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REVIEW ARTICLE

The Effectiveness of Orthoses as a Conservative Treatment in Treating Carpometacarpal Joint Osteoarthritis: A Systematic Review

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ABSTRACT

Objectives: The purpose of this research is to review the evidence regarding the impact and effectiveness of orthoses on pain, pinch, and grip strength for individuals diagnosed with carpometacarpal joint osteoarthritis.

Methods: A systematic review was conducted following Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines and then literature was gathered across nine databases. To be included in this review, studies had to be classified as a level 1 or 2 research study and the studies must include participants who were over 40 years of age, have a diagnosis of carpometacarpal joint osteoarthritis, and must utilize an orthosis for their symptoms. Articles were excluded from the review if participants utilized steroids or have past surgeries on the carpometacarpal joint. Researchers analyzed the quality of studies and extracted evidence pertaining to the effectiveness of various orthosis designs based upon outcomes of pain, pinch, and grip strength for individuals diagnosed with carpometacarpal joint osteoarthritis.

Results and Implications for Future Practice: The evidence strongly supports the use of a custom-made butterfly short opponens orthosis to decrease pain and increase pinch and grip strength. Prefabricated Neoprene and Custom-made Thumb Splint designs are effective for decreasing pain and increasing pinch, only. A Thumb Spica Splint and Colditz Splint are effective for increasing pinch strength. There is moderate evidence to suggest the use of the Ballena Orthosis and Colditz Orthosis to decrease pain. The evidence suggests that the Neoprene Comfort Cool Splint and Custom-made Hybrid splint should not be used to address issues of pain, decreased grip strength, and decreased pinch strength.

Key words: activities of daily living (ADLs), carpometacarpal joint (CMC), instrumental activities of daily living (IADLs), interphalangeal joint (IP), metacarpophalangeal joint (MCP), occupational therapy (OT), orthoses, osteoarthritis (OA), splints, trapeziometacarpal joint (TMC).

Research Question: What is the impact of using orthoses on pain and pinch/grip strength for individuals diagnosed with CMC joint OA?

Introduction

The carpometacarpal joint (CMC), also referred to as the trapeziometacarpal joint (TMC), is a saddle joint that articulates at the first metacarpal of the thumb and the trapezium, enabling adduction-abduction, flexion-extension, and circumduction [1] (Figure 1). These motions contribute to the thumb being a fundamental component of daily life functioning. It is reported that 45%-60% of hand functions require thumb involvement, therefore the thumb is used frequently and repetitively [2]. The frequent use of the thumb during daily activities imposes a great stress load on the CMC joint, which exacerbates cartilage loss, bony impingement, and pain, which are three defining factors of OA [1] Osteoarthritis is a degenerative joint condition in which there is defective integrity of the articular cartilage structure surrounding a joint and the bone structure it connects, such as in the carpometacarpal joint [3].

Figure 1: Carpometacarpal (CMC) Joint

STRUCTURAL CHANGES

There is strong evidence from previous literature to suggest that thumb CMC joint OA results from insufficiency and laxity of the anterior oblique ligament in the CMC joint and deterioration of the cartilage layers between the trapezium and first metacarpal bones of the thumb [4]. The insufficiency and laxity of the anterior oblique ligament and deterioration of the cartilage layers results in decreased joint space. Decreased joint space often results in irregular movement patterns, and in severe instances, visible zig-zag deformities which is presented in Figure 2 [4]. Once these deformities and symptoms are problematic enough to seek medical care, the diagnosis of CMC OA is determined through a grind test and/or radiological images of the thumb joint [5] Kroon et al., reference the use of ultrasound for assessing synovial fluid in the joint [6]. Radiological images lead to a four stage classification of carpometacarpal osteoarthritis.

Figure 2: Zig Zag Deformity of the Thumb

Stage 1 of carpometacarpal osteoarthritis classification is characterized by a symptomatic increase in the trapeziometacarpal joint space with signs of synovitis and subluxation. In stage 2, there is a narrowed trapeziometacarpal joint space with possible osteophytes smaller than 5 mm and/or sclerosis along the joint space. Stage 3 radiological images show an absent or narrow trapeziometacarpal joint space with osteophytes larger than 5 mm in size, but do not have any changes to the scaphotrapezial joint visible. Stage 4, the most severe stage, has the same defining factors as stage 3, except the scaphotrapezial joint is also narrowed [7].

