SCIENTIFIC ARTICLE

Conservative Treatment of Thumb Base Osteoarthritis: A Systematic Review

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Purpose To provide a systematic review of randomized controlled trials regarding the conservative treatment of thumb base osteoarthritis (OA).

Methods A systematic literature search was conducted in the electronic bibliographic databases Medline (Pubmed) and Embase (both starting year to May 2014) using predetermined criteria for studies on nonoperative treatment of thumb base OA.

Results Twenty-three articles fulfilled our inclusion criteria. Systematic evaluation demonstrated the following: (1) Hand therapy can possibly reduce pain. However, owing to the lack of good-quality (randomized controlled) trials with sufficient follow-up time, no proper conclusions can be drawn. (2) Although both steroid and hyaluronate intra-articular injections can provide pain relief, most authors conclude that injection of hyaluronate is more effective. Follow-up is rather short with a maximum of 12 months in 1 study. Furthermore, study comparison is hampered by heterogeneity of study design and outcome parameters. (3) The use of orthoses reduces pain without effect on function, strength, or dexterity. Included studies used various types of orthoses. Follow-up times varied (2 wk−7 y). (4) There is no justification for the use of transdermal steroid delivery. (5) There is insufficient evidence justifying the use of leech therapy. (6) There are no high-level evidence studies specifically evaluating the effect of analgesics and patient education in joint protection in patients with thumb base OA.

Conclusions There are only a few high-quality studies addressing the conservative treatment of trapeziometacarpal OA. Available evidence suggests only some effect of orthoses and intra-articular hyaluronate or steroid injections. *(J Hand Surg Am. 2015;40(1):16−21.*

Type of study/level of evidence Therapeutic II.

Key words Carpometacarpal, conservative, osteoarthritis, systematic review, trapeziometacarpal.

Additional material is available online.

OSTEOARTHRITIS (OA) OF THE BASE of the thumb is a disabling disease, which affects up to 36% of postmenopausal women.[1,2] It has substantial effects on stability of the trapeziometacarpal (TMC) joint, causes pain, and reduces the capacity to perform daily activities.[3]

Thus far, there is no curative treatment for thumb base OA. Over the past decades, several surgical procedures

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for thumb base OA have been advocated. Although no procedure has been proven superior, surgical intervention can be effective.[4] However, operative interventions are more prone to complications, and therefore, conservative options should be considered first. It is unclear which conservative measures, if any, are most effective.

The aim of conservative treatment is to restore thumb functionality, including pain relief, stability, mobility, and strength. Commonly used conservative measures are injections (cortisone, hyaluronate), analgesics, patient education in joint protection, strengthening exercises, assistive devices, and orthosis.[5,6]

Only a few review papers on conservative treatment of thumb base OA have been published. Egan and Brousseau[6] concluded that patients should be given the opportunity to try an orthosis, despite little evidence to support the use of orthoses in thumb base OA for pain relief. Mejjad and Maheu[7] and Mahendira and Towheed[8] reviewed nonsurgical therapies for OA of the hand, but these studies were not limited to treatment of the base of the thumb.

The aim of the present systematic review was to provide an overview of the efficacy of available conservative treatment methods for symptomatic thumb base OA, to provide treatment recommendations, and to give suggestions for future studies.

MATERIALS AND METHODS

We followed the Preferred Reporting Items for Systematic Reviews and Meta-Analyses guidelines. A systematic literature search in the electronic bibliographic databases Medline (Pubmed) and Embase was performed up to May 2014 using the following key words: basal, first, carpometacarpal, CMC, trapeziometacarpal, TMC, thumb, osteoarthritis, rhizarthrosis, arthritic, nonsurgical, symptomatic, conservative, splint, splinting, NSAID, analgesics, drug, pain, medication, hylan, hyaluronic, hyaluronidate, corticosteroid, steroid, orthosis, orthoses, exercise, physiotherapeutic, physiotherapy, hand therapy, occupational therapy, physical therapy, viscosupplementation, injection, tramadol, ibuprofen, acetaminophen, and diacerein.

