

PROLOTHERAPY

- ⦿ **Definition:** A method of injection treatment designed to stimulate healing
- ⦿ **Term first used by Dr. George Hackett in the 1950's**

PROLOTHERAPY

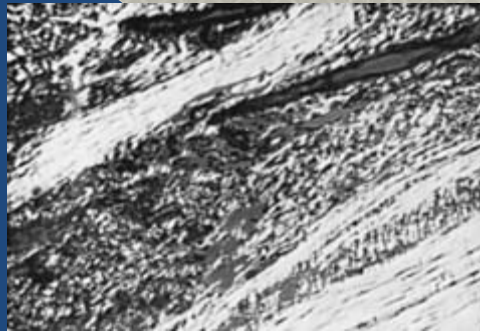
- ◎ THEORY: chronic musculoskeletal pain is secondary to inadequate repair of fibrous tissue
 - > By injecting an “irritant” solution, fibroblastic stimulation occurs, and healing is encouraged

PROLOTHERAPY

◎ LIGAMENTS:

- › Ligaments consist of dense and flexible fibrous connective tissue that stabilizes joints and supports them through their full range of motion.

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Adjacent to normal ligament tissue, immature collagenous tissue with thin, irregularly oriented fiber bundles 10 weeks after trauma (H&E stain, polarized light).

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- Ligaments are bradytrophic tissues, and therefore phases of wound healing are modified. In the inflammatory phase, macrophages phagocytose necrotic ligament tissue and cellular debris and secrete an angiogenetic factor. This process is followed by an ingrowth of capillary buds into the ligament wound. The predominating fibroblast is actively engaged in both degradation and synthesis of collagen. The majority of newly formed collagen is initially type III, which reinforces the first framework of granulation tissue. Type I collagen appears later in the wound and in a smaller proportion than normal. Glycosaminoglycans are markedly increased within the newly formed extracellular matrix and the fibronectin content is also higher. Fibronectin can be crosslinked to fibrin, to fibrinogen, and to collagen, which enables cell receptors to bind to the fibronectin–collagen complex. This mechanism promotes spreading of fibroblasts into the wound. Because of the poor vascularity of ligaments, this initial inflammatory phase takes longer than in wound healing. After the first week, the process of revascularization forms a diffuse vascular network. Collagen synthesis increases and peaks early in this proliferative phase but remains elevated for a long period. Macrophages are still apparent, but fibroblasts are the predominant cell type .

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- The newly formed bundles of collagen fibers are initially disorganized (irregularly oriented), The collagenous bundles gradually become arranged along the stress axis of the ligament and the scar tissue becomes less cellular. These changes are responsible for the increasing tensile strength of the matrix. In the scar remodeling phase, a gradual morphologic transition with further decrease in cellularity and in synthetic activity of the fibroblasts can be seen. The extracellular matrix becomes better organized, the bundles of collagen fibers appear more closely packed, and the vascularity of the scar tissue is decreased .

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- The scar matrix in a ligament gradually matures over a period of months to tissue that becomes highly organized and remodeled and closely resembles ligament tissue macroscopically . However, the scar matrix always remains slightly disorganized and hypercellular on microscopic examination. The amount of scar formation depends on local and systemic factors such as mechanical stress, oxygen tension, and pH, all of which differ between extra-articular and intra-articular ligaments. The rehabilitation conditions, such as immobilization or early mobilization, the amount of weight bearing, and functional stress, influence the appearance and the biomechanical properties of ligaments.

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- Several studies showed that early motion has a beneficial effect on ligament function. The mechanical stress applied by the functional load improves the reorientation of the collagen fiber bundles and increases the fibril size and density. Immobilization, on the contrary, is followed by a protracted state of catabolism within the ligament, and degradation of the structural matrix leads to progressive atrophy and lack of mechanical strength.