SYMPTOMS

This chronic degenerative disease presents differently in each individual, but the most common reports across any of the four stages of diagnosis are pain, decreased hand function in junction with below normal grip and pinch strength, and reports of decreased quality of life [8]. These symptoms affect over 20% of individuals over the age of 40 years and are most prevalent in postmenopausal women [9]. The prevalence reported in postmenopausal women has been cited as high as 57% of females [10]. The etiology for the development of osteoarthritis is largely unknown, however the most commonly reported factors that accompany a diagnosis of CMC OA include aging, repetitive and abnormal loading of the joint, heavy labor, joint instability, obesity, being female, having hereditary conditions, and past experiences of trauma to the thumb [3]. Li and White suggest that the lifetime prevalence of CMC OA is about 10% [11].

The presence of osteophytes and limited joint space contributes to limitations in range of motion (ROM) due to ligamentous structure, pain, and decreased grip and pinch strength. According to Valdes [12] and Kieken et al., [13], individuals with CMC joint OA demonstrate an average of a 60% reduction in grip strength and limited joint mobility compared to norms for their respective age group. In a Framington Study, individuals with symptomatic CMC joint OA had approximately 10% less grip strength than those without symptomatic CMC joint OA [14].

RELEVANCE TO PRACTICE

As the baby boomer population continues to age, and the lifespan continues to increase, the prevalence of CMC OA will continue to rise. CMC OA is a common diagnosis seen by occupational therapists and hand therapists due to the limited functional integrity of the thumb that decreases one's ability to participate in activities of daily living (ADLs) and instrumental activities of daily living (IADLs). These types of activities include self-care tasks, tasks requiring the opening of jars and bottles, participation in leisure activities, work tasks, and many other activities one participates in on a daily basis. The inability to perform daily and work-related tasks due to pain and limitations is frequently associated with depression and sleep disturbances, which contribute to an impaired quality of life [15]. All of the mentioned activities fall under the domains of occupational therapy and highlight the need for intervention for individuals experiencing pain and decreased pinch and grip strength as a result of a diagnosis of CMC joint OA of the thumb. Occupational therapists and hand therapists aim to provide treatment that relieves

pain, restores joint stability, and improves hand function, through conservative measures [1]. Therapists often attempt conservative measures to prevent surgery. Conservative measures often include joint protection principles, pain control, exercises, and splinting [16]. Conservative measures are often trialed prior to joint arthroplasty secondary to the complications that could occur following surgical intervention include infection of the surgical site, joint swelling, neurological changes, as well as the risk of returning to the operating room [17]. Even with surgery, many patients still suffer from chronic pain and instability of the CMC joint and could benefit from therapy [18]. Such therapy may involve the fitting and wear of orthoses. According to Hermann et al. [19], hand orthoses aim to reduce pain and prevent further deformities by placing the joints in functional positions that protect inflamed web spaces. The orthoses are not designed to alter the structure of the CMC joint, but to increase function, reduce pain, and slow the degeneration of the joint [20]. The European League Against Rheumatism (EULAR) strongly recommends that individuals with CMC OA should be provided an orthosis to prevent or correct subluxation and deformity of the thumb [14]

Occupational Therapy practitioners can provide clients with many variations of orthoses, in many variations of material, from custom-made to prefabricated designs. The most frequently used designs are prefabricated neoprene thumb orthoses, custom-fabricated hand-based Thumb Spica orthoses, Colditz design custom orthoses, and custom finger thermoplastic orthoses [4,21]. The design of some orthoses such as the Colditz splint are aimed at stabilizing the thumb to prevent further joint deformity and deterioration of the ligamentous structure by reducing motion at the thumb [4]. This orthosis prevents flexion of the thumb during pinch and allows the thumb and wrist joint motion to be unrestricted [22]. The design of shorter thumb spica splints are aimed at enhancing function and strength during activity [2,10] Orthoses designed for wear during activity allow full wrist and metacarpal movement for grip and pinch strength with support [10]. Wearing schedules are dependent upon the provider and the orthosis design.

