

# Whiplash Injury and Other Ligamentous Headache—Its Management With Prolotherapy\*

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**H** EADACHE occurs frequently as an annoying and often disabling symptom following a so-called "whiplash injury." It may persist, either as an intermittent pain, or a constant pain, even for years after the injury. Many of the long-term headache sufferers have accepted the gamut of proffered treatments, ranging from medications (analgesics, muscle relaxants, sedatives, antidepressants, vasodilators, vasoconstrictors, antiserotonins, glucocorticoids), through a variety of forms of physical therapy, neck braces and collars, local anesthetic infiltrations, various nerve blocks, occasional rhizotomies, occipital neurectomies, cervical laminectomies, intervertebral disc excisions, posterior fusions, and now anterior fusions.

When the patient does not improve following these forms of therapy, and many do not, then he is tagged as having a "functional overlay" or a "compensation neurosis," terms frequently effective in stifling further evaluation of treatment. We feel quite strongly that the failure of a patient

to respond to the physician's honest therapeutic efforts should make the physician question the efficacy of his forms of treatment, and not the patient's integrity. Arthur Steindler<sup>1</sup> phrased this admonition more effectively: "The examining physician has, of course, no absolute judgment on the existence of pain as such. He can, however, form an opinion as to the plausibility of the patient's complaints, provided he is broadminded enough to make due allowance for individual psychic reactions and does not arrogate to himself the opinion that what he cannot explain is non-existent."

The two-fold purpose of this report is to offer an explanation for these and related types of headaches, and to present a method of treatment that has been generally quite successful: prolotherapy.<sup>2</sup> Prolotherapy induces the production of new fibrous tissue and bone cells at the site of ligament and tendon attachments to bone by the injection of proliferant or sclerosing solutions *against bone* (Fig. 1).

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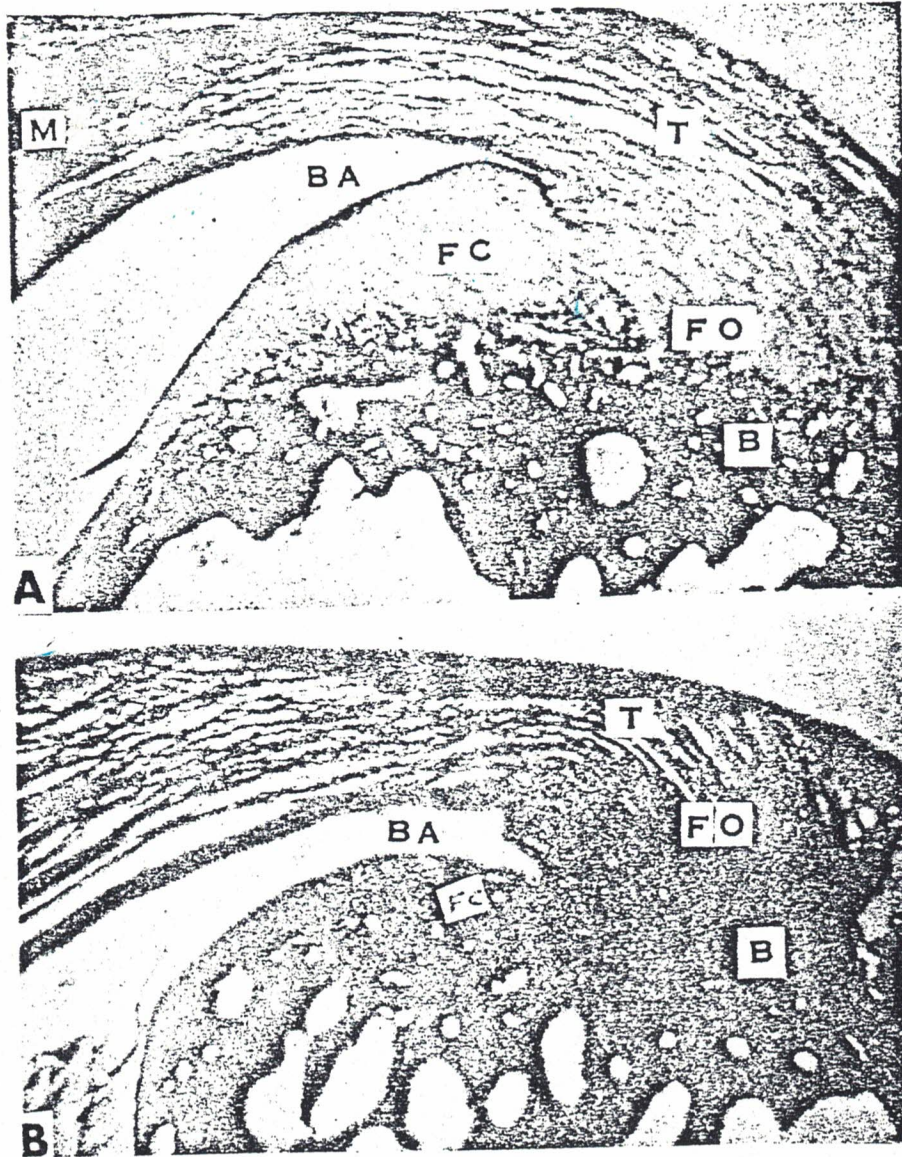


