

Relationship between Knee Osteoarthritis and Mild Cognitive Impairment: A Bibliographic Review

Isadora Cristina Ribeiro¹, Camila Vieira Ligo Teixeira², Marcio Luiz Figueredo Balthazar¹

¹ Department of Neurology, Medical School, University of Campinas (UNICAMP), Brazil

² Department of Diagnostic Radiology and Nuclear Medicine, University of Maryland School of Medicine, EUA

Abstract

Knee osteoarthritis (KOA) is a rheumatic disease that leads to decreased functional capacity and mental health. The pain generated by KOA has been shown to be associated with decreased joint function, disability, an increased risk of developing depressive symptoms, worse coping with the disease, decreased quality of life, and cognitive factors. However, the relationship between KOA and decreased cognitive health has not been fully elucidated. Mild cognitive impairment (MCI) is a diagnostic term that refers to decreased cognitive health, describing the situation between preserved cognition and dementia. It is used to describe people with a decline in one or more cognitive domains but who still have their sociofunctional performance intact. This literature review aimed to investigate the relationship between KOA and MCI. The search terms “knee osteoarthritis” and “mild cognitive impairment” were used using the BVS, Cochrane Library, PubMed, and Scielo databases, using the “and” connector. The articles that had one of the search terms in their title, both search terms in their abstract and that investigated both health conditions were selected. Studies that did not refer to humans, that were abstracts or clinical trial records of one of the articles already found in the search, or that were in duplicate were excluded. As a result, five articles were included in the literature review and evaluated. Studies have shown that MCI increases the risk of KOA and that practicing Tai Chi is effective in reducing knee pain, pain-related behavior, and the number of analgesics used by elderly individuals with MCI.

Introduction

Osteoarthritis is a frequent chronic disease [1] described as a low-grade rheumatic and inflammatory disease that results in joint cartilage degeneration [2,3]. It is classified as primary or secondary, depending on its origin of development, with no biological changes between the types. Primary osteoarthritis, also called idiopathic osteoarthritis, is dependent on the gene of the individual, while secondary osteoarthritis, also called posttraumatic osteoarthritis, occurs after involvement by other diseases or after a traumatic event [4].

Osteoarthritis affects structures such as hyaline cartilage and other joint tissues, leading to increased subchondral bone thickness, sclerosis of the bone plate, synovitis, distension of the joint capsule, growth of osteophytes, muscle weakness, and changes in ligaments and tendons [2]. One of the most affected joints is the knee, and knee osteoarthritis is considered the main cause of physical disability in the elderly [5-7].

This physical disability occurs due to the reduction of the functional capacity generated by the impairment of the joint, which in turn occurs through structural changes that hinder

joint mobility, which may generate stiffness, crepitus, edema, pain, loss of mobility, and reduced range of motion [5]. Due to its progressive progression, knee osteoarthritis leads to loss of joint function that can result not only in reduced functional capacity but also in total joint impairment [2,8].

Zhang et al. [9] presented a meta-analysis that evaluated approximately 250 million people with a prevalence of knee osteoarthritis of 3.6%, while the prevalence combined with disabling pain was approximately 35% in elderly individuals, characterizing high prevalence rates of knee osteoarthritis in this population.

The decrease in functional capacity resulting from knee osteoarthritis has consequences such as reduced mobility, autonomy, social contact, and the presence of pain. These factors favor the development of mental disorders in the patient. Pain, for example, is a common symptom of the disease [10,11], which is directly related to the decrease in quality of life [12] and with loss of joint function and disability [13,14], as well as a higher risk of depressive symptoms [15].

For Axford et al. [16], individuals with higher pain indices have worse functional capacity, worse responses to coping with

Correspondence: Isadora Cristina Ribeiro, Department of Rheumatology, Faculty of Medical Sciences, State University of Campinas, Rua Tessália Vieira de Camargo, Brazil. Email: isadora.cr@hotmail.com

Keywords: *knee osteoarthritis; cognitive dysfunction; elderly.*

Received: 4 April 2022; **Accepted:** 15 April 2022; **Published:** 20 April 2022

the disease, and an increased risk of depression compared to individuals without or with less pain. Among the disorders associated with the disease, depression and anxiety are the most prevalent in this population [17,18]. However, a systematic review by Urquhart et al. [19] found a relationship between knee pain from knee osteoarthritis and cognitive factors.