Combined searches were conducted to identify relevant studies. Furthermore, references were checked for identification of additional relevant articles.

Subsequently, the title and abstract of all records were screened. Studies were included if the following criteria were fulfilled:

- Primary study written in English
- Conservative treatment of thumb base OA
- Randomized controlled trial (RCT), review or meta-analysis of RCTs

RESULTS

Initially, 1,951 articles were retrieved (1,141 in Embase and 810 in Medline). After screening of title and abstract, 35 studies were selected. Eleven studies were excluded after reading the full text or because no full text was available (only abstract for presentation). One additional study was identified by checking references.

Study inclusion

Application of the inclusion criteria resulted in 25 included RCTs. These studies described the effects of hand therapy, intra-articular injections with hyaluronate or steroid, various orthoses, transdermal steroid delivery, and leech therapy.

The great degree of heterogeneity of the included studies in terms of population, intervention, and outcome did not allow for statistical pooling. Therefore, conclusions were drawn based on the main findings only.

Hand therapy

The effect of hand therapy has been studied in 6 RCTs (Appendix A, available on the *Journal*'s Web site at www.jhandsurg.org). Four different types of physical therapy were compared with similar control groups in which patients were treated with ultrasound at nontherapeutic doses.

Restoration of the glide component of joint movement to facilitate a full pain-free range of movement (Kaltenborn manual therapy) significantly decreased pain without increase in motor function in 1 study.[9] The authors concluded that joint mobilization may be effective in reducing pain.[9] A second RCT cautiously concluded that pressure pain threshold increased significantly after passive mobilization, without increase in motor function.[10] Secondary analysis also found limited hypoalgesic effects over the contralateral TMC joint.[11]

Hypoalgesia and increased pinch strength resulted from mobilization of the superficial cutaneous branch of the radial nerve.[12] The same authors also found reduced pain in the contralateral limb, suggesting a hypothetical bilateral hypoalgesic effect of the intervention.[13]

In the last RCT patients received multimodal manual treatment consisting of Kaltenborn joint mobilization, neurodynamic techniques, and an exercise protocol.[14] There was a significant reduction in pain intensity, without differences in strength or pressure pain thresholds. The authors concluded that a multimodal treatment approach is more beneficial in treating pain than a placebo intervention.

Overall, based on the present literature, hand therapy seems to provide some pain reduction in patients with symptomatic TMC OA. However, level of evidence was low based on only a few published RCTs with a short follow-up time and a relatively aged population.[9–14]

Intra-articular injections

Intra-articular corticosteroid injections are thought to decrease pain and inflammation in OA.[15] Alternatively, hyaluronate can be injected with the aim of restoring the reduced viscoelasticity of synovial fluids in osteoarthritic joints.[16,17]

Seven RCTs studied the effect of intra-articular injections (Appendix B, available on the *Journal*'s Web site at www.jhandsurg.org).

Meenagh et al[18] concluded that there was no clinical difference between intra-articular steroid injections compared with placebo injections.

Figen Ayhan and Üstün[19] compared the effect of intra-articular hyaluronate injections with saline injections and found significant improvements in hand function, pinch strength, and visual analog scale score for pain at the end of the follow-up time of 24 weeks in the hyaluronate group.

Roux et al[20] studied 3 groups in which patients received 1, 2, or 3 hyaluronate injections. They found no statistically significant differences between the groups regarding pain and function. After 3 months, patients in all groups improved; however, a placebo effect could not be excluded.

Three RCTs have compared intra-articular steroid with hyaluronate injections.[21–23] Bahadir et al[21] showed that pain decreased significantly for a period of 12 months in the steroid group and for 6 months in the hyaluronate group. The authors suggested that, based on significant improvement in hand function in the steroid group, steroid injections were more effective in the improvement of pain and hand function.

Studies of Fuchs et al[22] and Stahl et al[23] showed that both injections were effective in relieving pain and improving joint function. However, both groups of authors suggested that intra-articular hyaluronate injections seemed to be the better alternative because of a superior long-lasting effect of at least 6 months.

