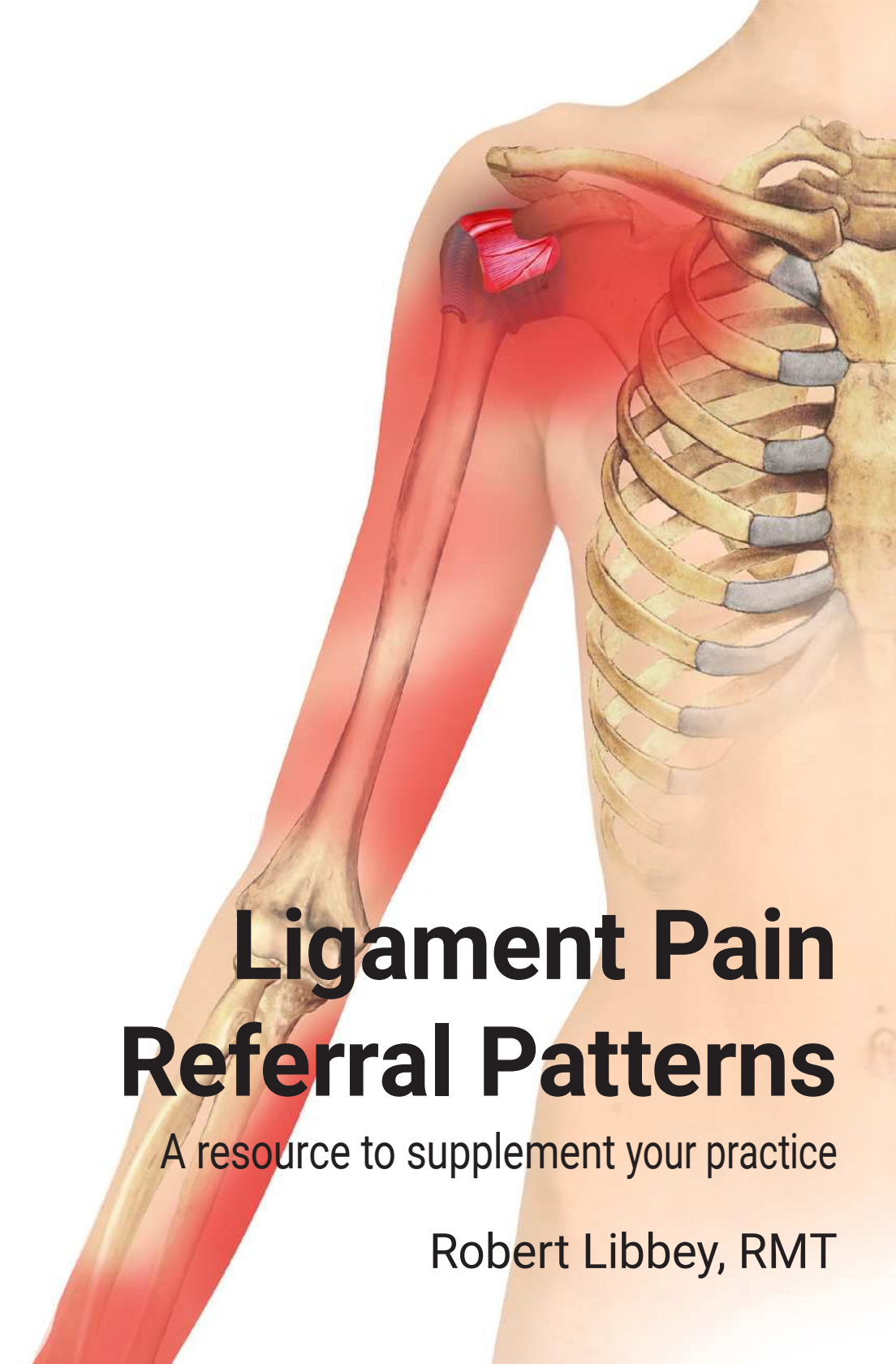


Ligament Pain Referral Patterns

A resource to supplement your practice

Robert Libbey, RMT

Advanced Praise for *Ligament Pain Referral Patterns: A resource to supplement your practice*

"For anyone interested in understanding or treating persons suffering with persistent pain, this book is a must-read. With no disrespect for the enduring genius of Dr. Janet Travell, Robert Libbey's text takes us further into the previously uncharted territory of ligamentous pain referral patterns.