A condition related to cognitive health that has been gaining attention is mild cognitive impairment, which refers to the decrease in the unnatural cognitive function of the aging process and is used as a diagnostic term applied to individuals between preserved cognitive function and dementia [20]. Individuals with this condition are characterized by a decline in one or more cognitive domains but have normal sociofunctional performance, i.e., without having their independence affected [21,22]. Elderly patients with mild cognitive impairment have a higher risk of developing Alzheimer's disease (AD) [23], with a conversion rate of 10 to 40% per year, when compared to 1-2% in healthy elderly individuals [24].

The impairment of physical and mental health generated by knee osteoarthritis allows the disease to have a high socio-economic impact. This impact is expected to increase since the prevalence of knee osteoarthritis accompanies the aging population [25,26]. Both knee osteoarthritis and mild cognitive impairment are frequent and influential diseases in the life of the elderly population [2,20]. Studies that evaluate the relationship between diseases enable the understanding of behaviors and associated consequences. However, the relationship between these two clinical conditions has rarely been investigated. Thus, this literature review aimed to combine articles that investigate knee osteoarthritis and mild cognitive impairment, contributing to the knowledge about the relationship between these two conditions in aging.

Methods

The present study was based on a literature review of scientific articles indexed in the search databases BVS (*Biblioteca Virtual de Saúde*), Cochrane Library, PubMed, and Scielo. The search terms "knee osteoarthritis" and "mild cognitive impairment" were investigated using the "and" connector. No period or type of study restriction was applied.

The inclusion criteria were studies that had one of the search terms in their title; Studies that had both search terms in their

abstract; Studies that investigated both conditions evaluated. And the following exclusion criteria were considered: Studies that did not refer to human beings; Summaries or clinical trial records of one of the studies already found in the search; Duplicate studies.

In the first moment of investigation, the number of articles found from the descriptors in the selected database was evaluated. Next, the inclusion and exclusion criteria were applied based on the reading of the titles and abstracts of the articles found. Finally, a careful reading of the selected articles was performed.

Results

The stages of the selection process of the articles to be included in this literature review, as well as the number of studies identified and selected, are described in flowchart 1. Due to the lack of manuscripts with the descriptors investigated in the Scielo database, it was not included in the flowchart.

After analyzing the studies found, five investigations were included in the literature review, respecting the inclusion and exclusion criteria. Table 1 shows the description of these articles and their main results.

The selected studies indicate a relationship between knee osteoarthritis and mild cognitive impairment or describe benefits from an intervention for a population with both health conditions.

Discussion

The present study aimed to investigate the relationship between knee osteoarthritis and mild cognitive impairment. For this purpose, a careful review of scientific articles was conducted, in which few studies were found that described the relationship between these diseases. Among them, the study by Yoshimura et al. [27] aimed to determine whether mild cognitive impairment, considered from the mini-state mental examination score (MMSE - a tool often used to identify cognitive decline), increases the risk of occurrence or progression of knee osteoarthritis. The study applied a logistic regression analysis that was adjusted for age, sex, regional differences, body mass index, handgrip strength, smoking, alcohol consumption, frequency of physical exercise,

Table 1. Articles included in the literature review.

Year	Authors	Title	Journal	Main results
2017	Yoshimura et al.	Epidemiology of the locomotive syndrome: The research on osteoarthritis/osteoporosis against disability study 2005-2015.	Modern rheumatology	The logistic regression analysis showed that mild cognitive impairment increases the risk of knee osteoarthritis.
2012	Yoshimura et al.	Does mild cognitive impairment affect the occurrence of radiographic knee osteoarthritis? A 3-year follow-up in the ROAD study.	BMJ open	Mild cognitive impairment significantly increases the risk of incidence, but not progression, of radiographic knee osteoarthritis.
2011	Tsai et al.	A randomized controlled trial of a 20 week Tai Chi program for osteoarthritic knee pain in elders with mild dementia.	The Journal of Pain	The practice of Tai Chi improves the pain of knee osteoarthritis, the behavior related to it and the use of analgesics.
2010	Chang et al.	Teaching Tai Chi to elders with osteoarthritis pain and mild cognitive impairment.	Activities directors' quarterly for Alzheimer's & other dementia patients	The practice of Tai Chi is effective for elderly patients with knee pain and osteoarthritis.
2009	Tsai et al.	The effect of Tai Chi on knee osteoarthritis pain in cognitively impaired elders: pilot study.	Geriatric nursing (New York, NY)	The Tai Chi provides clinical improvement of pain caused by knee osteoarthritis in the elderly with cognitive impairment.