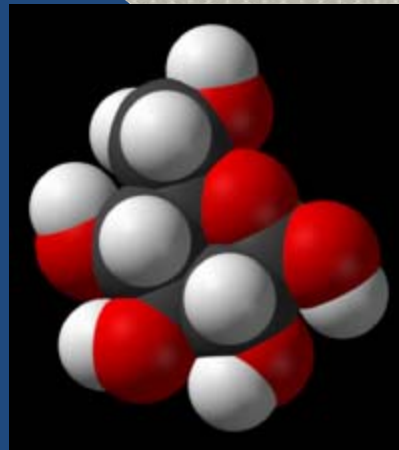
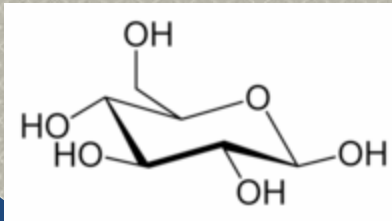
◎ Proliferants:

- Osmotics: cause outflow of water from cells into the injection site, causing significant but localized cellular trauma. Cell injury and death results in release of compounds which attract granulocytes and macrophages. A “wound healing” cascade is initiated.
- Glucose (Glc), a monosaccharide (or simple sugar), is an important carbohydrate in biology and commonly used in prolotherapy.

PROLOTHERAPY

Glucose

Dextrose



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◎ CHEMOTACTICS:

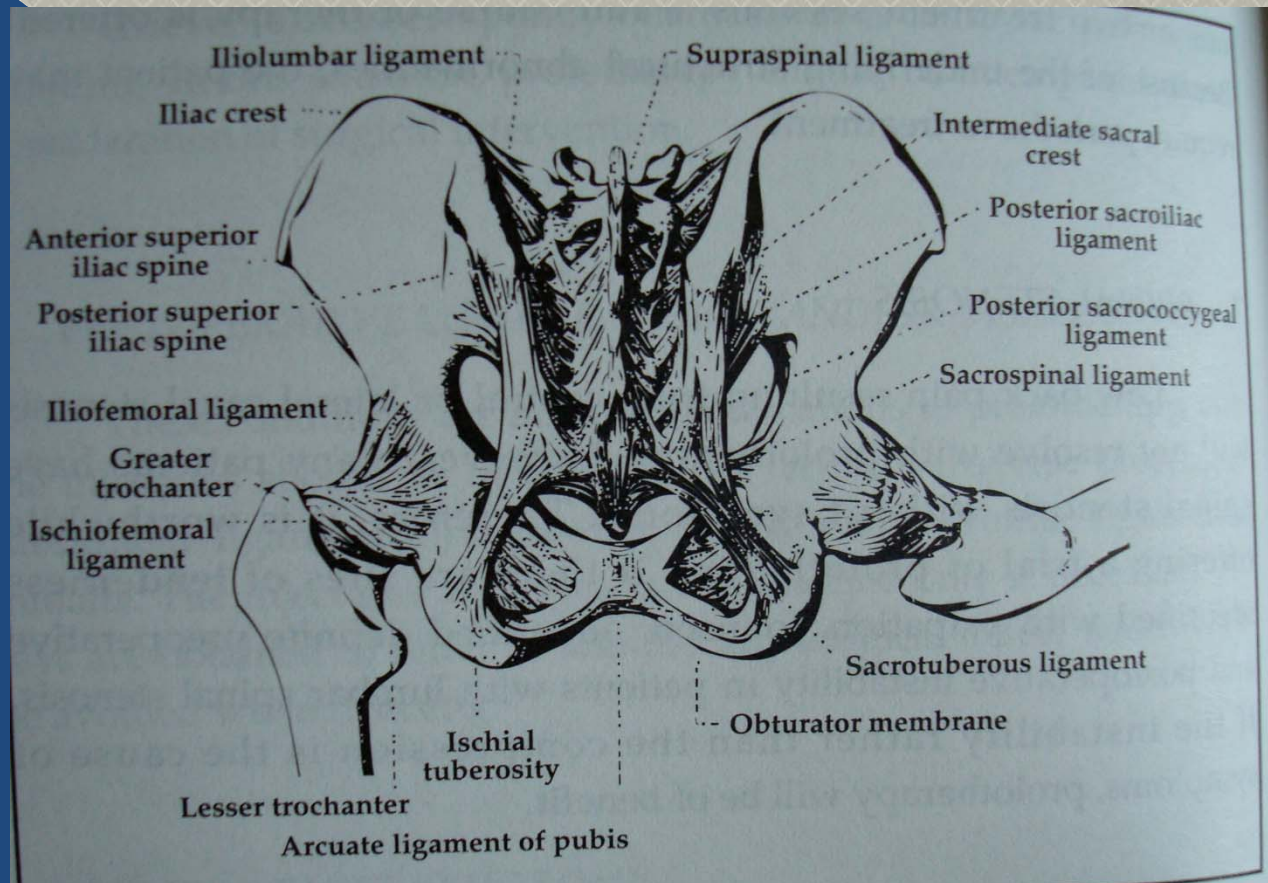
- > Sodium morrhuate: compound derived from cod liver oil– cold water fish oils are rich in polyunsaturated fatty acids which are direct biosynthetic precursors to the mediators of inflammation (prostaglandins, leukotrienes, and thromboxanes)