A therapist must collaborate with their client to determine the best type of orthosis for the client's needs, however there is a shortage of evidence-based regulations to suggest the most appropriate orthosis. There are limited studies available comparing different types of orthoses for the CMC joint, and there are gaps in the available literature in comparing the effectiveness of different types of orthoses for CMC joint OA in terms of pain, pinch, and grip strength. It is important to measure and analyze limitations in grip strength and pinch, especially with respect to pain, because they reflect upon the functional abilities of the thumb and hand. In preparation for this study, six systematic reviews were identified related to CMC OA, but none compared orthoses effectiveness for the specific outcomes of pain, grip, and pinch strength. This led three researchers to review the evidence available regarding which types of orthoses are most beneficial for individuals with CMC OA in terms of pain, pinch, and grip strength to improve quality of life related to this expanding condition.

Methods

ELIGIBILITY CRITERIA AND SEARCH STRATEGY

Researchers used Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) methodology to conduct this review across literature related to the topic area. Three researchers conducted a search for peer-reviewed articles related to the conservative approach of an orthosis to support individuals with carpometacarpal joint osteoarthritis. Researchers conducted the search in May 2020 across nine databases (CINHAL Complete, Medline, OT Seeker, Proquest Health Management, PubMed, Medline, Health Source, ScienceDirect, and PEDro). The search terms entered into the databases were "carpometacarpal joints" AND "osteoarthritis" AND ("splint* OR orthosis"). Researchers further specified that the literature searched was peer-reviewed, published between the years of 2010-2020, and written in the English language.

STUDY IDENTIFICATION AND SELECTION

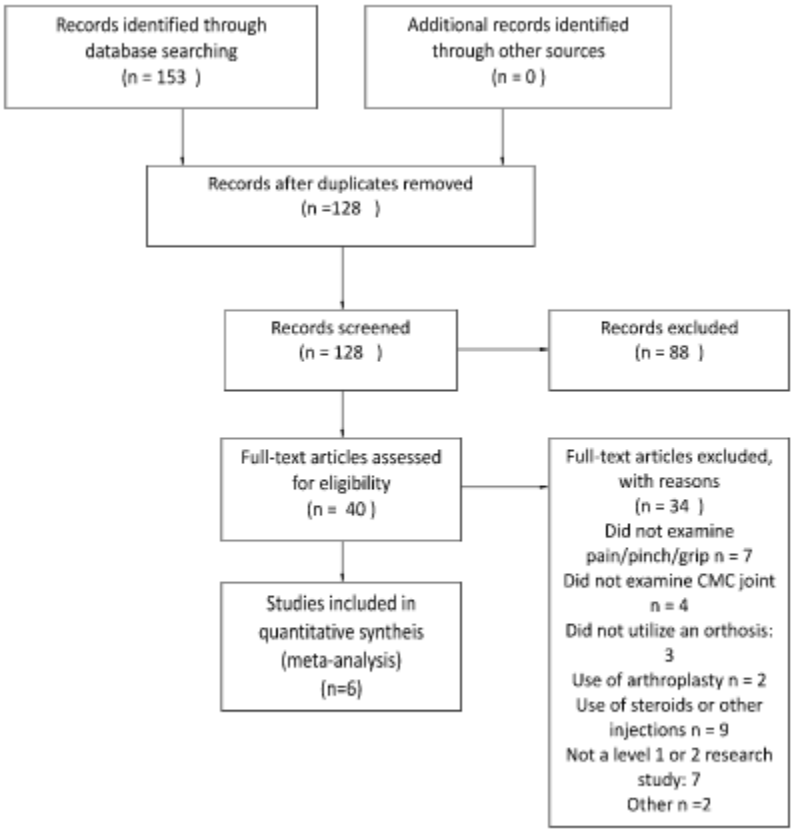
Upon conclusion of the initial search, researchers identified 153 original articles. Two researchers manually scanned for duplicates, narrowing the search down to 128 eligible articles. Next, two reviewers manually screened titles and abstracts to determine if they met the inclusion criteria. If the two reviewers could not reach consensus, a third researcher made the decision. After this step, 40 full-text articles were left to be reviewed. Initially, researchers sought to review the effectiveness of orthoses for individuals with CMC OA on pinch and grip strength. After analyzing 40 full-text articles, the three researchers found that pain was a recurring outcome measure. They then decided to further develop their research question due to the prevalence of pain as an outcome measure to examine the effectiveness of orthoses for individuals with CMC OA on *pain*, pinch, and grip strength. All researchers were involved in the full text screening of the remaining 40 studies. A standardized screening protocol was developed based on inclusion and exclusion criteria. At least