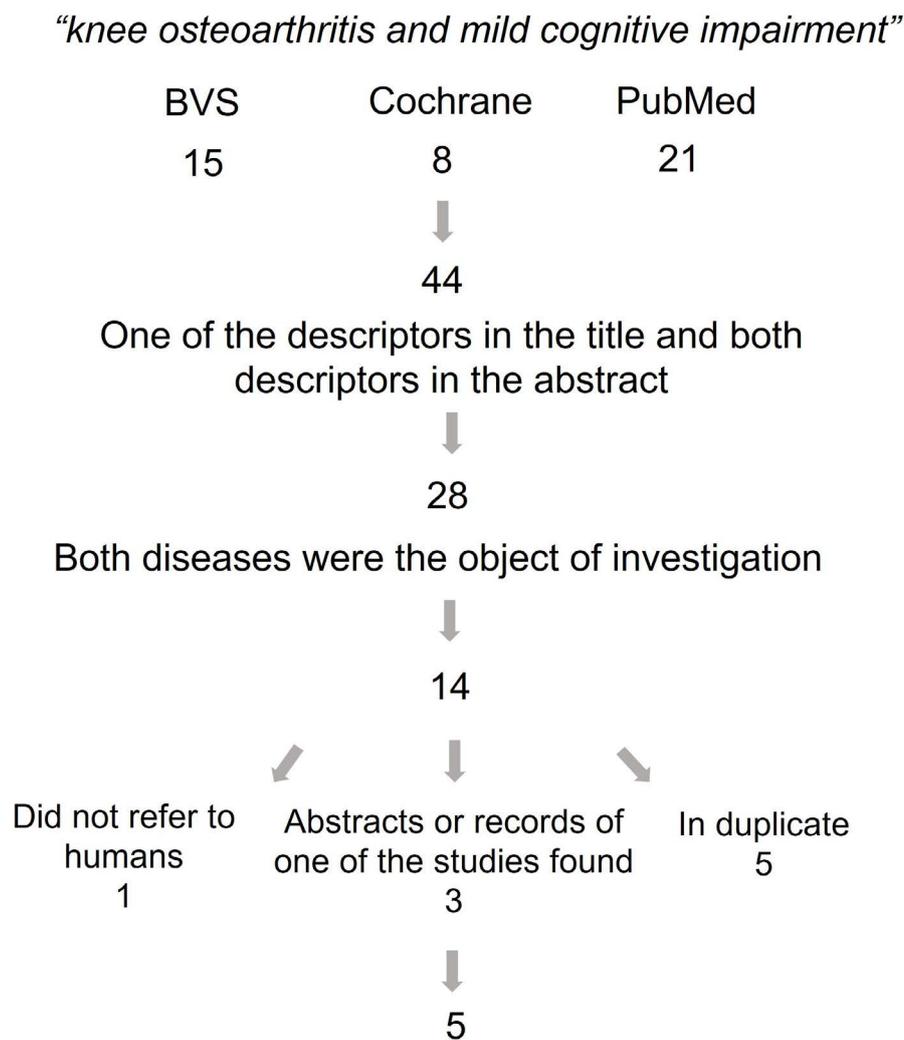


Figure 1: Flowchart of the stages of article selection to be included in the literature review.

and history of a knee injury. As a result, the MMSE score for individuals with mild cognitive impairment (score ≤ 23) was associated with the incidence of knee osteoarthritis. However, there was no significant association between the MMSE score and the progression of KOA in the analysis of degrees on the radiographic examination.

