Musculoskeletal Conditions in Patients With Diabetes: A Narrative Review

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Diabetes mellitus (DM) is a multisystem disease that affects millions of people worldwide. The vascular and cardiac effects of DM have been well-studied, but little is known about the prevalence of musculoskeletal (MSK) conditions in patients with DM. This review provides an in-depth analysis of a cross-sectional study investigating the presence of several common MSK disorders in patients with DM. This review also analyzes current literature to update health care professionals about the MSK conditions associated with DM.


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Os teopathic philosophy emphasizes the role of the musculoskeletal (MSK) system in the total health of the patient. MSK disorders often accompany chronic diseases such as diabetes mellitus (DM), which is a multisystem disease that poses a major public health problem. In 2018, approximately 10.5% of the US population and 13% of US adults had a diagnosis of DM, and according to a 2017 estimate, 450 million people worldwide were affected.1 DM can lead to numerous complications, including myocardial infarction, cerebral vascular accident, chronic kidney disease, and other vascular diseases.2 The vascular and cardiac complications of DM have been studied in depth, but to date, few studies have investigated the relationship between MSK disorders and patients with DM. It is unclear whether MSK disorders increase the risk of developing DM or if having DM increases the risk of developing MSK disorders. Do they occur simultaneously, influence each other, or are they part of the same pathophysiologic process?

Additionally, a 2019 survey3 investigating limited joint mobility as a Type 2 DM complication found that most general physicians may not be aware of MSK complications in DM. It is particularly pertinent for osteopathic physicians to inquire whether osteopathic manipulative treatment (OMT) and lifestyle modifications are beneficial for DM management and prevention. In this article, the authors sought to review the current literature to update health care professionals on the MSK conditions associated with DM.

Literature Search

The authors conducted a literature search in the EBSCOhost research platform to investigate the prevalence of MSK disorders in patients with DM. The search terms “musculoskeletal disorders,” “prevalence,” and “diabetes mellitus” were used and filtered for articles published from 2008 to 2019. Of the 118 studies retrieved, 14 were determined to be relevant based on their direct relationship of MSK disorder prevalence in DM. All
types of articles were considered during the article review process (eg, systematic review, randomized control trial, etc). The most informative of these were selected for this narrative literature review. Articles that contained repeated prevalence data from previous articles were excluded.

This article does not represent a comprehensive, systematic literature review; rather, it is a narrative review examining several recent publications in the literature deemed relevant by the authors to provide a brief overview of the topic.

Comorbidity Between DM and MSK Disorders

A 2018 cross-sectional study by Majjad et al⁴ provided insight into the relationship between DM and MSK disorders. The study included 376 patients with DM in a 14-month window from January 2015 to March 2016. The prevalence of MSK conditions, diabetes type, duration of DM, antidiabetic treatments, hemoglobin A1c (HbA1c) levels, and lipid profile were recorded. MSK disorders were primarily assessed using medical history and physical examination. Suspected carpal tunnel syndrome (CTS) was confirmed with electro-neuromyography, and osteoarthritis (OA) was confirmed with radiography. The prominent findings showed that MSK disorders were prevalent in 129 patients (34.3%) in the study population (N=376), with a higher prevalence in patients with type 2 DM compared with type 1 (119 [37.4%] and 10 [17.2%], respectively). The most common MSK disorders were OA (73 [19.4%]), shoulder capsulitis (47 [12.5%]) and CTS (33 [8.8%]). The 2 factors associated with significantly increased prevalence of MSK conditions were age older than 50 years and dyslipidemia.

A prior national survey⁵ of 5106 adults showed that diabetic adults also had a higher prevalence of chronic low back pain (LBP) compared with nondiabetic adults (19.8% and 12.9%, respectively, with \(P=0.05\)). A review by Silva et al⁶ confirmed the high prevalence of upper extremity MSK conditions in patients with diabetes, including flexor tenosynovitis (5%-36%) and diffuse idiopathic skeletal hyperostosis (13%-40%). Unfortunately, patients in the studies completed by Majjad et al,⁵ Hassoon et al,⁶ and Silva et al⁷ were not screened with an osteopathic structural examination, thus prevalence of somatic dysfunction was not reported.

However, Majjad et al⁴ also found that blood glucose and HbA1c levels were not correlated with MSK disorders (DM is defined as an HbA1c of greater than 6.5%). Therefore, the development of MSK disorders in patients with DM may be associated with other characteristics of the disease, comorbid conditions, or shared risk factors; the direct link between MSK conditions and DM remains unclear. A 2008 cross-sectional study⁷ demonstrated no direct link between high non-fasting glucose and general MSK conditions when participants were unaware of their DM status. Among the 64,785 participants involved, 30,157 participants (46.5%) reported chronic MSK conditions and 1,940 reported DM. Chronic MSK conditions were defined as pain and stiffness for more than 3 months during the past year and more than 15 days with symptoms during the last month including a wide range of body regions. Despite the lack of association between duration of DM, HbA1c, and chronic MSK conditions, patients with either type 2 DM or unclassified DM were 1.5 times more likely to report chronic widespread MSK conditions (OR 1.5; 95% CI, 1.2-1.9). This finding adds to the idea that while chronic MSK conditions appear to be associated with DM, they may not be directly linked to blood glucose levels.

