; posteroanterior (PA) neutral, PA clenched fist, lateral, and oblique views. The most popular and the most commonly used radiological classification of rhizarthrosis is the Eaton-Littler Classification, which uses a true lateral view of the thumb centered over the trapezium and sesamoids superimposed (Table 2)[13]. Later, a fifth stage was described as pan-trapezial arthritis, as TMC joint arthritis was observed rarely as an isolated entity[29].

The most common pathology co-existing with rhizarthrosis was reported to be the carpal tunnel syndrome[30]. Differential diagnosis of rhizarthrosis includes De Quervain's disease, trigger thumb, scaphoid fracture (distal pole), flexor carpi radialis (FCR) tenosynovitis, scaphotrapezial arthritis, wrist arthritis and subsesamoid

Table 1 Main ligaments of the trapeziometacarpal joint

Ligament		Description of the function
Dorsoradial (Figure 1)		Shortest and thickest ligament (Recently possible) Primary stabilizer against dorsal translation of the joint Opposes anterior oblique ligaments Basis for Eaton-Littler procedure
Anterior oblique (Figure 1)	Superficial	Stabilization against volar joint subluxation
	Deep	Known as beak ligament Act as a pivot point Primary joint stabilizer against dorsal translation
Posterior oblique		Stabilization of rotation
Intermetacarpal		Stabilization during radiovolar translation Stabilization of the thumb against collapse especially after trapeziectomy
Ulnar collateral		Helps to stabilization against volar joint subluxation

arthritis[19]. But careful and proper clinical and radiological evaluations will differentiate rhizarthrosis from the aforementioned clinical entities.

TREATMENT

The treatment of rhizarthrosis has evolved in the last decade, especially in terms of surgical methods. In general, the treatment mainly aims to relieve pain, to regain stability, mobility of the joint, to reestablish the strength of surrounding structures and to increase the comfort and function of the patient clinically. Treatment methods will be summarized concisely in this section.

Non-surgical treatment

In general, non-surgical methods are preferred at the initial stages by most of the clinicians, as the initial method of management. The choices include: non-steroidal inflammatory drugs, splinting with thumb spica cast, physical therapy and injections (steroid and hyaluronic acid)[3,31-36]. It should be kept in mind that continuous and repeated steroid injections have been shown to weaken the joint capsule[37]. They may complicate further surgeries. Therefore they should be used specially at inflammatory flare-up periods, but should not be applied repeatedly. Another important point is that; although most studies on conservative methods report good-excellent results on pain and functional scores, the methodological quality of these studies was recently found to be poor to fair[38].

Surgical treatment

Surgical treatment is most commonly reserved for symptomatic patients who are unresponsive to conservative methods or who are at advanced stages of the disease. Although several surgical treatment methods have been introduced since last 50 years, none of them has achieved to be the single most efficient treatment of rhizarthrosis. As the detail of the surgical techniques of all described procedures is not the aim of this review, a concise explanation of these methods will be discussed together with clinical results of relevant studies.

Trapeziectomy with or without tendon interposition or ligament reconstruction: The total excision of the trapezium was described firstly in 1949[39]. It was also called as "hematoma arthroplasty"[40]. Although symptomatology was not believed to correlate with its late problems, trapeziectomy alone does carry the risk of shortening of trapezial height and scaphoid impingement. That is why when trapeziectomy is performed alone; fixation with a K-wire is advised to prevent the height loss to some extent[41]. Based on mostly short-term follow-up studies, trapeziectomy alone yielded good clinical results[41,42]. In a Level Ⅲ study by Ritchie *et al*[43], it was shown that anterior approach yielded better clinical results than posterior approach.

There are two main methods, which can be added to total trapeziectomy; tendon interposition (TI) or ligament reconstruction (LR). The main aim of the LRTI is the reconstruction of AOL by using the half of flexor carpi radialis tendon or abductor pollicis longus tendon. TI arthroplasty by using the half of FCR tendon was firstly described in 1973[7]. The first description of LRTI arthroplasty was first described in 1986[37]. Although the strength and stability may not be restored fully with these procedures, it is possible to obtain a painless joint, as their main advantage[44]. Other than tendons, interposition with fascia lata, chondral tissue, Gelfoam, Gore-Tex, Marlex, Artelon implants, *etc*., were also reported[45-48]. Due to increased complications with non-autologous tissue, autologous tissue interposition should be preferred[45].

In a recent survey study among the active members of the American Academy for Surgery of the Hand, it was concluded that, trapeziectomy + LRTI was the treatment of choice by most surgeons and that the process of choosing treatment strategies was a question of future[49]. Longer follow-up clinical results also support the use of LRTI arthroplasty[50].