In a more recent study and through a logistic regression analysis, the same author revealed that mild cognitive impairment, hypertension, and a lower tolerance to glucose significantly increased the risk of the patient developing knee osteoarthritis [28]. These results corroborate their previous findings regarding mild cognitive impairment and the risk of incidence of knee osteoarthritis. The study also suggests that the prevention of conditions such as mild cognitive impairment and metabolic syndrome helps in the prevention of diseases that affect locomotion and generate physical disability, such as knee osteoarthritis. These conditions increase the risk of dementia and cardiovascular diseases, respectively, which are the main reasons for physical disability in the elderly [28].

Both studies by Yoshimura et al. [27,28] used the ROAD (*Research on Osteoarthritis/Osteoporosis Against Disability*) study as a basis. In 2012, the data referred to individuals who completed the second stage of the study (three years after the beginning). In the 2017 study, the results were generated from baseline and follow-up data from the second and third stages of the study (seven years after the beginning). Although they

have different objectives, they refer to a large cohort study that investigated a possible relationship between knee osteoarthritis and mild cognitive impairment, addressing factors essential for the knowledge of this relationship such as incidence, progression, prevention, and risk.

The other three studies included in this review are also from the same group of studies, which did not aim to investigate the relationship between knee osteoarthritis and mild cognitive impairment but rather to evaluate individuals with both conditions in a physical exercise intervention. It was previously shown that this type of intervention, characterized as nonpharmacological, is effective when combined with conventional treatment, describing a multifactorial treatment that aims to promote the reduction of symptoms, improvement of functional capacity, mental health, and quality of life., the delay or impediment of the progression of osteoarthritis and the decrease in the use of health services [9,29,30].

The article by Tsai et al. [31] refers to a pilot study that investigated possible improvements in pain through the practice of physical exercise by the Tai Chi modality in patients with osteoarthritis and mild to moderate cognitive impairment. For this purpose, seven elderly participants participated in a physical training intervention lasting 15 weeks. The results showed no significant differences in knee pain after the intervention in the evaluated participants. However, longer duration or better performance in the training protocol was associated with

improvement in pain scores, and when evaluated for a longer duration of practice of Tai Chi (20 weeks), the participants showed relevant clinical improvements.

The study by Chang et al. [32] describes a training protocol for Tai Chi applied to elderly individuals aged 70 to 90 years who had mild cognitive impairment (assessed by the MMSE score) and pain from knee osteoarthritis (measured by specific self-report questionnaires: Verbal Descriptor Scale or Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) in the pain domain). The diagnosis of knee osteoarthritis was also confirmed with the patient, his family, and the medical team responsible. The elderly participants participated in a 20-week Tai Chi intervention in 60 sessions.

The training protocol included specific teaching techniques for this population due to the physical and cognitive fragility presented. This method allowed this nonpharmacological and economic intervention to be appropriate for elderly patients with pain, knee osteoarthritis, and mild cognitive impairment because it is easily adaptable to the individual condition of each patient. The authors comment that in addition to physical exercise, they promoted cognitive stimulation and social interaction among the participants.

Subsequently, the research group documented those 55 elderly individuals were evaluated regarding pain, mean monthly dosage of analgesics used, and several behaviors related to knee osteoarthritis pain. The participants were divided into the groups of Tai Chi (n = 28) and control (n = 27), and it was reported that the pain scores of knee osteoarthritis, pain-related behavior and the dosage of analgesics used decreased after 20 weeks of treatment. practice, while in the control group, there were no changes in pain scores or analgesic dosage used, and there was a worsening of pain-related behavior [33].

The pilot study by Tsai et al. [31] contributed to the creation of an effective protocol to reduce knee pain from osteoarthritis in elderly individuals with mild cognitive impairment, which was later described by Chang et al. [32], contributing to the knowledge related to an easily accessible and efficient intervention in the improvement of pain in a population with both health conditions investigated in this review. The group of researchers also showed that in addition to being efficient in improving pain, the practice of Tai Chi improves the behavior related to it and decreases the use of analgesic drugs by this population [33].

Although the present study used four relevant databases to search for articles, we noted as a limitation the low number of articles found that relate to both health conditions investigated. We suggest further experimental studies that evaluate the relationship between knee osteoarthritis and mild cognitive impairment, contributing to the knowledge of the improvement of symptoms and the consequences associated with these diseases in the elderly population.