PROLOOTHERAPY

◎ IRRITANTS:

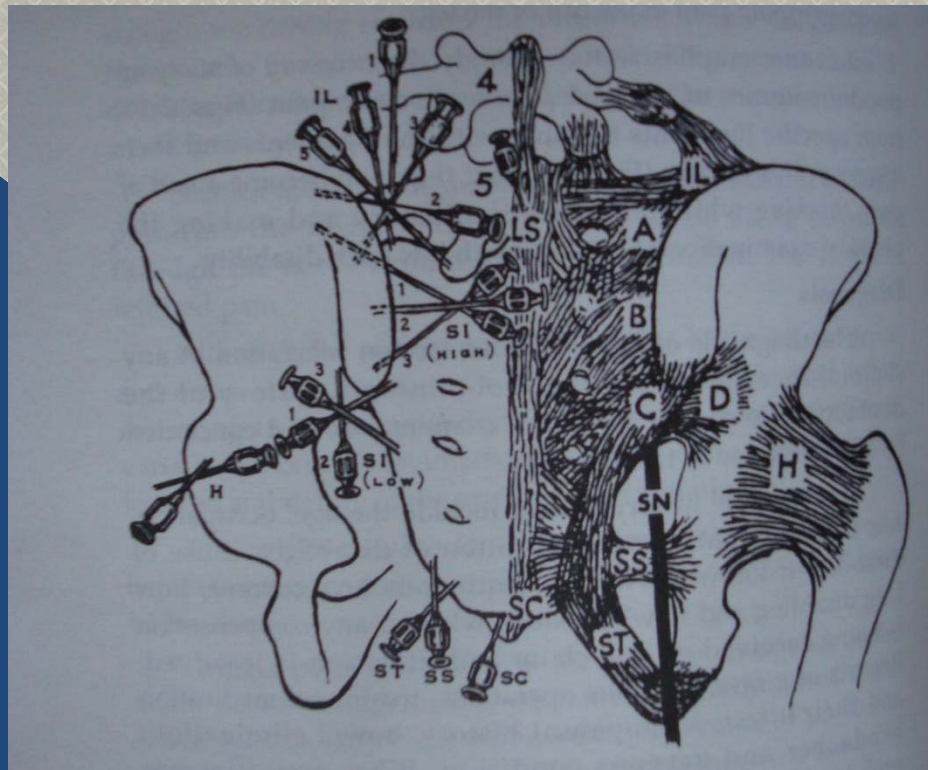
- > Phenol –Commonly used as P2G ;The Prolotherapy solution P2G includes phenol, glycerin, and glucose.
- > Guaiacol is a naturally occurring organic compound with the formula $C_6H_4(OH)(OCH_3)$. This colourless aromatic oil is derived from guaiacum or wood creosote.

