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A Literature Review on the Impact of Knee Orthoses in Managing Osteoarthritis: Efficacy and Patient Outcomes

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ABSTRACT

Background: A knee orthosis is a specialized orthotic device which designed to provide support, stability, and protection to the knee joint. It is commonly used to manage pain, improve function, or prevent further injury in conditions such as knee osteoarthritis, ligament injuries, or post-surgery recovery. Knee braces for osteoarthritis (OA) are designed to redistribute pressure from the damaged areas of the knee, improve joint alignment, and offer stability. There are various types of knee braces, including unloader braces, which shift weight away from the affected part of the joint, and supportive braces that offer general stabilization. By reducing pressure on the knee, these braces can help alleviate pain and improve mobility, allowing patients to maintain an active lifestyle.
Objective: The main objective of review is to evaluate and synthesize existing research on the efficacy of knee braces in managing osteoarthritis aiming to assess how knee braces impact pain relief, functional mobility, joint stabilization, and patient outcomes, while also examining the biomechanical mechanisms behind their effectiveness.
Study design: Literature review.
Significance: This literature review aims to identified the effectiveness and efficacy of different knee braces and how knee braces reduce pain, improve mobility, and delay the need for surgery in knee osteoarthritis patients.
Method: A literature review was conducted using Google Scholar, ScienceDirect, PubMed, Cochrane library and reference list from the pool of retrieved articles.
Result: After reading through earlier studies on knee orthoses for patients with osteoarthritis, many studies indicate the immediate pain relief and have a significant positive impact on enhancing balance, strength, walking speed, step length, quality of life, and physical function as well as a reduction in joint pain and stiffness. Additionally, it is found that in patients with osteoarthritis, knee orthoses enhance static balance, stability, knee adduction moment, and bone alignment. However, one study compares the knee orthoses with other orthotic devices such as foot orthoses, and concluded that other orthotic device is more successful than knee braces.
Conclusion: After reading through the 17 articles,16 articles, highlight the positive effects of knee orthoses on pain relief immediately, as well as on improving strength, balance, walking speed, step length, quality of life, and physical function in along with reducing joint pain and stiffness. And the remaining 1 article indicates that, in comparison to knee orthoses, foot orthoses are more beneficial in enhancing knee adduction moment, pain, and function

parameters in patients with knee OA. Hence, we can conclude after reviewing the literature that knee orthoses can be effectively used as a physical treatment to enhance balance and physical function among patients with knee OA.

Keywords: Knee osteoarthritis, knee orthoses, knee brace, unloads, offloading.

INTRODUCTION

Osteoarthritis (OA) is a common chronic condition resulting in musculoskeletal pain, fatigue, functional limitation and disability, increased healthcare utilization and high economic costs to society. It affects millions of people worldwide. It is sometimes referred to as "wear and tear" arthritis or degenerative joint disease.[1] The symptoms of OA include loss of articular cartilage, hypertrophy of bone at the margins, subchondral sclerosis, and a variety of biochemical and morphological changes to the synovial membrane and joint capsule.[2] It usually affects the hands, shoulder, hips, and knees.

Patients suffering from osteoarthritis (OA) generally show severe involvement in the medial compartment, which is marked by higher stresses across this compartment, joint inflammation, and cartilage and joint space loss. These contribute to pain, changes in muscle control and interferes with balance and postural control.[3]

knee OA is a leading cause of disability globally, with estimates suggesting that approximately 10% of men and 13% of women over the age of 60 are affected. Factors such as aging, obesity, previous knee injuries, and genetic predisposition contribute to its onset. Given its high prevalence and impact on quality of life, knee osteoarthritis represents a significant public health concern.[4]

Treatment of knee osteoarthritis focus on the minimising the knee adduction moment, enhancing balance, strength, walking speed, step length, quality of life, and physical functionality of joint as well as a reduction in joint pain and stiffness in patient with knee orthoses. A knee orthosis is a specialized orthotic device which designed to provide support, stability, and protection to the knee joint.

MATERIALS & METHODS

Various articles from following database like google scholar, science direct, PubMed and Cochrane library were retrieved through a search by using key words- knee osteoarthritis, knee orthoses, knee brace etc. Total 17 articles were included in the study and based on their findings; a review was constructed.

RESULT

Many articles were taken and studied, and 17 articles are selected according to the inclusive criteria of this literature review. The details of the reviewed articles are tabulated in the given table –1.