Fig. 1. Photomicrographs of Induced Fibro-osseous Proliferation. Bone-B, Tendon-T, Muscle-M, Fibro-osseous junction-FO, Fibro-cartilage-FC, Bursal Area-BA.

Photomicrographs of decalcified Achilles tendon attachments to the tibio-tarsal bones of a rabbit, two months after 1 injection of 0.5 cc. of a proliferating solution was made into the right leg (B). The injection was made against bone within the fibro-osseous attachment of the tendon. The control left leg (A) was not injected.

A. Control leg (above).

The tendon fibers (T) blend with the periosteum and continue into bone (B). They are firmly attached by calcification which extends outward into the fibro-osseous junction (FO).

B. Injected leg (below).

Proliferated new bone cells increase bone density (B), extend outward and increase the area and density of the fibro-osseous junction (FO), and encroach on the fibro-cartilage (FC) and bursal area (BA), without penetrating the tendon capsular sheath. The fibro-osseous conjunction is strengthened.

### *Anatomy and Physiology of the Injury*

In most instances of whiplash, or rather, occipitocervical injuries, the traumatic force exhausts itself in injury to the soft-tissue structures, without skeletal lesions, hence presenting no X-ray evidence of trauma. In the scale of pain sensitivity, periosteum ranks first, followed by ligaments, fibrous capsular structures, tendon, fascia, and finally muscle.<sup>3</sup>

Articular cartilage contains no sensory nerve endings; they are present, but scarce, in cancellous bone marrow.<sup>1</sup> "Bone pain" due to trauma is especially distinct at the points of attachment of tendons and ligaments to bone, with the greatest tenderness elicited at ligament origins and insertions.<sup>1</sup> Hackett states that the stretching or tearing of the fibers occurs principally at the attachment of ligament to bone, which he calls the fibro-osseous junction.<sup>2</sup> These collagenous perforating fibers, known as Sharpey's fibers, run perpendicular to the bony surface. Tensile strength is diminished where the collagenous fibers separate to enter the "pores" of bone, so to speak, and this is where injury is most frequent. The symptom of pain occurs when normal tension on an injured ligament stretches the relaxed ligament fibers, resulting in abnormal stimulation of the sensory nerves because the nerve fibers do not stretch.

When normal healing occurs, bone and fibrous tissue proliferate at the fibro-osseous junction. Interference with normal healing, due to motion at the site of injury or to a deficient healing capacity, results in a weak attachment, designated as ligament relaxation. Normal healing time for the injured soft tissues under discussion is three to four weeks, with an additional equivalent time period for further maturing and strengthening of the fibro-osseous bond. Thus, spontaneous repair that has not occurred 1½ to 2 months post-injury is not likely to occur later.

Leriche<sup>4</sup> emphasized that trauma causes a vasomotor response with a reactive hyperemia and edema. Wolff and Wolf<sup>5</sup> have found that hyperemia and inflammation lower the pain threshold so that minor,

ordinarily non-noxious stimuli applied to inflamed areas frequently produce pain. Stiffness and protective muscle spasm, while instituted as a protection against movement in painful conditions, often becomes a source of additional pain, due to the unphysiological degree of contraction itself, as in muscle cramps, or because of ischemia.<sup>1</sup> Wolff and Wolf<sup>5</sup> note that a most frequently encountered headache mechanism is that associated with sustained skeletal muscle contraction, involving chiefly neck muscles attached to the occipital region and vertex. This can occur in many long-standing headache cases of non-traumatic origin, too.