Heyworth et al[24] also suggested hyaluronate injections. They compared steroid, hyaluronate, and placebo injections and found that all patients had decreased pain, which persisted in the hyaluronate group during the entire follow-up period of 26 weeks. The placebo and steroid groups experienced less pain for only 4 weeks.

Overall, we concluded there is some evidence for pain relief by both steroid and hyaluronate intra-articular injections in patients with TMC OA.[19–24] Most authors found injection of hyaluronate more effective with a superior long-lasting effect.[19,20,22–24]

Orthoses

Ten RCTs studied the effect of orthoses in patients with symptomatic TMC OA (Appendix C, available on the *Journal*'s Web site at www.jhandsurg.org).

Gomes Carreira et al[25] and Rannou et al[26] compared the use of orthoses with control groups. Both concluded that the use of an orthosis reduced pain but did not change functional capacity, grip, or pinch strength.

Six RCTs compared the effect of various orthoses. The difference between prefabricated and custom-made orthoses was studied by Sillem et al[27] and Bani et al.[28] The second study included a control group. Pain improved after use of both orthoses; however, the custom-made orthosis gave significantly more pain reduction in both studies. Bani et al[28] also found improvements in pinch strength and Disabilities of the Arm, Shoulder, and Hand (DASH) score in the orthosis groups. Sixty-three percent of patients preferred the prefabricated orthosis.[27] The authors concluded that both types of orthoses had therapeutic effects.

Weiss et al[29] compared the use of short and long prefabricated opponens orthoses. Significant pain reduction was observed in both groups. The short orthosis was preferred by 73% (19 out of 26) of the patients. The authors also studied the difference between long prefabricated orthoses and short custom-made orthoses. Both types significantly reduced pain, but the prefabricated orthosis gave more pain reduction and was preferred by most patients (72%). The authors concluded that these studies supported current evidence that, in early stages of OA, pain relief can be obtained with use of an orthosis.[30]

In an RCT by Buurke et al,[31] in which the effect of 3 different orthoses was studied, no significant differences in pain scores between the orthoses could be demonstrated. A flexible elastic orthosis, made of soft material, scored significantly better on comfort and function than the more rigid types. Eight out of 10 patients preferred use of an orthosis for the entire day. Of these 8 patients, 6 preferred a flexible elastic orthosis and 2 patients preferred a semirigid orthosis.

Wajon and Ada[32] randomized patients to compare the efficacy of a thumb strap orthosis and abduction exercises on one hand with a short opponens orthosis

and pinch exercises on the other. Both groups showed reduced pain and increased strength and hand function after 6 weeks. No differences were found between the 2 groups. The authors suggested that patients could expect an improvement in pain, strength, and hand function within 6 weeks of conservative interventions, regardless of mechanism.

Hermann et al[33] compared the effect of a prefabricated soft orthosis and hand exercises with hand exercises only. After 2 months, they concluded that a soft orthosis had an immediate pain-relieving effect when worn, but no general effect when not worn.

Berggren et al[34] randomly assigned 33 patients with isolated TMC OA waiting for joint replacement arthroplasty to 3 treatment groups: technical accessories (special developed occupational therapy devices, like a pen handle), technical accessories and a semistable orthosis or technical accessories, and a nonstabilizing orthosis. All patients received advice on how to accommodate activities of daily living. After 7 months, 70% of patients no longer required an operation. During the following 7 years, only 10% of the remaining patients still requested surgery. No differences between the groups were found. The authors recommended that patients with TMC OA should first be treated with technical accessories for 6 months and eventually with an orthosis before deciding to perform an operation.

Overall, some evidence suggested that orthoses can reduce pain in patients with TMC joint OA but do not alter function, strength, or dexterity.[25–31,33,34]

Other conservative interventions

Jain et al[35] randomized patients to receive either transdermal steroid or placebo delivery by iontophoresis or phonophoresis (Appendix D, available on the *Journal*'s Web site at www.jhandsurg.org). No differences were found among the 4 groups regarding pain, strength, or well-being. The authors concluded that transdermal steroid delivery was not helpful in providing relief of symptomatic TMC OA.