Detail of reviewed articles

Author	Title	Type of orthosis used	Procedure of the study	Conclusion
Swami P et al. 2024	Prototype development of offloading knee brace for management of knee osteoarthritis: a case study.	New offloading knee brace	This study develops a light weight and cost – effective offloading knee brace to assess the effects on balance and strength in patients suffering from medial osteoarthritis.	It is concluded that offloading knee brace was effective in improving the balance and strength in person with medial knee osteoarthritis.
Bishop L. et al.	Tricompartment offloader knee	Offloader knee brace	This study designs a tricompartment	The result of this study demonstrated that the

2023	brace reduces contact forces in adults with multicompartment knee osteoarthritis.		unloader brace to determine the effect on knee contact forces and quadriceps muscle activity in individuals with knee osteoarthritis.	tricompartment offloader knee brace effectively reduces contact forces in both the Tibiofemoral and patellofemoral compartments of the knee and motion which requires high strength and control in knee OA patient. Further, it also unloads the joint by reducing compressive forces caused by the quadriceps muscles.
Dwarakanathan R et al. 2022	Efficacy of unloader knee orthosis and lateral wedge insole on static balance in medial knee osteoarthritis.	Unloader knee brace, lateral wedge insole	This study identifies and compare the effect of unloader knee brace and lateral wedge insole on balance parameter.	It is concluded that use of either lateral wedge insole or unloader knee brace improve balance parameter and joint function scores and after further comparing of both orthotic intervention unloader knee brace shows significant improvement in all static balance parameters compared to lateral wedge insoles except mobility scores.
Dessinger M et al. 2020	Can an OA knee brace effectively offload the medial condyle? An in vivo Fluoroscopic study.	Off-loader knee brace	This study assesses the changes in medial joint space and bone alignment after wearing an off-loading knee brace by analyzing its efficacy in relation to in vivo three-dimensional knee kinematics.	The result of this study experience positive changes in medial joint space and bone alignment after using the off-loaded knee brace.
Nandal S et al. 2020	Efficacy of Orthotic Treatment in Knee Osteoarthritis: A Review from 2000 to 2020.	Foot insole, knee brace	This study investigates the effect of orthotic treatment on knee osteoarthritis.	This study investigate that the use of orthotic management can improve the malalignment, knee joint pain and physical function of Knee osteoarthritis.
Khosravi M et al. 2019	Design evaluation in novel orthoses for patients with medial knee osteoarthritis.	Modified knee brace	This study evaluates the effectiveness of different types of knee orthoses (braces) designed for patients suffering from medial knee osteoarthritis (OA).	It is concluded that different types of knee orthoses design for knee OA patients are effective in improving the knee adduction moment and walking speed.
Gohal C et al. 2018	Effectiveness of valgus offloading knee braces in the treatment of medial compartment knee osteoarthritis: A systematic review.	Valgus offloading knee brace	This study determines the effectiveness of valgus offloading knee brace in treatment of medial compartment knee osteoarthritis.	This study found that the use of valgus offloading knee brace improve the pain but in terms of stiffness and functional results is still not well understood in the literature.

Thoumie P et al. 2018	Effect of unloading brace treatment on pain and function in patients with symptomatic knee osteoarthritis: the ROTOR randomized clinical trial.	Unloading knee brace	This study analysis the effect of unloading brace on pain and function in patient with knee osteoarthritis.	The study concludes that the REBEL RELIEVER unloading knee brace, combined with usual care, significantly reduces pain and improves function in patients with medial knee osteoarthritis compared to usual care alone. The brace provided rapid pain relief and functional improvement within 6 weeks, making it a valuable addition to conservative OA treatment.
Roodsari B et al. 2016	The effect of orthotic devices on knee adduction moment, pain and function in medial compartment knee osteoarthritis: a literature review.	Foot orthoses, knee brace	This study evaluates the effects of foot orthoses and knee braces on knee adduction moment, pain and function in patient with knee OA.	The result of this study shows that the foot orthoses are more effective in reducing the knee adduction moment and improving the pain and function parameter as compared to knee braces.
Petersen W et al. 2016	Biomechanical effect of unloader braces for medial osteoarthritis of the knee: a systematic review.	Knee unloader brace	This study performed a systematic review of studies examining the biomechanical effect of unloader braces in knee OA patient.	This study shows the evidence that valgus knee bracing can unload the medial compartment, reduction in knee adduction moment and effective in pain management and also improve biomechanical effects include increased walking speed, increase in step length or increased gait symmetry.
Kelly S et al. 2014	Osteoarthritic knee braces on the market: A literature review.	unloading knee brace, offloading knee brace	The study reviews the pros and cons of 15 osteoarthritic knee braces based on evidence and provide updated details about each brace, including features, indications, and pricing	The study concludes that 15 out of 42 osteoarthritic knee braces have proven effectiveness, reduced pain and improving function, with more research needed to validate their use as alternatives to surgery.
Steadman R et al. 2014	Current state of unloading braces for knee osteoarthritis.	Unloading knee brace	This study conducted to review the current state of unloading braces on knee mechanics, clinical impact, and long-term disease progression.	The study concludes that while unloading braces improve pain, function, and quality of life in patients with knee osteoarthritis, there is still debate about their biomechanical efficacy in altering long-term disease progression.
Arazpour M et al. 2013	The influence of a bespoke unloader knee brace on gait in medial	Unloader knee orthosis	This study identifies the effects of a new design of knee unloader orthosis on	The study concludes that a newly designed bespoke unloader knee orthosis significantly reduces the