two researchers read every article and inclusion in the final review was based on consensus. Of the 40 articles reviewed in full, researchers excluded 34 articles and were left with a total of six studies to be included in the final review. Before finalizing, bibliographies were also scanned for possible additional resources, but none were found.

INCLUSION AND EXCLUSION CRITERIA

Only level 1 and level 2 research studies were considered for review. To be included in this study, research studies had to involve participants who were at least 40 years of age with a definitive diagnosis of CMC joint osteoarthritis. The participants of the studies must utilize an orthosis as an intervention for CMC joint OA and the studies must examine pain, pinch, and/or grip strength as an outcome measure. Articles were excluded from the review based upon confounding variables to the effectiveness of the orthosis. These excluded criteria include the use of steroids, prior surgery on the affected area (arthroplasty), or any injection to treat OA.

Figure 4: PRISMA Chart



Results

ORTHOSES

A total of 315 participants who utilized orthoses for CMC joint OA were included across the six reviewed studies. Studies varied with wear schedules, intensity, and duration, ranging from 30 days to 10 weeks. Throughout the review, nine different orthoses designs were analyzed in terms of different outcome measures. The orthoses included the Soft Thumb Support 202 Orthosis, Prefabricated Orthosis, Custom-made Thumb Splint, Custom-made Butterfly Splint, Colditz Push Splint, Comfort Cool Splint, Thumb Spica Splint, Custom-made Hybrid Orthosis, and the Bellena Orthosis. The orthoses were designed in a variety of fashions to support the thumb and were composed of materials such as fabrifoam, neoprene, and different variations of thermoplastic. Wearing

schedules varied throughout the studies with some indicating all day wear, only when symptomatic, only when completing manual tasks, only at nighttime, or a different combination of the former. The evidence in this study does not conclusively or evidently suggest a proper wearing schedule. Studies in this review were organized by orthosis and by outcome measure. The outcome measures were not mutually exclusive; therefore, studies and orthoses that addressed several outcome measures were included in multiple categories. The primary outcome measures analyzed throughout this review were measurements of pain, pinch, and grip strength following the use of an orthosis for OA of the CMC joint. The custom made butterfly short opponens was most effective in improving pain, grip, and pinch while also meeting inclusion and exclusion criteria.

Type of Orthosis	Author, date	Image of Orthosis	Material	Description	Wear Schedule	Outcome measure
Custom-made Butterfly (short opponens)	Madalli et al., 2016		Perforated thermoplastic	Splint is 1.6 mm thick, blocks the first MCP joint to provide stabilization at the CMC joint, free ROM at the wrist and IP joints	16 hrs daily	Pain Grip Pinch

(Figure 6) Legend: Photo 1- Palmar Surface View
Photo 2- Lateral View
Photo 3- Dorsal Surface View

PAIN

The effectiveness of eight different orthoses, from five of the six level 1 or level 2 studies included in this review, were analyzed in terms of pain Pain was analyzed using assessments such as the Visual Analog Scale, AUSCAN Pain Scale, and Pain Numeric Rating Scale which are displayed in Figure 7. These assessments are self-reported measures and are subject to social-desirability biases, but they have been used in a variety of settings to establish concurrent validity. The Visual Analog Scale and Pain Numeric Rating scales are self-report tools on a 0-10 likert scale with 0 indicating no pain and 10 indicating severe pain. The AUSCAN Pain Scale is a five-question questionnaire that is a part of a larger AUSCAN assessment tool for individuals with hand osteoarthritis. Each question is assessed on a 0-4 likert scale with 0 being no symptoms and 4 being the worst [19]. Baseline pain measures for the Visual Analog Scale and Pain Numeric Rating Scale (0-10) ranged from 4 to 8.1, indicating moderate to severe pain when beginning the wear of an orthosis. Upon completion, pain measures ranged from 2.1 to 5.5, indicating an overall decrease in pain after wearing an orthosis. The Prefabricated Neoprene Splint, Custom-made Thumb Splint, Custom-made Hybrid Splint, Soft Thumb Support Orthosis, and Custom-made Butterfly Short Opponens Orthosis all significantly ($p<.05$) decreased pain. The Neoprene Comfort Cool Splint had no significant impact on pain. P values were not reported for the Ballena Orthosis or Colditz Splint, but participants that utilized the splint had an average decrease in pain of 2.6 and 2.5 respectively. Overall, the prefabricated neoprene splint, custom-made thumb splint, custom-made hybrid splint, and the custom-made butterfly short opponens orthoses ($P<.001$) demonstrated the best evidence to decrease pain.