What is now called the Barré-Lieou syndrome, first described in 1926, is based upon the anatomic connections existing between the somatic and sympathetic systems of the cervical region.<sup>6</sup> While cervical arthritic changes can be responsible for the symptoms, they are just as likely to appear in the wake of minor injuries of the cervical spine.<sup>1</sup> The syndrome can give rise to many signs and symptoms, including pain reaching almost any part of the head and neck, visual blurring with ciliary spasm, mydriasis, dizziness, loss of balance, tinnitus, lacrimation, salivation, rhinorrhea, dysphagia, nausea, vomiting, forgetfulness, nervousness, swelling and stiffness of the fingers. Such symptoms are too frequently considered functional, or amenable to treatment by a "cash transfusion." They occur, however, just as frequently in occipito-cervical injury cases where there is no possibility of personal gain to the patient.

It has long been known that irritation, or injury, if you will, of soft tissue attachments to bone can produce referral of pain to distant areas,<sup>7</sup> muscle spasm, hypalgesia and autonomic system phenomena.<sup>8</sup> Inman and Saunders<sup>9</sup> coined the term "sclerotic" to describe these predictable pain patterns, which do not follow the better known dermatome patterns. Hackett<sup>2</sup> has made many useful contributions to the mapping of such pain patterns, and particularly to evolving a valuable form of treatment, prolotherapy (Fig. 2).

# OCCIPITO-CERVICAL DISABILITY

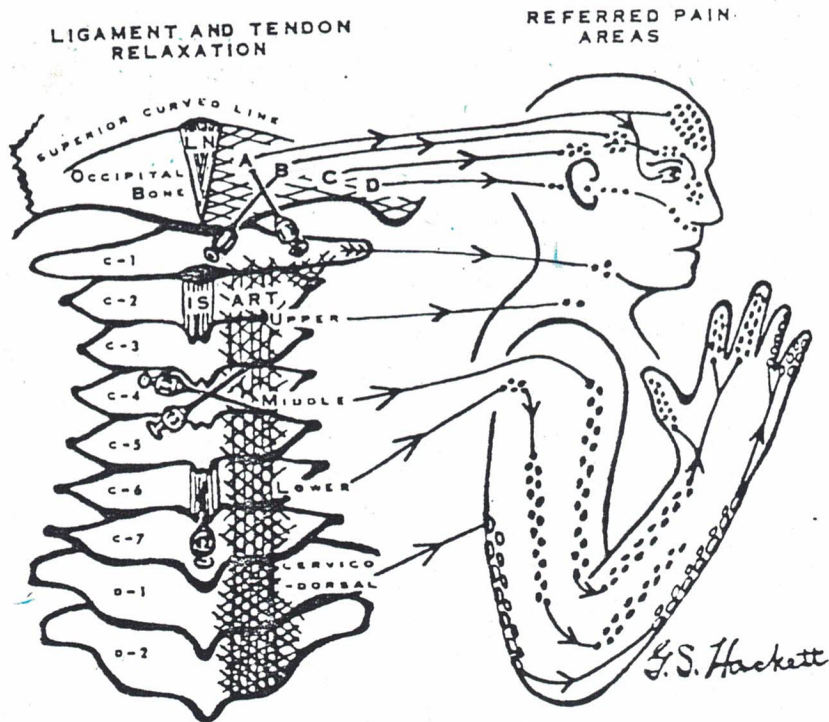


Fig. 2. Pain in the head, face and headache have their origin in weak fibro-osseous attachments of tendons to the occipital bone (A, B, C, D) when weak fibers yield under normal tension and permit tension-overstimulation of cervical spinal sensory nerves. Much pain in the arm and hand is from weak attachments of ligaments and tendons to the cervical and upper dorsal vertebrae.

Each pain area is almost always constant for a specific location of origin in all individuals, and is extremely valuable in diagnosis.