Michalsen et al[36] studied the effectiveness of leech therapy (Appendix D, available on the *Journal*'s Web site at www.jhandsurg.org). Female patients were randomized to a single treatment with locally applied leeches or a 30-day course with topical diclofenac twice a day. Patients in the leech therapy group experienced significantly less pain, better DASH scores, quality of life, and grip strength during the study period of 2 months. The authors concluded that a single course of leech therapy was effective in relieving pain and improving joint function. However, because the sample size was small and the intervention not blinded, they found the results of their study preliminary.

DISCUSSION

The aim of this systematic review was to provide an overview of the efficacy of reported conservative measures in the treatment of symptomatic TMC OA to provide treatment recommendations and to give suggestions for future studies. To ensure quality of evidence in present literature, only RCTs were included in this review.

We could not find RCTs on the effects of analgesics or patient education for TMC OA specifically.

Based on present evidence, hand therapy can reduce pain according to Villafañe et al.[9–14] However, follow-up time was short (2 wk up to 2 mo), the population relatively aged (70–90 y), and all patients had severe grades of OA. Different forms of hand therapy were studied, making comparison of outcomes impossible.[9–14] The efficacy of hand therapy should be studied with longer follow-up in a more varied population with different grades of OA. In addition, future studies should focus on different hand therapy interventions.

Another treatment option that warrants more study is a specific exercise program. Valdes and von der Heyde[37] provided specific recommendations for the development of a hand exercise program based on a biomechanical analysis. RCTs are needed to further investigate this subject.

There is some evidence that both steroid and hyaluronate intra-articular injections can reduce pain in patients with thumb base OA.[19–24] However, most authors concluded that injection of hyaluronate was more effective.[19,20,22–24] Based on present literature, we concluded that the effect of steroids is achieved faster, but is short lived, compared with hyaluronate, which seemed to have a longer-lasting effect but starts more slowly.[22,23] Limitations of the included studies were the great variety in type of medication, the number of injections, and the amount of medication injected. Therefore, the studies were difficult to compare. Also, follow-up time was short (with a maximum of 12 mo in 1 study).[21]

Studies suggested that hyaluronate injections in knee joints were less effective in the more advanced stages of knee OA.[38,39] However, this conclusion could not be made for TMC joints based on studies included in this review. Included studies used three different radiographic classification systems.[40–42] Also, Heyworth et al[24] did not mention the radiographic stage, and Meenagh et al[18] reported the radiographic stage but

did not describe which classification system was used. Most studies have considerable dispersion in their study groups, not allowing for subgroup analyses. For evidence-based conclusions, high-evidence studies are needed with more patients, evaluating the effect of both intra-articular injections compared with placebo and with a follow-up of at least 1 year. Furthermore, to conclude which specific type, dose, and frequency of hyaluronate or steroid is most effective, more studies are needed.

Present evidence suggests that orthoses can give some pain reduction in patients with TMC OA up to 1 year but do not influence hand function or strength. Seven RCTs did not include patients with concomitant scaphotrapeziotrapeziod OA.[25,28–30,32,33,34] The other 3 studies did not mention the stage of OA.[26,27,31] Therefore, no conclusions can be drawn about the effect of orthoses in patients with OA of both the TMC and the scaphotrapeziotrapezoid joints.

In addition, varied degrees of OA, different length, make, and material of orthoses worn under different circumstances and for varied time periods made comparison impossible. Follow-up times ranged from 2 weeks to 7 years.[34] Nevertheless, findings in the included studies indicated that orthoses decreased pain in patients with TMC OA. There was no strong evidence that a custom-made orthosis was superior to a prefabricated orthosis, that length of one orthosis was superior to another, or that a patient should constantly wear the orthosis.[25–32]

The results of the study of Berggren et al[34] seem promising. The majority of their patients did not require an operation after conservative management. Therefore, we recommend repeating this study with a larger number of patients.

Ideally, future studies should have a follow-up period of at least 1 year; should focus on prefabricated orthoses immobilizing only the TMC joint; and should assess the effect of using the orthosis at night, during activities of daily living, or both. The effect of additionally immobilizing the first metacarpophalangeal joint is also of interest.

