Manual labor metacarpophalangeal arthropathy in a truck driver: a case report

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Abstract

Objective: The purpose of this study is to present an unusual and rarely described case of occupational hand arthropathy involving the metacarpophalangeal (MCP) joints.

Clinical Features: A 62-year-old male truck driver (of 35 years) presented to a chiropractic clinic with pain and stiffness along the third metacarpal and MCP joint of the left hand. Examination revealed severe pain and limited flexion at the third MCP joint. Bilateral radiographs demonstrated severe osteoarthritis (OA) of this joint in the left (nondominant) hand and mild-to-moderate (asymptomatic) OA in the same joint on the right. Results of laboratory blood tests were unremarkable for metabolic, inflammatory, or infectious joint disease.

Intervention and Outcome: The patient was diagnosed with bilateral, third MCP joint OA associated with manual labor. He was treated unsuccessfully with a short course of low-level laser therapy, MCP joint mobilization, and hand-stretching exercises. After 3½ years, the patient continues to work despite ongoing and worsening symptoms. Three serial left hand radiographs are presented, highlighting the progressive nature of this arthropathy.

Conclusion: The differential diagnosis in patients presenting with manual labor MCP joint OA should include hemochromatosis and calcium pyrophosphate dihydrate crystal deposition disease. Because of the increased risk of serious systemic disease, it is imperative that these latter 2 disorders are ruled out before the former is diagnosed.

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Introduction

Osteoarthritis (OA) is the most common form of arthritis and often affects the knees, hips, hands, feet, and spine.^{1,2} In the United States, the incidence of

radiographic OA for those aged at least 26 years (including data of the hands, knees, and hips) ranges from 13.8% to 37.4%.³ The incidence of symptomatic OA is lower, however, ranging from 4.9% to 16.7%. In general, OA becomes more prevalent with age, affecting the hands and knees of women more frequently than men, especially in those aged at least 50 years. Clinically, OA often presents with pain, morning stiffness, crepitus, deformity, and joint swelling or enlargement.⁴ Multiple factors interact to

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cause this disorder (Fig 1). Osteoarthritis is normally diagnosed through patient consultation and examination, whereas radiographs (if taken) can provide further objective evidence of the disease (Fig 2).

Traditional medical management of OA may include patient education about its natural and progressive course, lifestyle modifications, exercise prescription, pharmacologic treatment, and/or surgery (if necessary).⁴ Common pharmacologic agents used are acetaminophen, nonsteroidal anti-inflammatory drugs, aspirin, and cyclooxygenase-2 inhibitors. Intraarticular steroid injections are another treatment option, but should be used sparingly.⁵ Commonly used alternative therapies may include herbs, supplements (eg, glucosamine), ointments or topical rubs, and other nonpharmacologic modalities such as exercise, physical therapy (or chiropractic), acupuncture, electromagnets, transcutaneous electrical nerve stimulation, ultrasound, and low-level laser therapy (LLLT).⁶⁻⁹ Because of the prevalence of OA in the general population and because chiropractic practice often involves the treatment of musculoskeletal disorders, chiropractic physicians are bound to encounter many patients with OA. In a recent cross-sectional study of arthritis patients (in North Carolina),⁷ more than 20% of those with OA reported seeing a chiropractic doctor for treatment.

In the hand, the distal interphalangeal and proximal interphalangeal finger joints, and the first carpometacarpal joint of the thumb, are most often affected by OA; the metacarpophalangeal (MCP) joints are less

- Age older than 50
- Crystals in joint fluid or cartilage
- High bone mineral density
- History of immobilization
- Injury to the joint
- Joint hypermobility or instability
- Obesity (weight-bearing joints)
- Peripheral neuropathy
- Prolonged occupational or sports stress

Fig 1. Risk factors for OA.⁴

Fig 2. This diagram depicts the classic features of OA including joint subluxation, nonuniform joint space loss, intraarticular loose bodies, osteophyte formation, subchondral sclerosis, subchondral bone cysts (geodes), and articular deformity. (Source: Reprinted with permission from TR Yochum and LJ Rowe, *Essentials of Skeletal Radiology*, 2nd ed, p 804, JP Butler, ©1996 Williams & Wilkins.)

commonly involved.¹⁰ Secondary OA involving the MCP joints is common, however, in hemochromatosis and calcium pyrophosphate dihydrate (CPPD) crystal deposition disease.¹⁰⁻¹³ Hand OA in both disorders usually involves the second and third MCP joints, bilaterally. The “iron salute” (of hemochromatosis) can be used by clinicians as an efficient screening tool for MCP arthropathy (Fig 3).¹⁴

An occupational OA involving the MCP joints has also been described in manual laborers.¹⁵⁻¹⁷ This disorder—thought to be from heavy work involving sustained gripping with both hands—has been termed the *Missouri metacarpal syndrome*.¹⁵ Presented here is the first such case to be described in the chiropractic literature. A discussion on the importance of making this diagnosis and ruling out its differentials is also included in this report.