Robert begins his book by elegantly tackling the current neuroscience underlying our understanding of persistent pain. His clinical expertise and many years of teaching and practicing enables him to present this information in a way that does not overwhelm the reader, but entices her to learn more.

I especially appreciated his elucidation of a "beyond-biopsychosocial approach" to understanding and treating persons with persistent pain. He avoids a polarized, black or white, approach and transcends and includes previous models to present us with a way of thinking that is flexible and allows for both subjective and objective insights to guide clinicians in their work.

And then comes the heart of the book: a tour de force of understanding every ligament in the body and its relationship to dealing with persistent pain. Additionally, the illustrations are beautiful and help one to clearly visualize the relationship of the involved nerves with their ligaments.

Make this book a permanent part of your learning library. You will not be disappointed."

- **Dr. Jeff Rockwell,** DC, MA, DOMP, NeuroMyoFascial practitioner, educator and developer of Polyvagal Touch

"A text that should be in every manual therapist's library. Robert allows the therapist to understand thoroughly an often-overlooked cause of our patient's pain experience. From outlining the physiology and anatomy to having quick-reference tables and high-quality images this text can serve a study tool for any student or a quick reference guide for the most seasoned therapists. His explanations for the role in which joints and ligaments are involved in the injury cycle will help connect the dots for anyone treating musculoskeletal pain."

- **Conor P. Collins**, BHSc., DipSIT, RMT

"The publication of Robert Libbey's Ligament Pain Referral Patterns represents not only an enormous accomplishment on Libbey's part, but also a watershed moment for practitioners who serve to alleviate the suffering of those in pain.

His maps simplify and render usable in clinical practice an enormous amount of disparate research which would otherwise be lost, forgotten, or forever inaccessible to those actually practicing pain relief. Libbey's exhaustive sleuthing documents joint pain referral patterns with defensible science.

His determination and persistence to bring this information forward reveals a deep and commendable compassion for suffering humanity. This book belongs not merely on the shelf, but in the hands of every practitioner who shares Libbey's mission to alleviate pain. It is not merely an erudite study of a vexing question.

Libbey's Ligament Pain Referral Patterns is also an extremely practical tool at the fingertips of a new generation of pain specialists."

- **Gil Hedley,** Ph.D.

"Robert's breakthrough work acknowledges various pain causation dimensions then eloquently and effectively focuses on probable neural pain pathways and patterns. He meticulously outlines their origins and distributions from the spinal central axis to peripheral soft tissues, placing emphasis on ligamentous laxity and injuries' contributions to pain.

Robert's masterful work shines much-needed attention to the under-recognized role that ligamentous pathologies play in various pain patterns.

The well-organized pain patterns found in this comprehensive text provide breakthrough schematics which are sure to contribute valuable guidelines and references that will be widely appreciated and practically applied both academically to students and clinically to seasoned practitioners."

- **Michael Koplen**, DC, LMT, QME
Director, Masters In Massage Institute®

"This is a must have reference for treating the symptom of pain. Ligament Pain Referral patterns will be a required reading and resource for my student base.

Thank you Robert Libbey for creating a superb reference for the therapeutic community."

- **Joseph Schwartz**, Dynamic Neuromuscular Assessment™

"This is absolutely a therapeutic textbook that I will leave open beside my treatment table.

As promised, Rob has filled in some of the gaps left by established massage therapy school curricula.

Thank you for going beyond the conventions of manual therapy's literary status quo.

I thoroughly enjoyed reading and applying the information found in these pages. The content is comprehensive yet succinct and, more importantly, refreshingly readable."

- **Paul John Elliott,** Stretching Canada

LIGAMENT PAIN REFERRAL PATTERNS

A RESOURCE TO SUPPLEMENT YOUR PRACTICE

ROBERT LIBBEY
REGISTERED MASSAGE THERAPIST

Chapter 1 | Introduction to Pain Mechanisms

The reader is encouraged to expand their knowledge of pain beyond the introductory information in this text.