It is quite likely that the majority of occipito-cervical injuries are minor and heal satisfactorily with little or no attention paid to them. What the physician sees in his office is the sampling error representing patients with more severe injury and disability. Even among this group, many will recover while comfort is achieved with the help of neck supports, anodynes, muscle relaxants, proteolytic enzymes and various modalities of physical therapy. Many patients, however, remain disabled despite such treatment, with persistent pain as the presenting symptom in all of them.

### *Background of Prolotherapy*

Hackett's initial monograph appeared early in 1956, detailing his 16 years of

experience in injecting ligaments and tendons (mostly, at that time, in the low back) with a solution of sodium psylliate (used for decades in undiluted form to fibrose varicosities) plus a local anesthetic agent. Not only was pain relieved, but proliferation of new fibrous tissue cells and bone was induced, and the "weld" of soft tissue to bone strengthened. By his 3rd edition, in 1958,<sup>2</sup> the applicability of prolotherapy had widened to include ligament and tendon relaxation involving virtually any part of the musculoskeletal system. Proliferant solutions have improved, too. Currently, most of us are using a dextrose proliferant stock solution containing 2.5% phenol, 25% glucose and 25% propylene

glycol in sterile water. This is diluted 1:2 with 1% aqueous xylocaine or 0.15% pontocaine. Efforts to find more effective (while remaining safe) proliferant solutions are still being made by Hackett<sup>10,11</sup> at the Animal Laboratory of the Timken Mercy Hospital, Canton, Ohio. Of importance is his finding that the addition of any parenteral glucocorticoid to the proliferant solutions will inhibit new tissue formation completely.

#### *Technic of Injection*

The main factor determining the number of injections required to relieve pain is the number of trigger points found by the examining physician. It is necessary to elicit tenderness at the bony attachments of soft tissues carefully and thoroughly. The trigger points are mapped out and marked on the skin by pen or eyebrow pencil. This can be done with the patient prone and with a pillow under the chest, distal to the

chin, with neck flexed, or with the patient sitting backwards astride a chair with neck flexed. Each interspinous ligament must be palpated, as must the articular ligament areas, the accessible tips of the transverse processes, the suboccipital triangles, the superior border of the spine of the scapula, the superomedial angle of the scapula (Fig. 3), the clavicular attachments of the trapezius and sternomastoid muscles (Fig. 4). Such an examination takes time and must be done methodically to be of value both for accurate anatomical diagnosis and for treatment.

A basic phenomenon of pain, early noted by Hippocrates,<sup>5</sup> complicates the picture somewhat. The existence of one pain raises the threshold for perception of another. Thus, in the presence of multiple injuries, the patient's greater pains will eclipse his lesser pains. Frequently he will become aware of the latter only after the former are relieved.

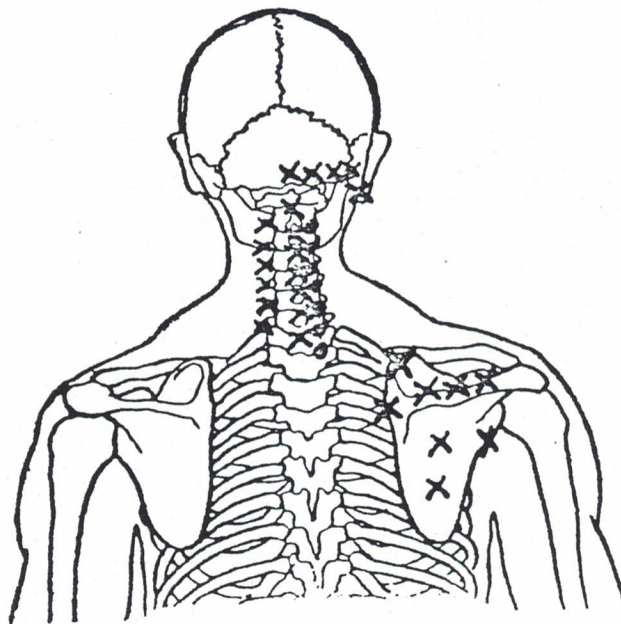


Fig. 3. Trigger points frequently found in examination of prone patient. Usually, not all are present in any one patient. X marks most trigger points. Dot is used to mark laminar and articular ligament trigger points.