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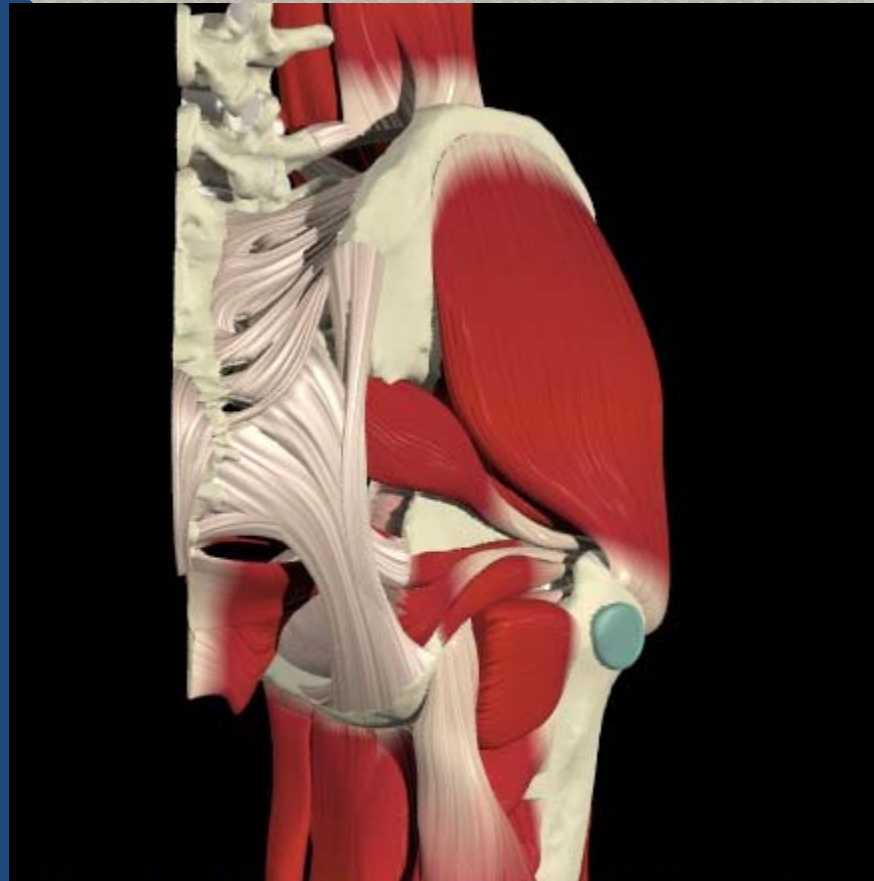


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- IL - iliolumbar lig
- LS - lumbosacral
- A-D posterior sacroiliac
- SS - sacrospinus
- ST - sacrotuberus
- H - hip, articular