Orthosis	Assessment	Author, date	Baseline	Time	Outcome	P Value
Prefabricated Neoprene Splint	Visual Analog Scale	Bani et al., 2013	6.6	10 weeks	2.9	p<.001
Custom-made thumb splint	Visual Analog Scale	Bani et al., 2013	6.7	10 weeks	2.1	p<.001
Custom-made Hybrid Splint	AUSCAN Pain	Sillem et al., 2011	27.67	4 weeks	21.98	p<.001
Custom-Made Butterfly (Short Opponens)	Pain NRS	Madalli et al., 2016	5.99	30 days	2.61	p<.001

Figure 7: Pain Effectiveness Table

GRIP

The effectiveness of six different orthoses from four studies included in this review were analyzed in terms of grip strength. Analyses of grip strength were conducted using Jamar dynamometers and Grippit electronic instruments. These tools allow administrators to objectively measure grip strength and compare to population norms, verifying that the instruments are reliable and valid. All units of measurement have been converted into kilograms (kg) and are present in the grip chart below (Figure 8). Of the six measured orthoses, only the Custom-made Butterfly Short Opponens Splint significantly ($p<.05$) improved grip strength. There was not a *significance measure or p-value* calculated for improvement regarding the Soft-Thumb Support 202 Orthosis, but in 2 months there was an average increase in grip strength of 1.58 kg for the right hand and 1.47 kg for the left.

Orthosis	Assessment	Author, date	Baseline	Time	Outcome	P-value
Prefabricated Neoprene Splint	Jamar Dynamometer	Bani et al., 2013	7.4 kg	10 weeks	9.1 kg	p=.130
Custom-Made Thumb Orthosis	Jamar Dynamometer	Bani et al., 2013	7.3 kg	10 weeks	8.7 kg	p=.151
Soft-Thumb Support 202 Orthosis (Right-hand)	Grippit electronic instrument	Hermann et al., 2014	12.31 kg	2 months	13.89 kg	NA
Soft-Thumb Support 202 Orthosis (Left-hand)	Grippit electronic instrument	Hermann et al., 2014	12.7 kg	2 months	14.17 kg	NA
Custom-made Butterfly Short Opponens	Jamar Dynamometer	Madalli et al., 2016	37.46 kg	30 days	49.64 kg	p<.00
Neoprene Comfort Cool Splint	Jamar Dynamometer	Sillem et al., 2016	18.17 kg	4 weeks	18.54 kg	p=.51
Custom-made Hybrid Splint	Jamar Dynamometer	Sillem et al., 2016	18.43 kg	4 weeks	19.25 kg	p=.12

Figure 8: Grip Effectiveness Table

PINCH

Pinch strength was measured through the use of valid and reliable instruments such as the Jamar Pinchmeter, B&L Mechanical Pinch Gauge, Preston pinch gauge, and Grippit electronic instruments. These tools allow administrators to objectively measure pinch ability and compare to population norms, verifying that the instruments are reliable and valid. All units of measurement for pinch strength have been converted into kilograms (kg) and are presented in the pain chart below (Figure 9). The Prefabricated Neoprene Splint, Custom-

made Thumb Splint, Colditz Splint, Comfort Cool Splint, Thumb Spica Splint, and Custom-made Butterfly Splint all significantly ($p<.05$) increased pinch strength. The Soft Thumb Support 202 Orthosis, Neoprene Comfort Cool Splint, and Custom-made Hybrid Splint did not increase pinch strength with a significant value. On average, participants that utilized the Soft Thumb Support 202 Orthosis actually decreased pinch strength upon conclusion of the study, and although it was not a significant value ($p>.05$), there were adverse effects on pinch associated with using this orthosis. It is important to note that the Neoprene Comfort Cool Splint was analyzed in two studies, where it was found to significantly ($p>.05$) increase pinch strength after 19 months in one study (Grenier, Mendonca, & Dalley, 2016), and did not significantly increase pinch strength in another study after only 4 weeks (Sillem et al., 2011).