Case report

A 62-year-old white man presented with a 5-year history of insidious and progressive pain and stiffness in his left hand. The pain was located along the dorsal aspect of the third metacarpal and MCP joint. It was

Fig 3. The “iron salute.” Impaired flexion of the third MCP joint is evident in the left hand of this patient. The “iron salute” is a nonspecific indicator of MCP arthropathy and can be seen in patients with hemochromatosis or CPPD crystal deposition disease and, occasionally (as in this case), in otherwise healthy manual laborers.¹⁴

described as a dull ache, with an intermittent throbbing quality, and graded with a severity of 4 on a numeric rating scale of 10. Acetaminophen medication and rest were typically palliative, whereas repetitive use (eg, gripping) was provocative. The patient had worked for more than 35 years as a truck driver, averaging 53 hours per week (over a 4-day workweek). His job included both city and freeway driving. Previous radiographs of the left hand (from 2 years prior) showed moderate OA of the third MCP joint (Fig 4).

Shortly after developing left hand symptoms, the patient began using a self-prescribed handgrip-strengthening device. While truck driving, he performed multiple sets (alternating between each hand), squeezing the handgrip exerciser for up to 40 to 50 repetitions, every 3 to 4 hours. This exercise routine—an attempt by the patient to strengthen his left hand—was repeated every workday over the course of nearly 5 years. The patient discontinued using the handgrip

device just before presenting to the chiropractic clinic for care. Musculoskeletal history also included moderate-to-severe OA in other regions, including the lateral tibiofemoral joint of the right knee and the first metatarsophalangeal joint of the left foot, and spinal disk degeneration at C5-6 and L5-S1.

Examination of the left hand revealed bony enlargement, severe tenderness to palpation, and limited flexion of the third MCP joint (Fig 3). There were no signs of acute inflammation such as swelling, redness, or warmth. Result of upper extremity neurologic examination was unremarkable for motor, reflex, and sensory testing; handgrip strength (without using dynamometry) was graded 5/5, bilaterally. Radiographs were taken of the left hand, which then revealed severe OA of the third MCP joint (Fig 5). Subsequent radiographs of the patient’s right hand revealed mild-to-moderate OA, also of the third MCP joint (Fig 6).

Because isolated MCP joint OA is atypical for the hand, the patient was referred to his family physician for blood work to rule out other secondary causes (eg, hemochromatosis, rheumatoid arthritis, or infection). Laboratory results including serum ferritin, rheumatoid factor, and the erythrocyte sedimentation

Fig 4. Posteroanterior radiographic spot view of the patient’s left (nondominant) hand reveals moderate OA of the third MCP joint (arrow). Note the osteophyte formation along the margin of the metacarpal head of the third digit (arrowhead).

Fig 5. Posteroanterior radiographic spot view of the patient's left (nondominant) hand, 2 years after the initial radiograph in Fig 4, now reveals severe OA of the third MCP joint. Specific findings include (1) subchondral sclerosis, osteophytes, and subchondral cysts (or geodes) within the base of the proximal phalanx and metacarpal head of the third digit (arrowheads); (2) severe, nonuniform loss of the third MCP joint space (arrow); and (3) mild lateral subluxation of the proximal phalanx on the metacarpal of the third digit (crossed arrow).

rate were normal (or negative). Based on these findings and because of his history working as a truck driver, the patient was diagnosed with manual labor arthropathy involving the third MCP joints of both hands. In comparison with the initial radiographs (Fig 4), the patient's left hand MCP joint degeneration was also diagnosed as progressive.