Transdermal steroid delivery is not effective.[35] Because there are other conservative treatment options with better outcomes, there seems to be no need for more research on this subject.

Leech therapy can reduce pain.[36] However, sample size in this single study was small, and the intervention was not blinded. The potential mechanism of action should be further clarified before consideration of further clinical investigations.

The varied results in the described studies could be explained by the fact that TMC OA is a chronic disease with exacerbations and remissions. Any intervention when patients are most symptomatic will often result in perceived improvement. However, the same improvement could occur with mere observation and education. This certainly reinforces the idea that conservative treatment or just observation is warranted for a considerable period of time before deciding to perform an operation, as done by Berggren et al.[34] Although nonsurgical measures like hyaluronate injections are not necessarily inexpensive, the question should be raised whether these conservative measures have any value over mere observation or counselling of the patient. Poole and Pellegrini[5] described patient education in joint protection as the most valuable therapeutic intervention. It seems important for patients to understand why symptoms exist and how functional use patterns contribute to problems. Although of great interest, no RCTs on this subject have been published.

There is a need for higher-quality RCTs investigating the different conservative treatment modalities for TMC OA. Because TMC OA is one of the most commonly seen hand surgery diagnoses, the implementation of much larger studies should be a realistic and achievable research goal. Ideally, future studies should include more patients, have longer follow-up times, and subgroup analyses regarding grade of OA and should include pain scores, strength measurements, and patient-reported outcome measures. Focus on oral analgesics, patient education, and comparison between modalities are of main interest for future studies in the context of present available data.

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APPENDIX A. Physical Therapy Interventions

Authors	Grade of OA	Sample Size	Treatment	Dosage	Follow-Up	Authors' Conclusions
Villafañe et al, 2013[14]	Eaton-Littler III–IV	30	Multimodal manual treatment approach: Kaltenborn joint mobilization, neurodynamic techniques, exercise protocol	12 sessions in 4 wk	3 mo	Significant improvement in pain, no difference in pressure pain threshold, grip strength, or pinch strength. Patients 65–90 y (mean, 82 y)
		30	Control (ultrasound at nontherapeutic doses)			
Villafañe et al, 2012,[10] and Villafañe et al, 2013[11]	Eaton-Littler III–IV	14	Maitland's passive accessory mobilization	4 sessions in 2 wk	2 wk	Passive accessory mobilization increases pressure pain threshold, but does not increase pinch or grip strength. Limited hypoalgesic effects over the contralateral TMC joint Patients 70–90 y
		14	Control (ultrasound at nontherapeutic doses)			
Villafañe et al, 2012,[12] and Villafañe et al, 2013[13]	Eaton-Littler III–IV	30	Radial nerve mobilization	6 sessions in 4 wk	2 mo	Radial nerve mobilization decreases pain sensitivity and increases tip pinch strength It also induced hypoalgesic effects on the contralateral hand, suggesting bilateral hypoalgesic effects of the intervention Patients 70–90 y
		30	Control (ultrasound at nontherapeutic doses)			
Villafañe et al, 2011[9]	Eaton-Littler III–IV	14	Kaltenborn mobilization	6 sessions in 2 wk	2 wk	Kaltenborn manual therapy decreased pain; however, it did not confer an increase in motor function Patients 70–90 y
		15	Control (ultrasound at nontherapeutic doses)			