Lifestyle Modifications and OMT for DM

Exercise is a well-established method for reducing HbA1c in patients with DM.⁸ The American Diabetic Association (ADA) recommends 150 minutes of both aerobic exercise and resistance training per week; thus, improving patient mobility should be the goal of physicians caring for patients with DM.⁹ Two recent literature reviews by Shubrook et al¹⁰ and Johnson et al¹¹
showed that lifestyle interventions, including the ADA’s recommendations on exercise, significantly reduced incidence of DM and progression of prediabetes to DM. Decreasing a patient’s pain sensitivity may play an important role in exercise completion by affecting patient exercise confidence and tolerability.12

Research has shown that OMT can be of benefit in the previously mentioned MSK disorders such as carpal tunnel and adhesive capsulitis. A 2018 systematic review13 on knee OA found that OMT with and without exercise resulted in reduced pain, increased function, increased physical performance, and a short-term benefit in range of motion with studies showing an effect ranging from 3 weeks to 1 year. A systematic review14 of shoulder conditions showed moderate-quality evidence to support OMT alone or in combination with exercise over the short- and long-term (the follow-up periods varied with each intervention that was analyzed). A 2018 randomized, controlled trial15 showed significant improvement in overall health status in patients with CTS who received OMT compared with nontreatment controls. Additionally, a review11 on the role of OMT in DM stated that addressing early tissue restrictions may have an impact on preventing or limiting future MSK complications in patients diagnosed with DM.

Finally, OMT causes a significant reduction in LBP for patients with DM.16 In 2008, the OSTEOPATHIC Health Outcomes in Chronic Low Back Pain trial17 evaluated the effect of OMT on LBP using a randomized, double-blinded, sham-controlled design. The results showed a significant pain reduction in LBP with OMT.17 Additionally, a subgroup analysis16 from the trial17 demonstrated a significant decrease in LBP in patients with DM. The subgroup analysis16 showed the efficacy of OMT on LBP in diabetic patients, and showed a significant increase in the baseline prevalence of somatic dysfunction in patients with DM. Elsewhere, OMT was shown to reduce LBP and was associated with decreased use of analgesics, including nonsteroidal anti-inflammatory drugs, in patients with LBP.18

Discussion
This review of the current literature raises several key points that should be considered by the osteopathic physician, such as the importance of screening patients with DM for MSK conditions. While the link between hyperglycemia or HbA1c level and MSK conditions warrants further investigation, consideration should be given to evaluating patients with DM for MSK conditions because they are likely to have associated risk factors. Early detection and management of MSK disorders may prevent further complications or development of chronic conditions. Also, OMT may decrease MSK pain, which could lead to increased exercise tolerance and decreased analgesic use, which can benefit patients with DM.

OMT may help slow the progression of physical disability and exercise avoidance, indirectly lowering HbA1c levels through increased exercise tolerance and physical mobility. Additionally, conditions such as OA (specifically knee OA) in patients with DM correlate with a higher rate of DM complications and increased mortality.19,20 Lessening pain in these patients may prevent further disability and potentially improve mortality rate. Further research is needed, but physicians should be aware of the prevalence of MSK conditions in patients with DM to accurately diagnose and treat them or consider referral to other MSK specialists as appropriate.

As stated, reduced pain has also been reported to reduce analgesic use for MSK disorders in patients with DM.18 Use of NSAIDs has been linked to increased risk of cardiovascular events and chronic kidney disease in patients with DM, which increases mortality in this patient population.21 Therefore, a comprehensive screening and appropriate treatment of MSK conditions in patients with DM is critical to optimize their possible outcomes.

Limitations and Future Research
Several limitations exist in the primary cross-sectional study reviewed.4 First, a cross-sectional study has no cause-effect determination because it lacks a control,
which makes it difficult to determine whether MSK conditions are associated exclusively with DM or if confounding variables exist. Second, the high prevalence of OA found in Majjid et al\textsuperscript{4} may have been due to shared risk factors including increased age and obesity. Further research is required to determine whether DM is strongly associated with specific MSK disorders or if other shared risk factors exist.\textsuperscript{22}

Although previous studies have shown promise, future studies are also needed to evaluate the role of OMT and analgesic use among patients with DM. Another limit of the Majjied et al study\textsuperscript{5} is that physical activity levels were not recorded. As discussed earlier, exercise is well established in the management and prevention of DM. Additionally, physical activity level can be a preventative measure or risk factor for certain MSK conditions. For example, prolonged immobilization is a known risk for shoulder capsulitis, and certain occupations with repetitive motions are linked with an increased risk for CTS.\textsuperscript{23,24} Physical activity is also a known preventative measure for the development of OA.\textsuperscript{25} Without controlling for physical activity level, the study’s ability to correlate DM with specific MSK conditions could be impacted. Further inquiries are needed to investigate the prevalence of MSK conditions in DM while controlling for physical activity.

**Conclusion**

A link between DM and certain MSK conditions has been identified in the literature. Studies have also shown that OMT can be effective in improving symptoms or reducing pain in these comorbid MSK conditions. Although promising research has been completed, further investigations are needed to establish the exact link between DM and MSK conditions because the role of HbA1c as an indicator for MSK abnormalities remains unclear. An understanding of the potential bidirectional relationship between DM and MSK disorders and the role of OMT may help guide the osteopathic physician in the appropriate application of OMT and exercise therapy for patients with DM. Increasing mobility and decreasing pain with OMT and exercise therapy can help patients with DM, and hopefully mitigate cardiovascular, neural, renal, visual, and MSK complications.

**Author Contributions**

All authors provided substantial contributions to conception and design, acquisition of data, or analysis and interpretation of data; all authors drafted the article or revised it critically for important intellectual content; all authors gave final approval of the version of the article to be published; and all authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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