

# Autologous fat transplantation for the treatment of trapeziometacarpal joint osteoarthritis

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## Abstract

Rhizarthrosis is a progressive and disabling pathology affecting the carpometacarpal joint. It's very common in elderly patients and typically affects postmenopausal women. The diagnosis of rhizarthrosis is mainly made by using different physical examination tests and by evaluating the type of pain and it's then confirmed by imaging. Over the last few years increasing attention has been devoted to the assessment of new treatment techniques for rhizarthrosis. In this context intra-articular injection of autologous fat grafting for cartilage regeneration has demonstrated promising results in experimental settings as an alternative to open surgery procedures. The aim of this study was therefore to sum up the evidences available so far on autologous fat grafting as an emerging treatment for patients affected by carpometacarpal rizarthrosis. An electronic literature research was carried out on Pubmed, Google Scholars and Cochrane Library using "fat grafting", "fat graft", "adipose", "fat transfer" and "lipoaspirate" as search terms. Authors believe autologous fat grafting is an interesting technique, that hand surgeon should keep in mind especially in early stages of rhizarthrosis were pain has not been solved with non-surgical treatment.

## Introduction

Trapeziometacarpal joint (TMJ) osteoarthritis (OA), or rhizarthrosis is a progressive and disabling pathology affecting carpometacarpal joint. It is the second most common degenerative disease of the hand, after distal interphalangeal joint

OA.<sup>1</sup> The carpometacarpal (CMC) joint, a biconcave-convex saddle joint, consists of the articulation between the first metacarpal of the thumb and the trapezium carpal bone. The permitted movements of the CMC joint are: flexion, extension, abduction, adduction, opposition, reposition, circumduction.<sup>2</sup>

Joint components degeneration, causes pain and decreased mobility in the early stages and loss of joint function with limitation of motion, weakness of pinch, up to complete dislocation of the base of the 1st metacarpus, in the more advanced stages.<sup>3</sup>

The exact cause of rhizarthrosis is unknown but genetics, previous fractures or dislocations, overuse and generalized joint laxity may predispose towards development of this type of arthritis. CMC OA is common in elderly patients, typically affecting postmenopausal women in their fifth or sixth decade of life, with an incidence ranging between 17% and 33%. In males of similar age the incidence is lower and ranges between 5% and 11%.<sup>4</sup> This may be caused by a more important laxity of the trapeziometacarpal joint ligaments in females.<sup>5</sup>

The diagnosis of rhizarthrosis includes physical examination grind test, MP test and Lever Test. It is also important to consider the location, duration, onset, frequency and intensity of pain. Patients often complain that activities requiring opposition or pinch grip, may worsen pain at the base of the thumb.

The Eaton-Littler classification is the most common radiographic classification system for basilar thumb arthrosis and is used to confirm the diagnosis.<sup>6</sup>

Treatment can be conservative through physiotherapy, orthosis and intra articular corticosteroid injections, resulting in only temporary success.

In the more advanced stages surgery is the only effective treatment. Different surgical techniques can be used: (i) ligament reconstruction or extension osteotomy; (ii) hemitrapeziectomy with interposition; (iii) arthrodesis; (iv) trapeziectomy; (v) hemi-/total arthroplasty and (vi) metacarpophalangeal joint implant arthroplasty. All of these procedures can be performed with/without denervation.<sup>7</sup> No procedures has been shown to be better in terms of pain relief, physical function and global patient evaluation at a long term follow up.<sup>8-9</sup> Over the last few years, intra-articular injection of autologous fat grafting for cartilage regeneration has demonstrated promising results in experimental settings.<sup>10</sup>

This type of surgery is minimally invasive and has low associated morbidity and risk. The aim of this study was therefore to sum up

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the evidences available so far on autologous fat grafting as an emerging treatment for patients affected by CMC rizarthrosis.

## Materials and Methods

An electronic literature research was carried out on Pubmed, Google Scholars and Cochrane Library. To find relevant studies, the following search terms were used: "fat grafting" AND (carpometacarpal OR thumb OR rhizarthrosis OR rhizarthritis); "fat graft" AND (carpometacarpal OR thumb OR rhizarthrosis OR rhizarthritis); "adipose" AND (carpometacarpal OR thumb OR rhizarthrosis OR rhizarthritis); "fat transfer" AND (carpometacarpal OR thumb OR rhizarthrosis OR rhizarthritis); "lipoaspirate" AND (carpometacarpal OR thumb OR rhizarthrosis OR rhizarthritis).

The reference lists of all relevant publications were screened for additional pertinent articles. Searches were updated to January 2020 (Table 1).

## Results

### Outcomes

Although the relative lack of evidence and low quality of the available literature so far, optimistic clinical outcomes have been achieved. In 2015, Bohr *et al.*<sup>11</sup> described the case of a patient affected by degenerative CMC joint arthritis Stage II according to Eaton and Littler not responsive to conservative treatments for more than 4 months. The patient underwent fat grafting using the Coleman procedure into the CMC joint with reduction of joint pain and increased range-of-motion of the thumb (pre-op DASH-Score of 46/100 compared to 22/100 at 12 months post-op).<sup>11</sup> Herold *et al.*<sup>12</sup> confirmed the positive results in their study, which included 50 patients with thumb CMC joint osteoarthritis ranging from Eaton and Littler stage II to IV. After the failure of conservative measures, the intraarticular injection of processed fat (Coleman technique) proved to be beneficial in terms of VAS score ( $p < 0.05$ ), DASH score ( $p < 0.05$ ), grip and pinch strength at 12 months follow-up.<sup>12</sup> However, analysing the subgroups separately they found significant better outcomes in patients at stage II, while only partial or no improvement in stage III or IV. The wider cohort of patients available so far was published by Haas *et al.*<sup>13</sup>, who performed fat grafting in 99 first CMC joints. They found that pain under stress at 2 and 6 weeks as well as 3, 6 and 12 months was significantly lower than at baseline ( $p < 0.001$ ). Moreover Michigan Hand Outcome Questionnaire scores were significantly higher at 6 weeks, 3, 6 and 12 months ( $p < 0.001$ ). No change in pinch and grip strength were detected at 12 months from the procedure.<sup>13</sup> In 2018, Erne *et al.*<sup>14</sup>