APPENDIX B. Intra-Articular Hyaluronic Acid and Corticosteroid Injections

Authors	Grade of OA	Sample Size*	Treatment	Dosage	Follow-Up	Authors' Conclusions
Figen Ayhan and Üstün, 2009[19]	Eaton-Glickel I–IV	33 with bilateral TMC OA	Hyaluronic acid (Hylan G-F 20) Control group (saline)	1 injection of 1 mL 1 injection of 1 mL	24 wk	Significant improvements in function, pinch strength, and VAS for pain in the hyaluronic acid group Only VAS for pain scores temporarily decreased in the control group at the sixth week
Bahadir et al, 2009[21]	Eaton-Littler II–III	20 20	Sodium hyaluronate (Ostenil) Triamcinolone acetonide (Kenacort-A)	3 injections (weekly) of 5 mg/0.5 mL 1 injection of 20 mg/0.5 mL	12 mo	Both injections are effective in reducing pain and improving grip strength Corticosteroid injections provide more effective and longer-lasting pain relief
Heyworth et al, 2008[24]	NA	20 22 18	Hyaluronic acid (Hylan G-F 20) Corticosteroid (betamethasone acetate) Control group	2 injections (weekly) of 1 mL First wk, 1 mL saline; second wk, 1 mL betamethasone acetate 2 injections saline 1 mL	26 wk Also 2 weeks neoprene thumb splint for all patients	No significant differences among the 3 groups Based on the durable relief of pain, improved grip strength, and the long-term improvement in symptoms compared with preinjection values, Hylan injections should be considered
Roux et al, 2007[20]	Kellgren II–IV	14 14 14	Hyaluronic acid (Sinovial) Hyaluronic acid (Sinovial) Hyaluronic acid (Sinovial)	1 injection of 1 mL 2 injections of 1 mL (weekly) 3 injections of 1 mL (weekly)	3 mo	No significant differences between the groups regarding pain and function In all groups, improvement of pain and function, significant in the groups with 2 and 3 injections
Fuchs et al, 2006[22]	Kellgren mean II	28 28	Hyaluronic acid (Ostenil mini) Triamcinolone (Volon A10)	3 injection (weekly) of 1 mL 1 injection of 1 mL	26 wk	88% of patients in the hyaluronic acid group and 79% of patients in the corticosteroid group had improvements in pain

(Continued)

APPENDIX B. Intra-Articular Hyaluronic Acid and Corticosteroid Injections (Continued)

Authors	Grade of OA	Sample Size*	Treatment	Dosage	Follow-Up	Authors' Conclusions
						Patients in the corticosteroid group had faster onset of pain relief, which decreased to the end of the study
Stahl et al, 2005[23]	Eaton-Littler II	25 27	Methylprednisolone acetate (Depomedrol) Sodium hyaluronate (Orthovisc)	1 mL/40 mg 1 mL/15 mg	6 mo	Significant improvement of pain in both groups after 1 mo; no difference between the groups Significant improvement in grip strength in the steroid group during the whole period In the hyaluronate group, improvement in grip strength after 6 mo and in pinch strength after 3 mo
Meenagh et al, 2004[18]	Mean III (used classification system not specified)	20 (18) 20 (17)	Triamcinolone hexacetonide Saline (control group)	0.25 mL/5 mg 0.25 mL 0.9%	24 wk All patients 48 h thumb spica splint	No significant differences between the groups regarding VAS for pain, joint stiffness, joint tenderness, or global assessments No improvement in VAS for pain compared with preinjection measurement

VAS, visual analog scale.
*Numbers in parentheses indicate the number of patients who completed the follow-up measurements.