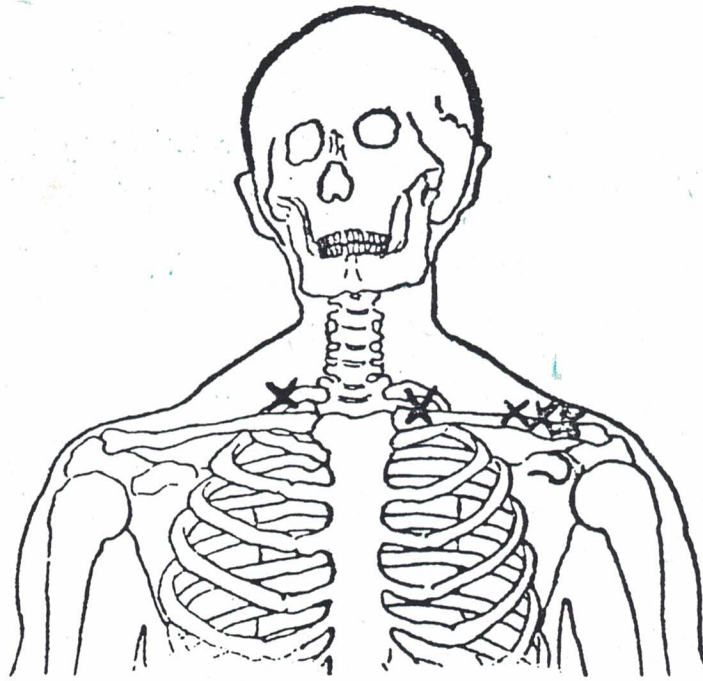


Fig. 4. These trigger points, at scalenus, sternomastoid, and trapezius insertions, should be sought with the patient supine.

This is true of tenderness, too. As treatment proceeds over a period of several visits, trigger points may be found later that could not be elicited initially. Unless these are taken care of, too, an inadequately treated patient may be dismissed as a poor result.

Each trigger area is injected with 1 to 3 c.c. of proliferant-anesthetic solution with a multiple puncture technic, that is, fanning out with the needle through each single skin puncture and depositing a few drops of the solution at each fibro-osseous junction where the needle tip reproduces pain, and often the pattern of pain referral. Of greatest importance is the point that *the needle tip must be in contact with bone* before any injection is made. There are no blood vessels or nerves of any size or importance at the fibro-osseous junctions of ligaments and tendons, and intrathecal injections will be avoided. Generally a 1½-inch, 22-gauge needle on a 10-c.c. Luer Lok syringe is adequate, even in well-upholstered patients. Pain is reproduced

momentarily at the time of injection, then disappears rapidly. Arbitrarily, I (D.O.K.) administer no more than 30 c.c. of proliferant solution at any one visit. Repeat injections are infrequent but may be required occasionally six to eight weeks after the initial injections. If one wishes, fewer injections may be given initially until the patient becomes used to the procedure.

#### Case Material

In this study, 264 headache patients were treated by prolotherapy in four widely separated areas of the United States. All of my own cases (D.O.K.), a total of 143, were taken from a previous study I made of 190 whiplash neck injury patients. The 143 cases represented 75% of the neck injury group in which headache was a prominent symptom. Although this presentation is confined to headache, it is important to realize that in 81% of the 190 whiplash cases, the injuries were not limited to the occipito-cervical area and re-

quired prolotherapy to the thoracic, lumbosacral and pelvic areas as well. One should not, like Salomé, center attention on the head alone.

In our 264 patients, 78% (206) had headaches of traumatic origin, and 22% (58) were non-traumatic. The latter group includes cervical arthritis of various types, migraine, tension headaches, histamine and other vascular headaches, neuralgic headaches, and headaches considered to be of functional origin.

The sex and age distribution of 39% (102) males and 61% (162) females may have a significance. If so, it escapes me. Age distribution follows a bell curve, varying from 13 years to 83 years, averaging about 42 years. In addition to the presenting symptom of headache, 84% (212) had neck symptoms: pain, stiffness, limitation of active motion; 56% had symptoms described earlier as the Barré-Lieou syndrome and indicative of cervical sympathetic system irritation.

All patients received other forms of treatment before prolotherapy was started.