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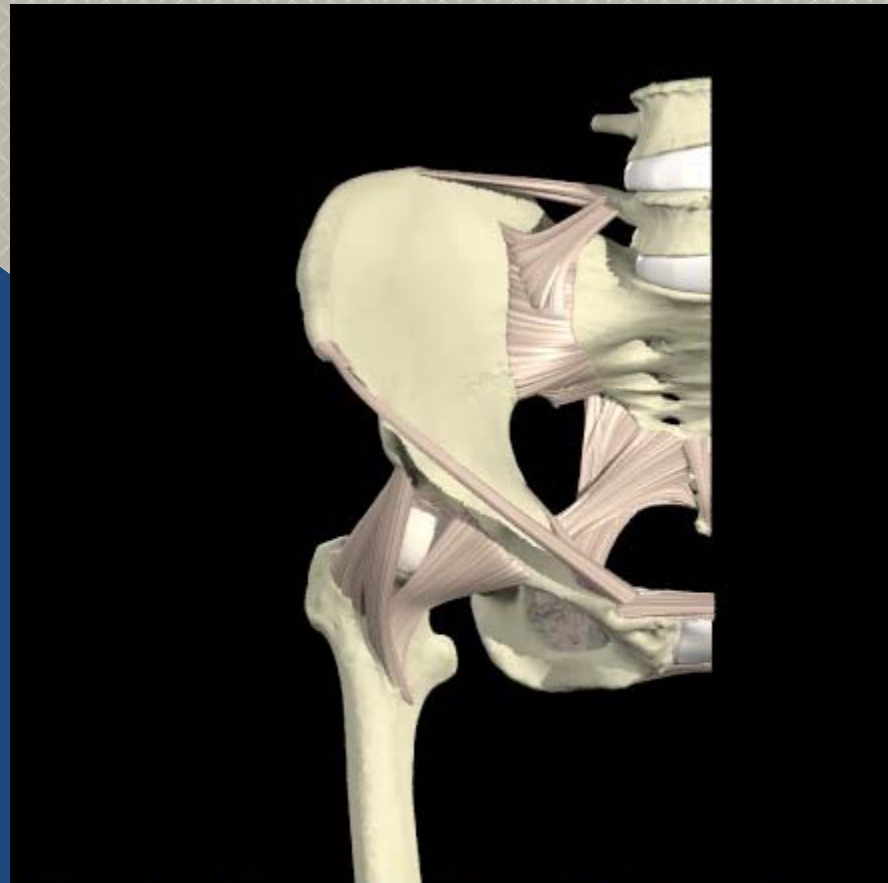
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PROLOTHERAPY

Anatomy Text

The lumbosacral band of the iliolumbar ligament runs from the inferior aspect of the fifth lumbar transverse process to the anterior part of the upper surface of the lateral part of the sacrum. It blends with the ventral sacro-iliac ligaments.

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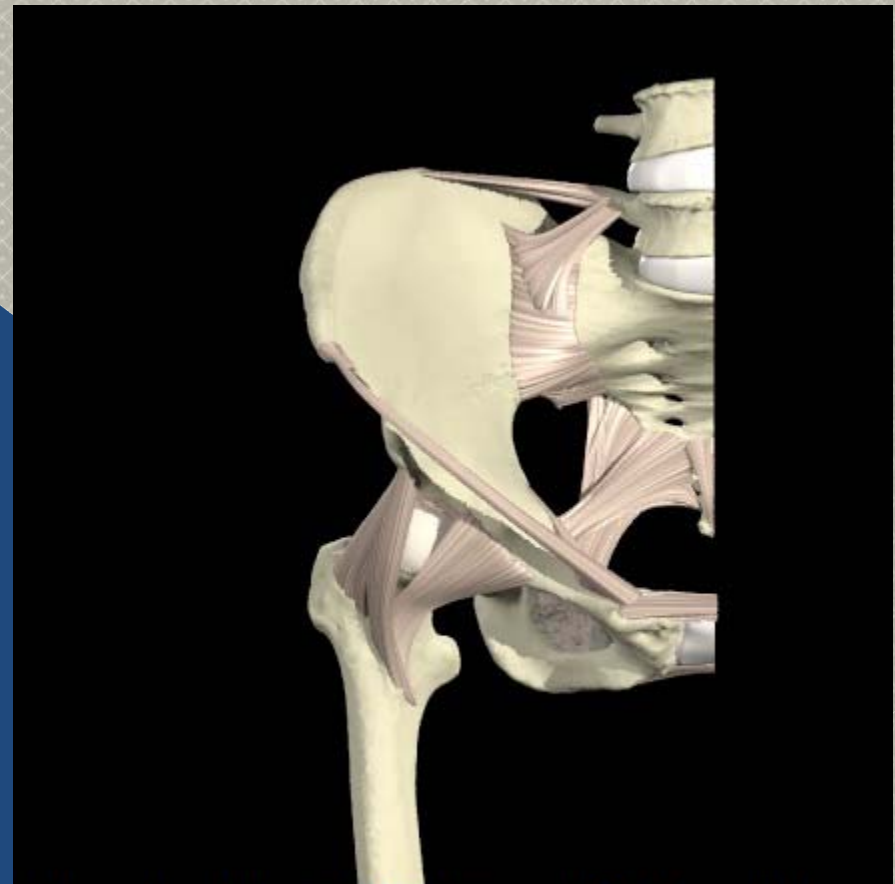