According to the current literature, three important results are obvious[42,51-54]. Firstly the addition of LR or TI to trapeziectomy has no clinical superiority over trapeziectomy alone. Secondly, trapeziectomy with LRTI was found to have more complications than trapeziectomy

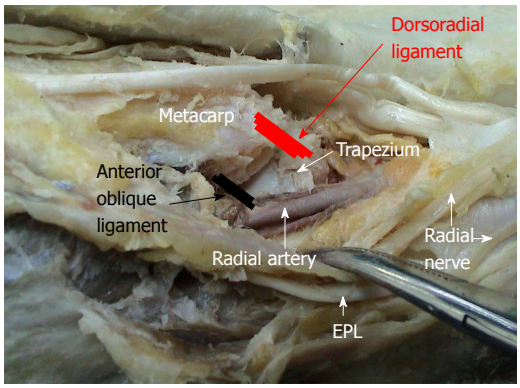

Figure 1 Anatomic dissection of the trapeziometacarpal joint, demonstrating dorsoradial ligament (red) and anterior oblique ligament (black). EPL: Extensor pollicis longus.

Table 2 Eaton-Littler classification of rhizarthrosis

Stage	Definition
I	Normal articular surface
	Possible widening of TMC joint indicating synovitis
II	Joint space narrowing
	Oteophytes < 2 mm
	Normal ST joint
III	Severe TMC destruction with subchondral sclerosis
	Osteophytes > 2 mm and presence of loose bodies
	Normal ST joint
IV	TMC and ST joints are both affected

TMC: Trapeziometacarpal; ST: Scaphotrapezial.

alone. At last, trapeziectomy alone or with LRTI have no evidence-based clinical superiority over other techniques.

TMC joint arthrodesis: Another alternative technique for the treatment of rhizarthrosis is the arthrodesis of this joint. The optimal position of the arthrodesis was defined classically as 45 degrees of abduction and antepulsion, slight pronation of the thumb[53]. Since the first report on its results[54], high-level randomized studies are still lacking. One problem related with arthrodesis is the relatively high rates of delayed union and non-union (8%-21%), especially when K-wire is used[55-58]. Although complication and reoperation rates are higher than that of trapeziectomy or trapeziectomy + LRTI, this was not found to be significant clinically[59]. In a recent prospective, randomized study by Vermuelen *et al*[60] arthrodesis was not recommended in the treatment of women who are forty years or older with stage Ⅱ or Ⅲ rhizarthrosis.

In conclusion, high-level randomized studies are still needed for definite conclusions of the clinical efficacy of TMC joint arthrodesis. So it should not be used as a first-line treatment especially in young patients.

TMC joint replacement: The first prosthetic replacement of TMC joint following trapeziectomy was performed by Swanson at late 1960s[61]. In this technique, trapezial Silicastic implants were used. In the two main review studies in the literature by Martou *et al*[53] and Wajon *et al*[54], it was pointed out that silicastic implants had high complication rates with only short term clinical satisfaction and that silicone arthroplasty had no additional benefits but comparable adverse effects when compared with trapeziectomy and LRTI, respectively. It was also revealed from these studies that these implants have more long-term complications such as subluxation, fractures and silicone synovitis[62].

Total TMC joint arthroplasty has evolved over time since its first development at early 1970s[63]. Currently, this option is advisable for stages Ⅱ and Ⅲ, with its reported mostly better outcomes and lesser implant failures[53,64-67]. The amelioration of the outcomes and decrements of failures may be attributable to the gradual improvement of the quality of the implants. Prospective randomized studies with long-term follow-up are required in order to make concrete conclusion on various arthroplasty options and on their cost-effectiveness.

Thumb metacarpal osteotomy: The closing wedge abduction osteotomy at the level of proximal metacarpus of the thumb was firstly introduced in 1973[68]. Although the studies lack both sufficient sample size and higher level of scientific evidence, it was advised to prefer this technique at earlier stages -at most stage I or II[69].

Other treatment methods of denervation of TMC joint, reconstruction of the volar beak ligament, suture button suspensionplasty and role of arthroscopy: Besides the core treatment options mentioned before, there are other methods described in the literature for Rhizarthrosis, such as: denervation of the TMC joint, reconstruction of the volar beak ligament, suture button suspensionplasty and TMC joint arthroscopy[70-72]. The common point for all of these procedures is that prospective, randomized, comparative studies are required in order to determine for using which method for which group of patients.

CONCLUSION

The TMC joint is a common region in the body, where OA is encountered, especially in the postmenopausal women. Although the exact etiology is not still certain, ligamentous laxity is a common finding in most of the cases. Regarding to the existing literature, the most commonly used treatment methods are conservative measures and trapeziectomy with LRTI. Moreover newer treatment methods have emerged in the recent years. In conclusion, if long-term prospective, randomized, comparative studies are performed, there will be an appropriate answer to choose the optimal treatment methods for each stage of rhizarthrosis.

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