An astonishing 46% (120) of the group had their symptoms over one year before prolotherapy was begun. This ranged up to 40 years and averaged between four and five years; 86% had symptoms longer than one month. The 14% in which prolotherapy was started earlier were chiefly patients in the traumatic group where pain was overwhelming.

Seventy-two per cent (189) of the patients completed their prolotherapy in 1 to 5 series of infiltrations; 20% (53) in 6 to 10 series; and 8% (22) in 11 to 20 sessions; 88% (233) were handled as office patients; 12% (31) were hospitalized for intensive treatment.

Pre- and post-injection medications were required generally with the earlier proliferant solutions containing sylvasol or zinc sulfate. Various combinations of anodynes, sedatives, and anti-emetics were used. The dextrose proliferant now employed by all of us is much gentler, and pre-medication can often be omitted. Afterwards, salicylates, codeine and its derivatives, or synthetic anodynes are generally adequate.

Nausea with or without vomiting is not infrequent as an autonomic system symptom following injury or irritation at any fibro-osseous injection. Anti-emetics such as belladonna derivatives, torecan, compazine and trilacon are useful here. After initial pain relief, which occurs in two to three minutes, many patients have temporary reactions such as soreness coming on in a few hours and lasting several hours to a few days, neck stiffness, mild vertigo. On the other hand, many patients have absolutely no side effects. There have been no deleterious complications whatsoever, and no infections.

The follow-up period in these patients is: 20% (52) up to 6 months; 20% (52) 6 months to 1 year; 16% (41) 1 to 2 years; 17% (45) 2 to 3 years; and 27% (72) 3 to 5 years.

The results of treatment are defined as follows: excellent equals no residual symptoms or signs; good equals no headaches, but some residual mild, non-disabling symptoms, such as tinnitus or paresthesias; fair equals occasional headaches, plus associated mild, non-disabling symptoms; poor equals no pain relief and no improvement at all.

In the 206 traumatic headache patients, 63% had excellent results, 16% good results, 10% fair, and 11% poor. According to the definitions, then, 79% were completely relieved of headaches. All of us have found that we learn from each patient, and improve our diagnostic acumen and therapeutic technics with further experience. In my own group of patients, all traumatic, the last patient with a poor end result was treated in April, 1959.

In the 56 non-traumatic headache cases, 29% had excellent results; 18% good results (or 47% completely relieved of headaches); 35% fair and 18% poor results. Of significance in this group is the point that fibro-osseous junction relaxation may well become an important factor in considering the approach to treatment of long-standing headache problems even where trauma plays no part as a causative element.

### Summary

Prolotherapy is offered as the treatment of choice for patients still bothered by headaches and associated annoying symptoms a month or so after sustaining occipito-cervical injuries. It is often a most useful form of adjunctive therapy for long-standing headaches of non-traumatic origin. Prolotherapy stimulates the production of new fibrous tissue and bone cells at the site of predilection both for injuries and for ligament/tendon relaxation following sustained muscle spasm: the fibro-osseous junction. The strengthening of the "weld" here occurs over a period of 6 to 8 weeks following the intraligamentous injection *against bone* of a proliferant solution which is described. The anatomy and physiology of the frequently widespread symptoms following occipito-cervical injuries are described.

Two hundred and sixty-four patients were treated by this method; 78% had headaches of traumatic origin; 56% had associated sympathetic (Barré-Lieou) symptoms; 86% had symptoms longer than 1 month and 46% for over 1 year when prolotherapy was begun. In the traumatic group, results were satisfactory in 79%, with a rating of excellent in 60%. In the 56 non-traumatic cases, 47% were satisfactory; 29% excellent. Sixty per cent of the cases were followed over 1 year (27% for 3 to 5 years). To date, no infections, complications, or other deleterious effects have occurred following prolotherapy.

Presented by Dr. Kayfetz, 91 West 10 Street, Pittsburg, California.

### Discussion

Following this paper Dr. Blumenthal stated that everyone should not go right out and start sticking needles in everyone. He stated to prevent nausea and vomiting

that occurs from treatment he prescribes 25 mg. Phenergan and an oral tablet—Torecan. Dr. Blumenthal recommends a suppository for the patient who has had too much medication.

Dr. Dronin of California expressed an opinion that whiplash caused a trigger mechanism for typical migraine. When whiplash is controlled the migraine is cleared up as well.

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