Orthosis	Assessment	Author, date	Type of pinch	Baseline	Time	Outcome	P-value
Prefabricated Neoprene Splint	Jamar Pinchmeter	Bani et al., 2013	Lateral	5.4 kg	10 weeks	6.8 kg	p<.00
Custom-made Thumb Splint	Jamar Pinchmeter	Bani et al., 2013	Lateral	4.6 kg	10 weeks	6.4 kg	p<.00
Colditz Splint	B&L Mechanical Pinch Gauge	Greneir, Mendonca, & Dalley, 2016	Lateral	N/A	19 months	Increased 1.2 kg	p<.00
Neoprene Comfort Cool	B&L Mechanical Pinch Gauge	Greneir, Mendonca, & Dalley, 2016	Lateral	N/A	19 months	Increased 1.12 kg	p<.00
Thumb Spica Splint	B&L Mechanical Pinch Gauge	Greneir, Mendonca, & Dalley, 2016	Lateral	N/A	19 months	Increased 1.65 kg	p<.00
Custom-made Butterfly Short Opponens	Jamar Pinchmeter	Madalli et al., 2016	NA	4.52 kg	30 days	5.17 kg	p<.00

Figure 9: Pinch Effectiveness Table

RISK OF BIAS AND LIMITATIONS

The Risk of Bias in the six individual studies was analyzed following a color system looking at selection bias, performance bias, detection bias, attrition bias, and reporting bias. Randomization occurred in five of the six studies where only two included allocation concealment. Three of the six studies used blinded assessors, but not blinded participants as they were aware of the orthoses they were wearing and of the assessment tools. None of the studies had blinded outcome measures, as participants reported their own pain and were not blinded to the results on the grip and pinch assessment tools. Attrition bias was not an issue for any of the studies as there was very low mortality reported in any of the six studies. Information about all of the participants seemed to be widely provided in each of the studies, although information about all of the orthoses were not fully presented. Further instructions would be beneficial for better clarification in some of the discussed orthoses, such as the Custom-made Thumb Splint [2].

There are limitations in this review secondary to the fact that all of the orthoses discussed were not evaluated for all of the outcome measures. For instance, the Colditz Orthotic, Bellena Orthotic, and Thumb Spica Splint should be further researched to better address more affected outcomes of CMC joint OA. The six studies did not have the same intensity and duration of wear which could skew the results for accuracy. There is room for further examination into wear schedules and the duration it requires for an orthosis to have positive results.

There are also other orthoses that are used to counter CMC joint OA that were not present in this analysis. Another component of orthotic wear for CMC joint OA that could be beneficial to research is the satisfaction and comfort regarding wear.

The results of this review provide occupational therapy and hand therapy practitioners with emerging evidence to guide practice in conservative management techniques regarding pain and decreased pinch and grip strength for individuals diagnosed with CMC joint OA. Throughout this review, there is ample evidence to support that utilizing an orthosis for CMC joint OA can improve the outcome measures of pain, decreased grip strength, and decreased pinch strength. Across six different studies, nine orthoses were reviewed. Eight of the orthoses were examined for changes in pain, six orthoses were examined for changes in grip strength, and all nine orthoses were examined for changes in pinch strength.

