

Prolotherapy in the Treatment of Foot Problems

To the Editor:

The idea of inducing inflammation of a joint and adjacent structures to allow for the proliferation of scar tissue in an effort to stabilize a joint is not a new one. In the fifth century BC, Hippocrates supposedly treated separated shoulders by cauterizing areas of the shoulder to promote axillary scarring. Sclerotherapy, the injection of areas around the enthesis with an inflammatory agent to promote tensile strength and increase the size of adjacent ligaments, has been used in one form or another since the 1950s in the treatment of arthritic conditions of the back and peripheral joints as well as hernias.

Sclerotherapy for hypermobile joints works by strengthening opposing ligament structures. This is similar to strengthening the abdominal muscles when treating low-back problems. Sclerosants are available in various forms and combinations of glucose, glycerine and phenol, morrhuate sodium, polidocanol (hydroxy-polyethoxy-dodecane), and zinc sulfate. An anesthetic is often used in conjunction with the sclerosant to minimize initial discomfort from the injection.^{1,2}

In order to understand how sclerosants work, it is important to know how the treated joint was weakened. In an arthritic joint, the pain is due to an inflammatory response to the degenerating joint. Corticosteroid injections can decrease the inflammation, but they do not address the degeneration of the joint. If degeneration of the adjacent tissues continues, the joint can lapse into hypermobility, resulting in pain. Hypermobility can be treated with a sclerosing agent used in prolotherapy.^{1,2}

Histologic studies have shown that an inflammatory response to the sclerosant reaches a peak within 24 hours and subsides at 48 hours. Fibroblast formation that occurs at 3 days precedes the eventual collagen formation at 7 days. Dense fibrous tissues adjacent to the joints are seen at 8 weeks.¹

In a study of rabbit ligaments injected with a 5% morrhuate sodium solution and a control group injected with sterile saline solution, Liu et al³ found a substantial difference in mean fibril diameters of injected ligaments (129.9 nm for morrhuate sodium-injected ligaments *versus* 83.2 nm for controls). Under

electron microscopy, collagen fibrils were more densely packed and of a more uniform size in the sclerosed ligaments as compared with the controls. An increase in tensile strength was evident in the sclerosed ligaments as compared with the control ligaments. Therefore, by strengthening adjacent ligaments and decreasing movement at painful joints, painful joint degeneration may be controlled.³

Podiatric Applications

Hypermobility of joints in the foot can be a difficult problem to treat and can be the primary factor in recurrent capsulitis, heel pain, and metatarsalgia. This condition sometimes responds to strapping, orthotic devices, and a decrease in overall activity. However, a decrease in activity can lead to further hypermobility, with ligament repair facilitated by mechanical stimulation and stress. If strapping and orthotic therapy do not relieve persistent pain secondary to joint hypermobility, prolotherapy can be an alternative treatment. By strengthening tissue structures adjacent to the joint, the joint is rendered slightly more immobile, thereby decreasing accumulation of inflammatory aggregates and preventing pain.

Case 1

A 52-year-old woman presented with a complaint of pain in the right foot, which had become worse despite oral nonsteroidal anti-inflammatory drug treatment for the previous 8 weeks. The patient's neurologic and vascular status were normal. Pain was elicited at the right calcaneocuboid joint on palpation and passive range of motion. The biomechanical examination revealed slight pronation of the calcaneocuboid joint even with the forefoot supinated.

Subsequent corticosteroid injections, strapping therapy, orthoses, and physical therapy (consisting of hydrotherapy, iontophoresis, ultrasound heat therapy, and electrical stimulation twice weekly for 6 weeks) proved to be minimally successful.

Prolotherapy was initiated as an alternative to surgery. The patient received 3 mL of a 1:1 mixture of 5% dextrose and 0.5% bupivacaine with epinephrine injected into the calcaneocuboid joint and adjacent soft-tissue structures. Phenol was not used because of its possible neurolytic action. The patient received a total of three injections to the same joint area at 2-week intervals. She experienced discomfort through-

out the treatment; 2 weeks after the third injection, however, she was much improved. No pain was elicited on palpation of the calcaneocuboid joint, and there was no pronation with the forefoot supinated. The patient was discharged with orthotic therapy.