APPENDIX C. Orthoses

Authors	Grade of OA	Sample Size	Treatment	Dosage	Follow-Up	Authors' Conclusions
Hermann et al, 2014[33]	Kellgren and Lawrence I–IV	28 27	Prefabricated soft orthosis and hand exercises Only hand exercises	Orthosis was worn as much as patients wanted, especially when symptomatic and when performing heavy manual tasks	2 mo	Soft orthosis has an immediate pain-relieving effect when worn, but no general effects when not worn
Bani et al, 2013[28]	I–II used system not specified	12 12 11	Prefabricated neoprene orthosis Custom-made orthosis Control group	Both orthoses 4 wk (during routine activities of daily living), with 2 wk wash-out period	10 wk Cross-over design	With both orthoses, reduction of pain and better Disabilities of the Arm, Shoulder, and Hand scores, function, and pinch Custom-made orthosis: better pain reduction compared with prefabricated orthosis
Sillem et al, 2011[27]	NA	54	Custom-made hybrid orthosis Prefabricated Comfort Cool orthosis	Both orthoses 4 wk (when symptomatic, during heavier manual tasks, and eventually at night) with 1 wk wash-out period	9 wk Cross-over design	No significant difference between the orthoses regarding hand function, grip strength, and pinch strength 63% of patients preferred the prefabricated orthosis, although this one gave less pain reduction
Gomes Carreira et al, 2010[25]	Classification of American College of Rheumatology II–III	20 20	Custom-made functional thermoplastic orthosis Control group: after 90 d, this group also wore an orthosis	180 d (during activities of daily living)	180 d	After 45 days: use of orthosis during activities of daily living reduces pain, but has no effect on function, grip or pinch strength, or dexterity
Rannou et al, 2009[26]	NA	57 55	Custom-made neoprene orthosis Usual care	Nighttime use	1 y	No difference in pain after one mo between both groups More reduction in pain and disability after 12 mo with use of orthosis
Wajon and Ada, 2005[32]	Eaton-Glickel I–III	19 21	Thumb strap orthosis and abduction exercise Short opponens thumb orthosis and pinch exercise	Full-time use for 2 wk, then also start exercises (4 wk)	6 wk	Both groups showed improvement No significant difference between the groups regarding pain, strength, and hand function

(Continued)

APPENDIX C. Orthoses (Continued)

Authors	Grade of OA	Sample Size	Treatment	Dosage	Follow-Up	Authors' Conclusions
Weiss et al, 2004[30]	Eaton-Littler I–II	25	Prefabricated neoprene orthosis (immobilizing TMC and metacarpophalangeal joints) Custom-made thermoplastic orthosis (immobilizing TMC joint)	Both orthoses for 1 wk; use when symptomatic	2 wk Cross-over design	Significant reduction of pain after use of both orthoses; the prefabricated orthosis gave significantly more pain reduction No difference in strength 72% of patients preferred the prefabricated orthosis
Berggren et al, 2001[34]	Maximum level III	11 11 11	Technical accessories Technical accessories and a semistable textile orthosis Technical accessories and a nonstabilizing leather orthosis	7 mo	7 y	At 7 mo, only 10 of 33 patients still wanted an operation During the following 7 y, only 2 more patients wanted an operative intervention
Weiss et al, 2000[29]	Eaton-Littler I–IV	26	Prefabricated short opponens orthosis (immobilizing TMC joint) Prefabricated long opponens orthosis (immobilizing metacarpophalangeal and TMC joints and wrist)	Both orthoses for 1 wk; use when symptomatic	2 wk Cross-over design	Both orthoses gave reduction of pain, but no increase in strength 73% of the patients preferred the short orthosis
Buurke et al, 1999[31]	NA	10	Thermoplastic semirigid orthosis (Sporlastic 07051) Firm elastic orthosis (Gibortho 6302) Supple elastic orthosis (Uriel 25)	All orthoses for 4 wk	12 wk	8 of 10 patients preferred the permanent use of an orthosis 6 patients choose the supple elastic and 2 the semirigid orthosis

APPENDIX D. Other Treatment Modalities

Authors	Grade of OA	Sample Size*	Treatment	Dosage	Follow-Up	Authors' Conclusions
Michalsen et al, 2008[36]	Eaton Glickel; however, grade NA	16 15	Leech therapy Nonsteroidal anti-inflammatory gel	Single session with 2–3 leeches 30 d twice a day	2 mo	Significant decrease in pain score, improvement in Disabilities of the Arm, Shoulder, and Hand score, quality of life, and grip strength for at least 2 mo in leech therapy group.
Jain et al, 2010[35]	Eaton-Glickel mostly III	17 (11) 18 (10) 15 (7) 17 (6)	Iontophoresis with placebo delivery Iontophoresis with steroid delivery Phonophoresis with steroid delivery Phonophoresis with placebo delivery	6 sessions in 3 wk	6 mo	Only 40% of patients could be evaluated after 6 mo No relief of symptoms, improvement in hand strength, or satisfaction Transdermal steroid application might not be effective.

*Numbers in parentheses indicate the number of patients who completed the follow-up measurements.