The patient underwent a short course of left hand treatment including LLLT, MCP joint mobilization, and finger-stretching exercises. A pulsed, 905-nm near-infrared, indium gallium arsenide, class IIb laser probe was used for LLLT. On each office visit, the laser treatment was applied—with the laser probe held at 90° to the joint capsule—to 5 points over the dorsal and palmar aspects of the third MCP joint. Each point was irradiated for 2 minutes, at a power density of 10 W/cm², for a total treatment energy dose of 12 J per point. Manual treatment of the MCP joint, which preceded each laser treatment, included a rhythmic, traction-type mobilization (performed as

1 set of 10 repetitions). The patient was also prescribed a finger-stretching exercise, where all 5 finger and thumb pads of opposing hands were pressed together and slowly fanned out into extension and abduction (held for 15 seconds; 2 repetitions, 2-3 sets per day). The patient was treated 2 times per week for 3 weeks. Outcome measures used were numeric rating scale for pain, palpation examination, and visual estimation for range of motion.

After 3 weeks and a total of 6 treatments, overall pain severity, MCP joint tenderness, and range of motion remained unchanged. The patient experienced subjective, short-term relief only. Once resuming his work duties as a truck driver, the left hand symptoms returned. At that point, the author discontinued LLLT and mobilization treatment. The patient was instructed to continue performing finger-stretching exercises (as described above) on a daily basis and was referred to his family physician for reassessment.

After 3 ½ years, the patient continues to work 50+ hours per week (over 4 days) as a truck driver, despite ongoing and worsening pain symptoms. He no longer uses the handgrip-strengthening device; instead, he uses acetaminophen (as needed) to manage any severe episodes of left hand pain or stiffness. A third set of left

Fig 6. Posteroanterior radiographic spot view of the patient's right (dominant) hand, 2 years after the radiograph in Fig 4, reveals mild-to-moderate OA of the third MCP joint (arrow).

Fig 7. Posteroanterior radiographic spot view of the patient's left (nondominant) hand, 3½ years after the initial radiograph in Fig 4, shows further degeneration and remodeling of the third MCP joint. Note the “beak” osteophyte at the margin of the third metacarpal head (arrow), along with an articular loose body (arrowhead) and eburnation (crossed arrow) at the base of the third proximal phalanx.

hand radiographs has also been taken, which continues to show destructive arthropathy of the third MCP joint (Fig 7). The patient has given written consent to having his personal health information, including hand photo- and radiographs, published.

Discussion

The patient in this case did not benefit from 6 sessions (over 3 weeks) of LLLT and mobilization to the third MCP joint of the left hand. A discussion on the effectiveness (or lack thereof) of LLLT in treating OA, however, is beyond the scope of this article. Other authors have written more extensively on this topic.^{9,18,19} The primary purpose of this article was to present a case of MCP joint OA associated with a manual labor occupation and, in doing so, familiarize chiropractors with the so-called Missouri metacarpal syndrome.¹⁵ This article also serves to remind the chiropractic physician of the key differentials of MCP arthropathy, namely, hemochromatosis and CPPD crystal deposition disease.

Secondary causes of MCP arthropathy

Osteoarthritis of the hand typically affects interphalangeal finger joints and the carpometacarpal joint of the thumb.¹⁰ Isolated (and progressive) OA of MCP joints, as in this case, is less often described. For the chiropractic physician, the differential diagnosis of MCP joint OA should include secondary causes, such as hemochromatosis and CPPD crystal deposition disease.^{10,11} These 2 conditions commonly affect the hands and wrists and, in particular, the second and third MCP joints. Chiropractors can easily screen for this arthropathy by assessing patients for the “iron salute” (Fig 3). Of utmost importance, however, secondary causes must be ruled out because of their more serious, even systemic, sequelae that can result if not properly diagnosed (Fig 8).

Hemochromatosis, or iron overload, is a hereditary disorder of iron metabolism. Laboratory findings of elevated serum iron and ferritin support its diagnosis. Long-standing hemochromatosis leads to systemic iron deposition. This can result in severe dysfunction involving organs such as the liver (cirrhosis, with risk of hepatocellular carcinoma), pancreas (diabetes), skin (brown discoloration), and heart (cardiomyopathy)^{10,12}; therefore, early diagnosis and treatment are vital. Regular phlebotomy is the simplest method for removing excess iron and improving the prognosis in patients with hemochromatosis.