Conclusion

Investigating the relationship between knee osteoarthritis and mild cognitive impairment, we found studies that suggest that mild cognitive impairment increases the risk of developing knee osteoarthritis in elderly individuals and that the practice of Tai Chi can be used therapeutically in the relief of pain from knee osteoarthritis in elderly individuals with mild cognitive impairment, influencing pain-related behavior and the amount of analgesics used.

References

1. Lawrence RC, Felson DT, Helmick CG, Arnold LM, Choi H, et al. (2008) Estimates of the prevalence of arthritis and other rheumatic conditions in the United States: Part II. *Arthritis & Rheumatism* 58(1):26-35.
2. Coimbra IB, Pastor EH, Greve JM, Puccinelli ML, Fuller R, et al. (2002) Consenso brasileiro para o tratamento da osteoartrite (artrose). *Rev Bras Reumatol* 42(6):371-374.
3. Mobasheri A, Rayman MP, Gualillo O, Sellam J, Van Der Kraan P, et al. (2017) The role of metabolism in the pathogenesis of osteoarthritis. *Nature Reviews Rheumatology* 13(5):302-311.
4. Altman R, Asch E, Bloch D, Bole G, Borenstein D, et al. (1986) Development of criteria for the classification and reporting of osteoarthritis: classification of osteoarthritis of the knee. *Arthritis & Rheumatism: Official Journal of the American College of Rheumatology*. 29(8):1039-1049.
5. Felson DT (2016) Challenges of identifying and treating patellofemoral osteoarthritis. *British journal of sports medicine* 50(14):832-833.
6. Ferreira AH, Godoy PB, Oliveira NR, Diniz RA, Diniz RE, et al. (2015) Investigation of depression, anxiety and quality of life in patients with knee osteoarthritis: a comparative study. *Revista brasileira de reumatologia* 55:434-438.
7. Stubbs B, Aluko Y, Myint PK, Smith TO (2016) Prevalence of depressive symptoms and anxiety in osteoarthritis: a systematic review and meta-analysis. *Age and ageing* 45(2):228-235.
8. Wong LY, Lo RY, Chiu CK, Lee WK, Lee YL, et al. (2015) Prevalence of psychiatric morbidity in Chinese subjects with knee osteoarthritis in a Hong Kong orthopaedic clinic. *East Asian Archives of Psychiatry* 25(4):150-158.
9. Zhang YM, Wang J, Liu XG (2017) Association between hypertension and risk of knee osteoarthritis: A meta-analysis of observational studies. *Medicine* 96(32).
10. Nicholl BI, Mackay D, Cullen B, Martin DJ, Ul-Haq Z, et al. (2014) Chronic multisite pain in major depression and bipolar disorder: cross-sectional study of 149,611 participants in UK Biobank. *BMC psychiatry* 14(1):1-1.
11. Stubbs B, Eggermont L, Mitchell AJ, De Hert M, Correll CU, et al. (2015) The prevalence of pain in bipolar disorder: a systematic review and large-scale meta-analysis. *Acta Psychiatrica Scandinavica* 131(2):75-88.
12. Mesci N, Mesci E, Külcü DG (2016) Association of neuropathic pain with ultrasonographic measurements of femoral cartilage thickness and clinical parameters in patients with knee osteoarthritis. *Journal of physical therapy science* 28(8):2190-2195.
13. Knapik JJ, Pope R, Orr R, Schram B (2018) Osteoarthritis: Pathophysiology, Prevalence, Risk Factors, and Exercise for Reducing Pain and Disability. *Journal of special operations medicine* 18(3):94-102.
14. Messier SP, Mihalko SL, Legault C, Miller GD, Nicklas BJ, et al. (2013) Effects of intensive diet and exercise on knee joint loads, inflammation, and clinical outcomes among overweight and obese adults with knee osteoarthritis: the IDEA randomized clinical trial. *Jama* 310(12):1263-1273.
15. Pereira D, Severo M, Barros H, Branco J, Santos RA, et al. (2013) The effect of depressive symptoms on the association between radiographic osteoarthritis and knee pain: a cross-sectional study. *BMC musculoskeletal disorders* 14(1):1-9.
16. Axford J, Heron C, Ross F, Victor CR (2008) Management of knee osteoarthritis in primary care: pain and depression are the major obstacles. *Journal of psychosomatic research* 64(5):461-467.
17. Axford J, Butt A, Heron C, Hammond J, Morgan J, et al.