	compartment osteoarthritis: A pilot study.		gait parameters in patients with mild-to-moderate medial knee osteoarthritis.	knee adduction moment and improves walking speed in patients with mild-to-moderate medial knee osteoarthritis. However, it also reduces the range of motion at the knee. The orthosis shows potential as a conservative treatment, offering immediate benefits in improving gait parameters without significantly affecting cadence
Feehan L et al. 2012	The effectiveness of off-loading knee orthoses in the reduction of pain in medial compartment knee osteoarthritis: A systematic review.	Offloading knee brace	This study determines the effectiveness of knee orthoses in the treatment of pain in unilateral compartment osteoarthritis (OA).	It is concluded that offloading knee brace is effective in relieving the pain and unloading the medial compartment of knee. It also improves quality of life and increase the function.
Briggs K et al. 2012	Improvement in quality of life with use of an Unloader knee brace in active patients with OA: A prospective cohort study.	Unloader knee brace	This study investigates the improvement in quality of life with use of an unloader knee brace in active patients with OA.	This study shows the improvement in physical quality of life, decreased pain and increased joint function with the use of unloader knee brace in patient with knee OA. Patients also showed the desire for participating in recreational activities after using the unloader knee brace.
Raja K et al. 2011	Efficacy of knee braces and Foot orthoses in conservative management of knee osteoarthritis: A systematic review.	Knee braces and foot orthoses	This study finds the effectiveness of knee braces and foot orthoses in conservative management of knee osteoarthritis.	This study concluded that knee braces and foot orthoses are effective in reducing pain, stiffness and improving physical function.
Reeves D et al. 2011	Conservative biomechanical strategies for knee osteoarthritis.	Lateral wedge insole, walking aids, valgus knee braces	This study evaluates the effectiveness of various conservative biomechanical strategies, such as footwear, insoles, gait modification, and knee braces, to reduce knee adduction moments and slow the progression of knee osteoarthritis.	The study concludes that several conservative biomechanical strategies, such as lateral wedge insoles, valgus knee braces, toe-out gait, and flexible footwear, effectively reduce knee adduction moments and help manage knee osteoarthritis. These interventions can slow disease progression, particularly in early stages, though long-term benefits vary depending on the method and patient adherence.

DISCUSSION

The research on knee orthoses for osteoarthritis (OA) covers a range of studies, each contributing unique insights into the efficacy of various brace designs and their impact on patients with knee OA. Swami P et al. (2024) developed a new offloading knee brace aimed at improving balance and strength in individuals with medial knee osteoarthritis. Their study concluded that the brace effectively enhanced both parameters, providing a promising solution for managing OA symptoms.[5] Similarly, Bishop L et al. (2023) explored the use of a tricompartment offloader knee brace to assess its impact on knee contact forces and quadriceps activity in individuals with multicompartment OA. The study found that the brace significantly reduced contact forces in key knee compartments and alleviated compressive forces from the quadriceps, making it effective in reducing joint stress.[6]

In another study, Dwarakanathan R et al. (2022) compared the effectiveness of an unloader knee brace and a lateral wedge insole on balance parameters in medial knee OA patients. Both interventions improved balance and joint function, but the unloader knee brace demonstrated superior results, particularly in static balance.[3] Dessinger M et al. (2020) conducted an in vivo study to evaluate the changes in medial joint space and bone alignment after using an offloading knee brace. The results showed positive effects on joint space and alignment, further supporting the use of these braces in OA management.[7]

Nandal S et al. (2020) provided a comprehensive review of orthotic treatments, including foot insoles and knee braces, between 2000 and 2020. Their findings indicate that orthotic management can significantly improve knee joint pain, malalignment, and physical function.[8] Khosravi M et al. (2019) assessed different knee brace designs and concluded that they were effective in improving walking speed and knee adduction moments in patients with medial knee osteoarthritis.[9] Gohal C et al. (2018) conducted a systematic review to determine the effectiveness of valgus offloading knee braces, finding that while they help reduce pain, more research is needed to fully understand their impact on stiffness and functional outcomes.[10]