The Prefabricated Neoprene Splint, Custom-made Thumb Splint, Neoprene Comfort Cool Orthosis, Custom-made Hybrid Splint, Soft Thumb Support 202 Orthosis, and Custom-made Butterfly (Short Opponens) Splint were analyzed with the outcome measures of pain, pinch, and grip strength. Of these six orthoses, only one orthoses design, the Custom-made Butterfly (Short Opponens) Splint, significantly improved symptoms of pain and also significantly increased grip and pinch strength. This evidence suggests that it is best practice to provide clients with CMC joint OA experiencing pain and decreased grip and pinch strength a butterfly style orthosis composed of perforated thermoplastic with a suggested wear schedule of 16 hours daily for at least 30 days. The Prefabricated Neoprene Splint and Custom-made Thumb Splint were evaluated in terms of pain, pinch, and grip strength, but were only deemed to significantly improve pain and pinch. They are both composed of neoprene and may offer more comfort to the client, so although they do not support grip strength, they do enhance pinch strength and decrease pain and are a viable option for individuals with CMC joint OA.

The Soft Thumb 202 Orthosis was evaluated in terms of pain, grip, and pinch strength, but only significantly decreased pain. There was not a considerable increase in grip strength, and the use of this orthosis actually slightly decreased pinch strength from pretest to posttest. This is a viable option for individuals whose chief complaints are pain, but have not yet experienced decreased grip and pinch strength secondary to CMC joint OA. The use of this orthosis would likely be successful for individuals in the earlier stages of OA. The Neoprene Comfort Cool Orthosis and Custom-made Hybrid Orthosis did not significantly impact pain, pinch, or grip strength. Therefore, there is evidence to suggest that these orthoses are not effective in supporting common conditions associated with CMC joint OA.

The Thumb Spica Splint was not analyzed for grip strength or pain, but it did have a significant effect on pinch strength. The Bellena Orthosis was only analyzed for pain, which participants did report a 32% pain decrease after 3 months of wear, but significance values were not calculated. The Colditz Splint was examined for only pain and pinch strength, where it significantly improved pinch, and although significance values were not calculated, pain levels of participants that used this orthosis decreased by an average of 35%.

Implications for Future Practice

Because of the ever-increasing prevalence of CMC joint OA, it is crucial for occupational therapy and hand therapy practitioners to have an adequate understanding of the best orthoses to provide clients. Occupational therapists and hand therapists are particularly well-suited to provide various orthoses due to their extensive studies in biomechanical sciences with a connection to promoting daily life functioning. The evidence discussed in this review has the following implications for conservative practice with clients with CMC joint OA:

- For individuals with pain, decreased grip strength, and decreased pinch strength evidence suggests providing a Butterfly (Short Opponens) Splint composed of perforated thermoplastic that blocks the first MCP, but allows free range of motion for the IP and wrist joints.
- For individuals with pain and decreased pinch strength, evidence suggests providing a Butterfly Splint, Prefabricated Neoprene Splint or a Custom-made Thumb Orthosis that stabilizes the CMC joint.
- For individuals with decreased pinch strength, evidence suggests providing a Colditz Splint, Thumb Spica Splint, Butterfly Splint, Prefabricated Neoprene Splint, or a Custom-made Thumb Orthosis.
- For individuals with pain, evidence suggests providing a Bellena Orthosis, Soft Thumb 202 Orthosis, Colditz Splint, Prefabricated Neoprene Splint, Custom-made Thumb Orthosis, or a Butterfly Splint.
- Evidence suggests that the Neoprene Comfort Cool and Custom-made Hybrid designs are

not effective for CMC joint OA in respect to pain, decreased grip, and decreased pinch strength.

Conclusion

Research demonstrates ample evidence to support that utilizing an orthosis for CMC joint OA can improve the outcome measures of pain, decreased grip strength, and decreased pinch strength. The evidence strongly supports the use of the Butterfly Orthosis for individuals experiencing discomfort in all three outcome measures, and the Prefabricated Neoprene and Custom-made Thumb Splint for individuals experiencing pain and decreased pinch. It is also justifiable to provide individuals experiencing decreased pinch strength a Thumb Spica Splint or Colditz Splint, while there is conflicting evidence to support the use of a Neoprene Comfort Cool Splint. There is moderate evidence to suggest the use of the Ballena Orthosis and Colditz Orthosis to decrease pain. The evidence suggests that the Neoprene Comfort Cool Splint and Custom-made Hybrid splint should not be used to address issues of pain, decreased grip strength, and decreased pinch strength. Further research needs to be conducted to support best practice for the duration and intensity of wear schedules, but information is provided throughout this review to suggest what has proven to be effective throughout the studies analyzed.

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