Pain is one of the most frequent reasons that people feel compelled to seek out professional medical advice. It is the chief symptom of many diseases and disorders. While there is always an underlying cause of pain, it's not easy to identify and treat in every case. Management of chronic pain is often not straightforward, and a variety of solutions may have to be trialed. In developed countries with advanced healthcare, chronic pain has emerged as a significant issue.

To effectively manage pain in what is an increasingly large patient population, it is imperative that healthcare professionals have a thorough insight into the origins and perception of the painful sensation. This chapter aims to inform readers with a basic overview of the mechanisms of pain generation and transmission; its different types, including referred pain; and the factors that influence pain perception.

WHAT IS PAIN?

Whether someone experiences a real or perceived threat, the pain or discomfort they feel is an adaptive process that attempts to ensure their survival and identity. According to the International Association for the Study of Pain (IASP), "pain" may be defined as an "unpleasant sensory or emotional experience associated with actual or potential tissue damage, or described in terms of such damage" (Merskey et al., 1979). The very definition highlights the fact that pain is not just a physical experience—it has a significant psychological component as well (Cohen et al., 2018).

Pain is a complex experience produced by a widely distributed neural network in the brain; the "body–self neuromatrix" (Melzack, 2001) (Figure 1). Neurosignature patterns may be triggered by sensory inputs, but they may also be generated independently of them. Although one may not need actual tissue to feel pain (phantom pain), the brain must perceive and feel it. The neuromatrix is the primary mechanism that generates the neural pattern that produes pain. It is genetically determined and modified by our sensory experience. Its output pattern is determined by multiple influences, of which somatic sensory input is one (Melzack, 2001).

WHAT ARE THE DIFFERENT TYPES OF PAIN?

There are several ways to categorize pain. They are based on various factors, including its duration, location, origin, and mechanism of transmission. The following are some common classifications of pain:

Based on duration

- **Acute pain** has a sudden onset and lasts for a limited period of time. It is typically related to a specific physical insult such as trauma or surgery. Once the damaged tissue heals, the pain resolves spontaneously.

- **Chronic pain** is usually associated with degenerative diseases and conditions. The pain is constant and may lead to adaptive physical changes in the body such as taut muscles and limitation of movement. It can also induce emotional changes like fear, anxiety, and depression (Grichnik & Ferrante, 1991).

Based on location

- **Primary or localized pain** is easy to pinpoint. It is confined to the damaged tissue, which can be readily identified.

- **Referred pain**, on the other hand, is not felt at the point of its origin. Instead, the pain is perceived at an anatomical location well away from it. Referred pain contributes significantly to the generation of chronic pain. Chronic pain is often described as being the "sum" of referred pain arising from different anatomical structures.Referred pain is prominent in musculoskeletal diseases (Graven-Nielsen, 2006).

  The neurophysiological model for referred pain (Fig. 2) includes two collections of dorsal horn neurons. The first dorsal horn neuron has receptive fields in local soft tissue and the second dorsal horn neuron has receptive fields in distal deeper tissues associated with referred pain.

  Injury from a mechanical, chemical, or thermal stimulus causes nociceptive activity to excite the first dorsal horn neuron(s). Latent collateral synaptic connections are then opened and either excite the neighboring neurons or facilitate the synaptic afferent input from the referred pain area, either of which causes the perception of referred pain; i.e., central sensitization.

The time needed for this sensitization to occur may account for the delay between perceiving the local pain and perceiving the distal, deeper referred pain. A possible explanation for the progressive inhibition of referred pain is that the descending inhibitory control mechanism (desensitization) features a relatively stronger inhibition on heterogeneous somatosensory structures than the source of pain does (Graven-Nielsen, 2006).

Based on origin

- **Nociceptive pain** has its origin at the level of the nociceptors, which are primary sensory receptors. These receptors are specialized in detecting and transmitting signals from stimuli that can cause tissue damage and that may be perceived as painful. This process is known as "nociception." Stimuli include tissue injury, extremes of heat, and noxious chemicals.