Calcium pyrophosphate dihydrate crystal deposition disease, or pseudogout, is frequently associated with

- Calcium deposition
- Congenital or developmental
- Endocrine
- Genetic defects
- Infectious
- Metabolic
- Neuropathic
- Post-traumatic
- Rheumatologic diseases (other than primary OA)

Fig 8. Secondary causes of OA.⁴

systemic disorders such as hyperparathyroidism, gout, and hemochromatosis.^{10,13} It is characterized by calcific deposits, which occur in multiple joints including the knees, wrists, MCP joints, hips, shoulders, elbows, ankles, pelvis, and spine. The prognosis is usually excellent when treated with the anti-inflammatory colchicine; however, severe destructive arthropathy resembling neuropathic (Charcot) joints may occur.¹³

Therefore, it is imperative that chiropractors rule out secondary causes in patients presenting with MCP joint OA. In this case study, the patient's serum ferritin level was normal; and there was no radiographic evidence of chondrocalcinosis. Rheumatoid arthritis, which also frequently involves the MCP joints,¹⁰ was ruled out as well because the patient's blood test results were negative for rheumatoid factor and the erythrocyte sedimentation rate was within normal limits.

Manual labor MCP arthropathy

To the author's knowledge, this is the first case of MCP arthropathy due to manual labor to be described in the chiropractic literature. Only a few other studies describing similar cases were found in PubMed.¹⁵⁻¹⁷ In a case series by Williams et al,¹⁵ all 7 patients studied were male manual laborers (farmers, truck drivers, heavy machine operators, and a mason). Their ages ranged from 51 to 72 years, and all had engaged in heavy labor involving their hands for between 31 to 50 years. Powerful gripping with both hands was commonly used at work and was hypothesized to be the major etiologic factor resulting in MCP joint degeneration. All patient radiographs revealed bilateral hand OA, particularly in the second and third MCP joints. The OA was asymmetric in 3 of these patients, where the right (dominant) hand was more severely involved. A similar pattern was found in a case involving a right-handed baker.¹⁷ The patient in the current case, also right-handed, demonstrated bilateral MCP degenerative changes; however, these changes were more severe in the left (nondominant) hand. Hand symptoms were also entirely left-sided; the right hand was asymptomatic.

As a truck driver (of 35 years), the patient in this case had used his right hand to shift gears and his left hand more often to steer. He drove both in the city—which involves a greater frequency of gear shifting—and on the freeway. Gripping a steering wheel may place more force across the MCP joints when compared with using the gearshift. Furthermore, the patient in this case

repeatedly used a handgrip exerciser while driving. Research of hand biomechanics has shown that there are much higher compressive forces in the proximal interphalangeal and MCP joints of the hand compared with the distal interphalangeal joints during grasping activities (eg, gripping a briefcase, holding a glass, or opening a jar).²⁰ This could help explain the MCP joint OA patterns seen in this case and others involving manual labor.

In a study investigating grip strength, Chaisson et al²¹ found a statistically significant association between higher handgrip strength and the development of MCP joint OA; this association was strongest in men. Among the group with the lowest measured grip strength, only 4% developed MCP joint OA; in the group with the highest grip strength, 11% developed it ($P < .05$ for trend). The authors of this study suggest that higher grip strength may lead to increased load across the joints' articular surfaces, thereby increasing joint damage. In the current case, therefore, the patient's attempt at increasing hand strength would have been counterproductive and likely contributed to the progressive MCP joint degeneration observed.

Limitations

Any conclusions based on this single case study are inherently limited. More research is needed to determine whether truck driving, particularly prolonged gripping of the steering wheel (vs using the gear shift), is a risk factor for developing OA of the MCP joints. There is also a paucity of literature showing the effectiveness of LLLT in the treatment of hand OA.¹⁸ Future research in this area should investigate the effects of various LLLT applications (eg, treatment frequency, location, duration, and dosage).

Conclusion

Presented here was an unusual case of severe, symptomatic third MCP joint OA in the left (nondominant) hand of a truck driver, along with mild-to-moderate (asymptomatic) OA in the same joint on the right. It is possible that truck driving for more than 35 years, repeatedly using a handgrip exerciser, and gripping the steering wheel on a daily basis (particularly with the left hand) may have led to this atypical pattern of hand OA. Patients with higher handgrip strength, combined with years of manual labor involving prolonged hand-gripping tasks, have been shown to be at increased risk for developing MCP joint

OA. Moreover, if these patients continue to work despite ongoing or worsening pain symptoms, they may risk developing more progressive and destructive MCP arthropathy. In reaching the correct diagnosis, clinicians must also rule out other secondary causes, particularly ones with more serious and potentially systemic sequelae. The chiropractic physician's differential diagnosis in these patients should include hemochromatosis and CPPD crystal deposition disease, in addition to manual labor arthropathy.

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