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Anatomy Text

The sacrospinous ligament lies deep to the sacrotuberous ligament. It is triangular in outline; its base is attached to the edge of the lower sacrum and coccyx and the apex attached to the ischial spine. Its pelvic surface is intimately related to the coccygeus muscle.

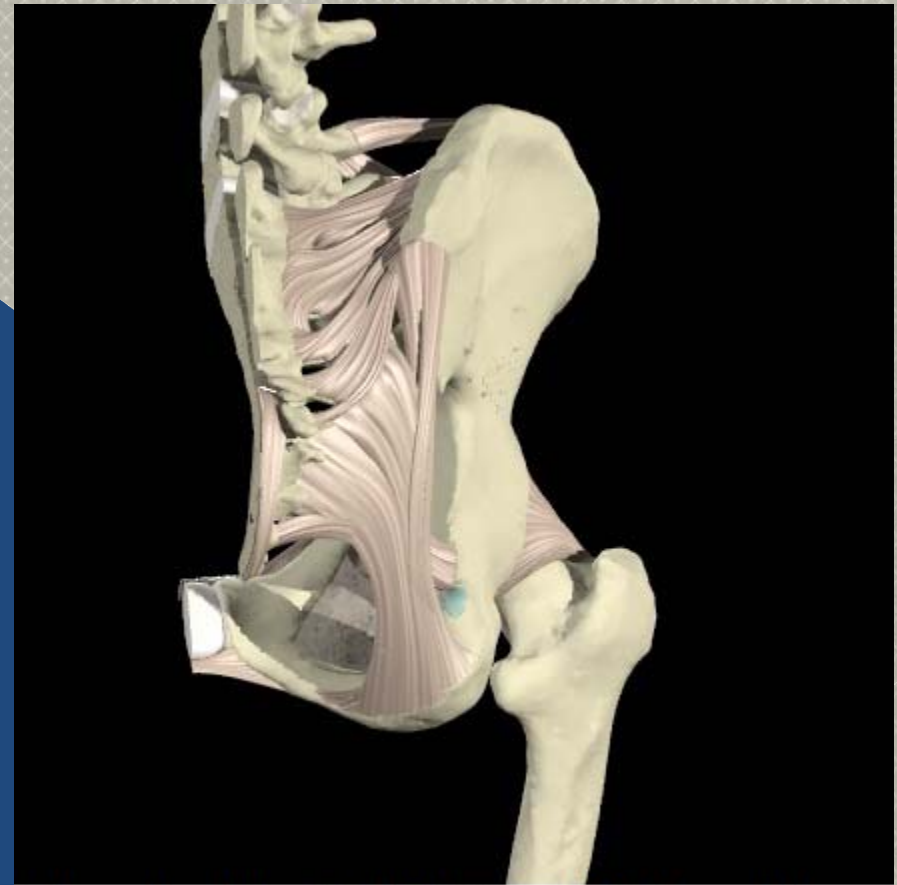


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The dorsal sacro–iliac ligaments overlie the interosseous ligament; they are separated from it by the dorsal rami of the sacral spinal nerves and vessels. The upper part arises from the intermediate sacral crest, with the lower part arising from the lateral crest. It inserts onto the posterior superior iliac spine and inner lip of the dorsal part of the iliac crest.

The ligaments are often partially divided into cranial and caudal parts. The cranial part joins the superior articular processes and lateral crests of the first and second sacral vertebrae to the ilium, and is referred to as the ‘short posterior (dorsal) iliac ligament’.