- (2010) Prevalence of anxiety and depression in osteoarthritis: use of the Hospital Anxiety and Depression Scale as a screening tool. *Clinical rheumatology* 29(11):1277-1283.
18. Nazarinasab M, Motamedfar A, Moqadam AE (2017) Investigating mental health in patients with osteoarthritis and its relationship with some clinical and demographic factors. *Reumatologia* 55(4):183.
 19. Urquhart DM, Phyomaung PP, Dubowitz J, Fernando S, Wluka AE, et al. (2015) Are cognitive and behavioural factors associated with knee pain? A systematic review. *In Seminars in arthritis and rheumatism*. 44(4):445-455.
 20. Petersen RC, Roberts RO, Knopman DS, Boeve BF, Geda YE, et al. (2009) Mild cognitive impairment: ten years later. *Archives of neurology*. 66(12):1447-1455.
 21. Petersen RC, Parisi JE, Dickson DW, Johnson KA, Knopman DS, et al. (2006) Neuropathologic features of amnesic mild cognitive impairment. *Archives of neurology* 63(5):665-672.
 22. Winblad B, Palmer K, Kivipelto M, Jelic V, Fratiglioni L, et al. (2004) Mild cognitive impairment—beyond controversies, towards a consensus: report of the International Working Group on Mild Cognitive Impairment. *Journal of internal medicine* 256(3):240-246.
 23. Petersen R (2000) Mild cognitive impairment: transition between aging and Alzheimer's disease. *Neurologia* 15(3):93-101.
 24. Schmidtke K, Hermeneit S (2008) High rate of conversion to Alzheimer's disease in a cohort of amnesic MCI patients. *International Psychogeriatrics* 20(1):96-108.
 25. Rezende MU, Campos GC, Pailo AF (2013) Conceitos atuais em osteoartrite. *Acta Ortopédica Brasileira* 21(2):120-122.
 26. Le TK, Montejano LB, Cao Z, Zhao Y, Ang D (2012) Health care costs in US patients with and without a diagnosis of osteoarthritis. *Journal of pain research* 5:23.
 27. Yoshimura N, Muraki S, Oka H, Kawaguchi H, Nakamura K, et al. (2012) Does mild cognitive impairment affect the occurrence of radiographic knee osteoarthritis? A 3-year follow-up in the ROAD study. *BMJ open* 2(6):e001520.
 28. Yoshimura N, Muraki S, Nakamura K, Tanaka S (2017) Epidemiology of the locomotive syndrome: the research on osteoarthritis/osteoporosis against disability study 2005–2015. *Modern rheumatology* 27(1):1-7.
 29. Rosemann T, Laux G, Kuehlein T (2007) Osteoarthritis and functional disability: results of a cross sectional study among primary care patients in Germany. *BMC Musculoskeletal Disorders* 8(1):1-8.
 30. Dunlop D, et al. (2005) Risk factors for functional decline in older adults with arthritis. *Arthritis & Rheumatism* 52(4):1274-1282.
 31. Tsai PF, Beck C, Chang JY, Hagen J, Kuo YF, et al. (2009) The effect of tai chi on knee osteoarthritis pain in cognitively impaired elders: pilot study. *Geriatric Nursing* 30(2):132-139.
 32. Chang JY, Tsai PF, Woods S, Beck C, Roberson PK, et al. (2011) Teaching Tai Chi to elders with osteoarthritis pain and mild cognitive impairment. *American journal of recreation therapy* 10(1):11.
 33. Tsai P, Chang J, Beck C, Kuo Y (2011) A randomized controlled trial of a 20 week Tai Chi program for osteoarthritic knee pain in elders with mild dementia. *The Journal of Pain* 12(4):P71.

Copyright: © 2022 Ribeiro IC. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.