Case 2

A 58-year-old woman presented with a complaint of a painful left heel. Physical examination revealed an overweight individual with a history of polyarthritic symptoms. Radiographs revealed a plantar calcaneal spur and some early arthritic changes in the rearfoot. The patient was treated for symptoms of plantar fasciitis with ultrasound heat therapy, iontophoresis, and electrical stimulation. Following several physical therapy sessions, she felt a "pop" in her foot while walking. She presented to the office with an exquisitely tender swelling at the insertion of the abductor hallucis muscle at the left heel. Radiographs showed increased soft-tissue density and a possible deficit in confluence of the soft tissue in the area of the plantar musculature at the level of Chopart's joint. Corticosteroid injections, physical therapy, and immobilization with Unna boots, CAM Walkers (Zinco Industries, Inc, Pasadena, California), and strapping did not improve her symptoms, which were suspected to be due to a partial tear of the plantar fascia and resultant myositis. It was decided to begin prolotherapy for suspected plantar fascial rupture.

As before, 3 mL of a 1:1 mixture of 5% dextrose and 0.5% bupivacaine with epinephrine was injected into the area of the rupture and adjacent areas. Three injections were administered at 2-week intervals. The patient eventually improved. However, it is difficult to determine whether the improvement was due to the prolotherapy or the physical therapy. The patient felt strongly that improvement began shortly after the third injection. The swelling and pain at the plantar aspect of the heel eventually decreased. Unfortunately, no magnetic resonance images were obtained before or after the prolotherapy to determine the extent of the rupture and the degree of healing.

Case 3

A 62-year-old woman presented with a complaint of pain in her right heel. Radiographs revealed an enlarged medial tubercle of the calcaneus with some periosteal tufts indicative of possible rheumatic involvement. The patient was treated with three corticosteroid injections and twice-weekly physical therapy for 3 weeks. Physical therapy included ultrasound heat therapy, iontophoresis, electrical stimulation,

and hydrotherapy. Posterior night splints were applied to prevent symptoms of plantar fasciitis secondary to nocturnal contracture. Strapping and temporary orthoses were also used as adjunctive therapy.

The patient's symptoms were minimally improved following a 3-week course of the above-mentioned treatment, and surgery was considered. The patient, however, refused surgery and requested other treatment options. Prolotherapy was decided on to strengthen adjacent ligaments and the insertion of plantar musculature as a means of preventing excessive motion at the area of inflammation. Again, treatment consisted of injection of 3 mL of a 1:1 mixture of 5% dextrose and 0.5% bupivacaine with epinephrine into the heel; three injections were administered at 2-week intervals.

The patient's symptoms did not improve, however, and she eventually was lost to follow-up. Further rheumatoid arthritis profiles revealed possible rheumatic inflammatory involvement that could not be addressed by prolotherapy.

Case 4

A 57-year-old woman complained of an iatrogenic floppy second right toe. Physical examination revealed a loose second right interphalangeal joint with excessive space between bony articulations within the area. Plantarflexion and dorsiflexion were noted to be about 90°. The patient's digit was treated with the same solution and intervals of injection as described above. Injections were administered specifically to the articulating bony surfaces in an effort to induce an inflammatory reaction that would produce fibrotic changes leading to reduction of joint mobility. Minimal correction was achieved. At the patient's 3-month follow-up examination, the digit exhibited 70° of plantarflexion and 50° of dorsiflexion.

Conclusion

The symptoms of the patient in Case 1 were much improved with prolotherapy. An increase in ligament strength was probably responsible for the decrease in pronation of the calcaneocuboid joint. In this case, it was probably the effect of the prolotherapy treatment on the adjacent ligaments that improved the patient's hypermobility. In Case 2, prolotherapy was probably the primary reason for the patient's improved ambulation; it is unlikely that physical therapy would have actually repaired the fascial tear. The prolotherapy treatment probably repaired some of the muscular attachments. The patient in Case 3 did not improve with prolotherapy, as the symptoms

were due to an inflammatory condition that was not caused by hypermobility. Future studies with magnetic resonance imaging documentation of ligaments before and after injections should be performed to determine the true effect of this treatment on joints and entheses of the human foot. The lack of response to treatment in Case 4 was probably due to the large gap between the bones in the floppy joint. The prolotherapy injections probably could not induce enough fibrotic tissue formation in such a large joint space to immobilize the joint.

Other possibilities exist for use of prolotherapy in the foot, including in the treatment of sprains, strains, fascial tears, overload injury, recalcitrant tendinitis, and bursitis. Prolotherapy has even been used for recalcitrant heel spurs (Steve Smith, DPM, personal communication, 1999). Prolotherapy is a safe and practical treatment option for hypermobile joints of the foot and ankle and a possible alternative to surgery for minimally hypermobile joints that cause persistent pain.

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