Thoumie P et al. (2018) conducted the ROTOR randomized clinical trial to evaluate the effect of an unloading knee brace, specifically the REBEL RELIEVER, on pain and function in patients with symptomatic knee osteoarthritis. The study found that the brace, when combined with usual care, significantly reduced pain and improved function in patients with medial knee osteoarthritis within six weeks, offering rapid relief and functional benefits as a conservative treatment option.[11]

Roodsari B et al. (2016) reviewed the effects of foot orthoses and knee braces on the knee adduction moment, pain, and function in patients with medial knee osteoarthritis. Their findings indicate that while both interventions are effective, foot orthoses provide greater reductions in the knee adduction moment and improved pain and function parameters compared to knee braces.[12] In the same year, Petersen W et al. (2016) conducted a systematic review on the biomechanical effects of unloader braces in patients with medial knee osteoarthritis. The study provided evidence that valgus knee bracing effectively unloads the medial compartment, reduces knee adduction moments, and aids in pain management. It also improves biomechanical outcomes such as walking speed, step length, and gait symmetry.[13]

Kelly S et al. (2014) performed a comprehensive review of osteoarthritic knee braces, analyzing 15 out of 42 braces available on the market. The study concluded that these braces were effective in reducing pain and improving function. However, it highlighted the need for more research to validate their use as alternatives to surgery, emphasizing that while many braces are beneficial, further study is necessary to support their widespread clinical application.[14]

Steadman R et al. (2014) conducted a comprehensive review on the current state of unloading braces for knee osteoarthritis. Their study explored the effects of unloading braces on knee mechanics, clinical impact, and long-term disease progression. They concluded that unloading braces improved pain, function, and quality of life in patients with knee osteoarthritis, but there remains debate regarding their biomechanical efficacy in influencing long-term disease outcomes.[15]

Arazpour M et al. (2013) performed a pilot study assessing the influence of a bespoke unloader knee brace on gait parameters in patients with mild-to-moderate medial knee osteoarthritis. The study found that the brace significantly reduced the knee adduction moment and improved walking speed. However, it also reduced the range of motion at the knee. Despite this limitation, the orthosis offered immediate benefits in improving gait without affecting cadence, positioning it as a promising conservative treatment.[16]

Feehan L et al. (2012) conducted a systematic review focusing on the effectiveness of offloading knee orthoses in reducing pain in patients with medial compartment knee osteoarthritis. The study concluded that offloading knee braces were effective in relieving pain, unloading the medial compartment, improving quality of life, and enhancing functional outcomes.[17]

Briggs K et al. (2012) conducted a prospective cohort study to examine the improvement in quality of life with the use of an unloader knee brace in active patients with osteoarthritis (OA). The study found that the unloader knee brace significantly improved physical quality of life, decreased pain, and increased joint function in patients with knee OA. Additionally, patients expressed a greater desire to participate in recreational activities after using the brace, highlighting its positive impact on lifestyle and mobility.[18]

Raja K et al. (2011) performed a systematic review on the efficacy of knee braces and foot orthoses in the conservative management of knee osteoarthritis. The study concluded that both knee braces and foot orthoses were effective in reducing pain and stiffness while improving physical function, offering valuable non-surgical treatment options for managing OA symptoms.[19]

Reeves D et al. (2011) explored conservative biomechanical strategies for managing knee osteoarthritis, including lateral wedge insoles, walking aids, and valgus knee braces. The study demonstrated that these interventions effectively reduce knee adduction moments, which can help slow the progression of knee OA. The study emphasized that interventions such as lateral wedge insoles, valgus knee braces, toe-out gait modification, and flexible footwear are particularly beneficial in early-stage OA, though their long-term benefits depend on patient adherence and the specific method used.[20]

Together, these studies demonstrate the effectiveness of various orthotic interventions in managing the symptoms of knee osteoarthritis, particularly in reducing pain, improving balance, and enhancing joint function. However, some areas, such as long-term outcomes and specific functional improvements, require further investigation.

CONCLUSION

The literature review of the 17 articles underscores the significant positive impact of knee orthoses on various health outcomes for patients with knee osteoarthritis (OA). The majority of studies highlight that knee orthoses provide immediate pain relief and contribute to improvements in strength, balance, walking speed, step length, quality of life, and overall physical function. Additionally, they effectively reduce joint pain and stiffness, enhancing the daily lives of individuals with knee OA. However, it is worth noting that one article suggests foot orthoses may offer greater benefits in terms of knee adduction moment and certain functional parameters. Despite this, the overall consensus from the literature strongly supports the use of knee orthoses as

a valuable physical treatment option to enhance balance and physical function in this patient population. Thus, healthcare providers can consider knee orthoses as a key component in the management of knee OA, tailoring treatment plans to maximize patient outcomes.

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