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The massive interosseous sacro-iliac ligament is a strong thick structure that runs between the sacrum and the ilium. It fills the narrow irregular space between the roughened areas of bone above and behind the auricular surfaces of the sacro-iliac joint.



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The sacrotuberous ligament has an extensive attachment; to the posterior superior and posterior inferior iliac spines, the posterior surface of the sacrum (where it blends with the posterior (dorsal) sacro-iliac ligaments), the lateral aspect of the lower sacrum and to the upper surface of the coccyx. The fibers converge as they pass downwards and laterally. They twist on themselves and then diverge to attach to the medial margin of the ischial tuberosity and the lower margin of the ischial ramus. Distal fibers of gluteus maximus attach to the ligaments posterior surface.



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◎ Knee arthritis study

- › K. Dean Reeves, MD: randomized prospective double – blind placebo controlled study of dextrose prolotherapy for knee osteoarthritis with or without ACL laxity.
- › Alt. Ther. Hlth. Med. 2000; 6(2): 37–46
- › Average knee pain – 8 years
- › 35 out of 111 knees had no cartilage remaining in one or more major compartments.
- › Treatment – 3 injections of 9cc of simple 10% dextrose over 6 months versus water injection
- › Results: dextrose group – 35% reduction in pain; 45 % improvement in swelling; and 67% improvement in knee buckling plus 13 degree improvement in knee range of motion. Treatment superior to placebo – ($p = 0.015$)

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◎ Finger and Thumb arthritis study:

- › Randomized prospective placebo controlled double blind study
- › Inclusion- average pain = 5 years; xray evidence of arthritis
- › Treatment - 3 injections of ½ cc of 10% dextrose on either side of the joint versus water injection over 6 months
- › Results - 42% improvement in pain and an 8 degree improvement in flexibility. Dextrose superior to placebo. Pain (p=.027) and flexibility (p=.003)
- › Journal of Alt Compl Med 2000;6(4): 311 -320; Reeves et al

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- Treatment of Loose ACL Ligament with dextrose injections
- Knees injected bimonthly with 10 - 25 % for 1 year and then an average of 4 times yearly until 3 year follow up
- 16 knees treated all with loose ACL
- At follow up 10/16 knees were no longer loose (KT - 1000) arthrometer; symptoms were improved
- Reeves et al - Alt Ther. Hlth Med May-June 2003, 9(3); p58-62

PROLOTHERAPY

- Efficacy of dextrose prolotherapy in elite male kicking-sport athletes with chronic groin pain
 - > 22 rugby and 2 soccer players with chronic groin pain that prevented full sport participation and who were nonresponsive both to therapy and to a graded reintroduction into sports activity
 - > Intervention: – Monthly injection of 12.5% dextrose and 0.5% lidocaine in thigh adductor origins, suprapubic abdominal insertions, and symphysis pubis, depending on palpation tenderness. Injections were given until complete resolution of pain or lack of improvement for 2 consecutive treatments.
 - > Outcome – by VAS for pain with sports; and Nirschi pain phase scale(NPPS) , a measure of functional impairment from pain
 - > Results: A mean of 2.8 treatments given. VAS improved from 6.3(+/- 1.4) to 1.0 (+/- 2.4) ($p < .001$) and mean reduction NPPS from 5.3 (+/-0.7) to 0.8 (+/- 1.9) ($p < .001$). Twenty of 24 patients had no pain and 22 of 24 were unrestricted with sports at final data collection
 - > Archives Phys Med Rehabil. 2005;86: 697– 702

PROLOTHERAPY

◎ Back pain > 10 years

- > Double blind study; 81 patients
- > One group – sham manipulation and normal saline injections
- > Other group – manipulation and a prolotherapy (dextrose, glycerin and phenol – P2G)
- > 6 treatments
- > 88% of prolotherapy group had moderate to marked improvement ($p < .001$) at 6 months post treatment
- > 35 in prolo group vs 16 in control > 50% improvement
- > Published: Lancet July 18–1987; 2(8551):143 –6