compared outcomes of patients undergone fat grafting in the CMC to outcomes of patients undergone Lundborg resection arthroplasty. They included only patients affected by rhizarthrosis at stages III and IV as classified by Eaton and Littler. Interestingly, no significant difference in DASH, VAS, grip strength, pinch strength, and patient's satisfaction was noted between the groups. It was also found that time from surgery to absence of pain was shorter in the fat grafting group.<sup>14</sup> In addition, incision to suture time was also shorter in the fat grafting group.<sup>14</sup> Fat grafting into the CMC joint has also been combined with arthroscopic synovectomy in a small cohort of patients (12 subjects) with early stages of rhizarthrosis (I-II stages according to Eaton-Littler classification).<sup>15</sup> In the former study the harvested fat tissue was only decanted but not centrifuged.<sup>15</sup> Kemper *et al* showed decreased mean values in VAS at 24 months compared to the preoperative assessment.<sup>15</sup> Interestingly, pain and function improved during the early months but satisfaction was not achieved until 7 to 12 months after surgery. Strength was measured in both hands and the difference between treated and nontreated hand is shown in percentage. After 3 to 6 months, strength was reduced in the operated hand, whereas during the following months, strength improved steadily. Improvement in VAS and quick DASH.<sup>15</sup>

### Complications

Most of the complications described in the studies included in our review deal with persisting pain after the fat grafting procedure. However, although the minimal invasiveness of the lipotransfer, we have to be aware of possible side effects.

In Herold *et al.*<sup>12</sup> cohort, two patients

reported a transient paraesthesia of branches of the superficial radial nerve that completely resolved after 2 months. Three patients did not relate sufficient pain relief after the procedure and as such underwent additional surgical treatment.<sup>12</sup>

The following complications were described by Haas *et al.*<sup>13</sup>: one haematoma after liposuction occurred out of 89 patients (99 CMC joints). One patient suffered from severe pain and subsequently received firstly intravenous analgesics, later, after discharge, the pain was treated with oral medication and stopped 3 weeks postoperatively. They reported that in 2% of the cases, further operation was needed before follow-up examination could be conducted.<sup>13</sup>

In Erne *et al.*<sup>14</sup> case-control study, one patient in the fat grafting group received a revision surgery because of persisting pain (conversion to a resection arthroplasty).<sup>14</sup>

Kemper *et al.*<sup>15</sup> reported that one patient suffered from pro-longed pain symptoms in the whole arm limb for nine months. Diagnosis of complex regional pain syndrome (CRPS) was not confirmed. No donor site morbidity.<sup>15</sup>

## Discussion

Although only few authors published their work on fat-grafting as treatment for TMJ OA and that the underlying mechanisms of therapeutic and reparative effects of fat grafting are not fully understood, this technique seems to be an interesting alternative to open surgery procedures.

In all studies we included in this review, authors reported good results regarding pain reduction, daily life activities, hand strength

**Table 1. Summary of relevant publications.**

Author	Type of study	N of patients	Stage	Follow up	Volume	Technique
Stefan Bohr (2015) <sup>9</sup>	Case report	1	Stage II according to Burton, Eaton and Littler; Stage I-II according to Dell.	12 months	1 mL	Coleman
Holger Erne <sup>12</sup> (2018)	Case-control study	21 patients 12 (control – Lundborg resection arthroplasty) 9 (fat grafting)	Stages III and IV as classified by Eaton and Littler	23.6 months (ResectGroup) 18.1 months (FG)	1.3 mL	
Elisabeth M. Haas <sup>11</sup> (2019)	Case series	99 patients	Stages from I to III as classified by Eaton and Littler	12 months	1-2 mL	
Christian Herold <sup>10</sup> (2017)	Case series	50	Stages II-IV as classified by Eaton and Littler	12 months	1 mL	Coleman
Robert Kemper <sup>13</sup> (2018)	Case series	12	I-II Eaton-Littler	12-24 months	2 mL	Arthroscopic debridment and fat grafting (sedimentation)

and satisfaction for patients who underwent autologous fat grafting; and reported better or comparable results when fat grafting was compared to other techniques. Complications were limited. Despite this it is difficult to draw conclusions as in those studies there was no uniformity regarding the fat grafting technique and the fat quantity injected, as the Eaton-Littler stages of OA were very variable from a study to another without out a clear distinction in results (except in Herold *et al.* article<sup>12</sup>), and as follow-up has never been longer than 24 months. Another limitation is that there are only two articles which present comparative studies<sup>14-15</sup>, without considering numerous validated techniques as other kinds of biological arthroplasty, arthroprosthesis or spacers.

## Conclusions

Authors believe autologous fat grafting is an interesting technique, that hand surgeon should keep in mind especially in early stages of rhizarthrosis cases with pain that has not been resolved with non-surgical treatment, in order to maintain the biomechanical balance of the hand without prevailing conversion to classical, more invasive procedures if they become necessary.

Further studies are surely necessary to better evaluate this innovative procedure regarding not only clinical results but radiographic and histological findings too.

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