  A classic example is touching something pointy and feeling pain. There are two kinds of nociceptive pain—somatic and visceral. **Somatic pain** nociceptors are located on surfaces, such as the skin, subcutaneous tissues, periosteum, and joint capsules. It is generally localized to the area of injury, and depending on the mechanism of injury it may either be sharp or dull. **Visceral pain** nociceptors are located on the viscera, or organs. Pain in these regions is difficult to localize and may radiate. The pain usually feels deep and cramping.

- **Neuropathic pain** occurs because of damage to the nerves of the body. The damage can be at the level of either the peripheral or central nervous system. Because the neurons are damaged, they can fire inappropriately, giving rise to nerve impulses (Chakravarthy & Sen, 2010).

Musculoskeletal pain is a common cause of chronic pain and can lead to a dramatic decline in patients' activity levels as well as quality of life. Back pain alone is responsible for a large number of musculoskeletal pain syndromes. It is reported that around 80% of people will experience low back pain at some point in their lives (Hicks et al., 2002). Historically, clinical treatment of chronic musculoskeletal pain has largely focused on the treatment of the soft tissues such as muscle and fascia. The ligamentous articular tissues have been an underrecognized source of pain, discomfort, and dysfunction.

Ligaments, articular tissues, and joint capsules are body-wide connective tissue specializations that provide a dynamic tension system (continuous tension, discontinuous compression) between joints (Scarr, 2018, p. 85). Ligaments play a major role not only by providing the body with sensory information but also in assisting in protecting the body. There is a joint stability system in which muscular tissue and ligaments interweave and function mainly in an "in-series" arrangement, creating a delicate balance between the stability and mobility of joints (van der Wal, 2009).

When a ligament is injured, this balance is disrupted. Research has shown that injured ligaments play a major role in the pathogenesis of chronic pain. In this chapter, we explore the place of ligaments in the musculoskeletal architecture of the body and learn how their injury contributes to chronic pain.

What are ligaments?

Ligaments are bands of fibrous, regular, dense, collagenous connective tissue that connect bones and help in the formation of joints. They form a joint stability system that is active both at rest and during movement. Ligaments are elastic structures that provide small amounts of stretch under tension, as occurs during normal joint movement. They return to their normal resting length once the strain is removed (Bogduk & Long, 1980). Ligaments also provide flexibility, allowing bones forming a joint to move freely relative to each other. At the same time, they can be tough and unyielding, preventing excessive movement at a joint.

When ligaments are subject to excessive or prolonged strain, they may not be able to return to their original shape and instead remain in a lengthened state. This ligament laxity plays a major factor in unexplained musculoskeletal pain.

What are ligaments made up of?

Ligaments are essentially made up of water and proteins. Water alone makes up about two-thirds of the ligament. Of the remaining one-third, nearly 75% is collagen while 25% is made up of other proteins, such as proteoglycans, elastin, and various glycoproteins (Bogduk & Long, 1980) Some of the key components of ligaments, along with their functions, are mentioned below:

- **Collagen:** Around 85% of the collagen present in ligaments is type I collagen. The collagen fibers are arranged in bundles that are oriented parallel

to the long axis of the ligament. These bundles are cross-linked, which adds strength to the ligament. They may be crimped along their length, which allows for elongation of the ligament without damage.

- **Cellular components:** Fibroblasts are located between the collagen bundles. They secrete extracellular matrix and regulate metabolic activity within the ligament.

- **Proteoglycan:** This protein, which is located in the extracellular matrix, stores water and contributes to the viscoelastic nature of the ligament.

Innervations

The deep fascia is a fibrous layer that envelops not only all the muscles but also tendons, joints, and ligaments, connecting several elements of the musculoskeletal system and transmitting muscular force over a distance (Stecco, 2015). The deep fascia is richly innervated (Stecco et al., 2007; Taguchi et al., 2013; Tesarz et al., 2011) and could be active in proprioception (Itoh, 2004) and the perception of pain. The capsule ligament has been identified as the first innervated tissue while the deep fascia is second. The capsular ligament has a higher percentage of innervation with respect to the capsule itself (with a statistically different density of innervation), confirming that ligaments can play a role in proprioception (Stecco, 2020).

The functional role of ligaments in the musculoskeletal system — the ligamentomuscular reflex

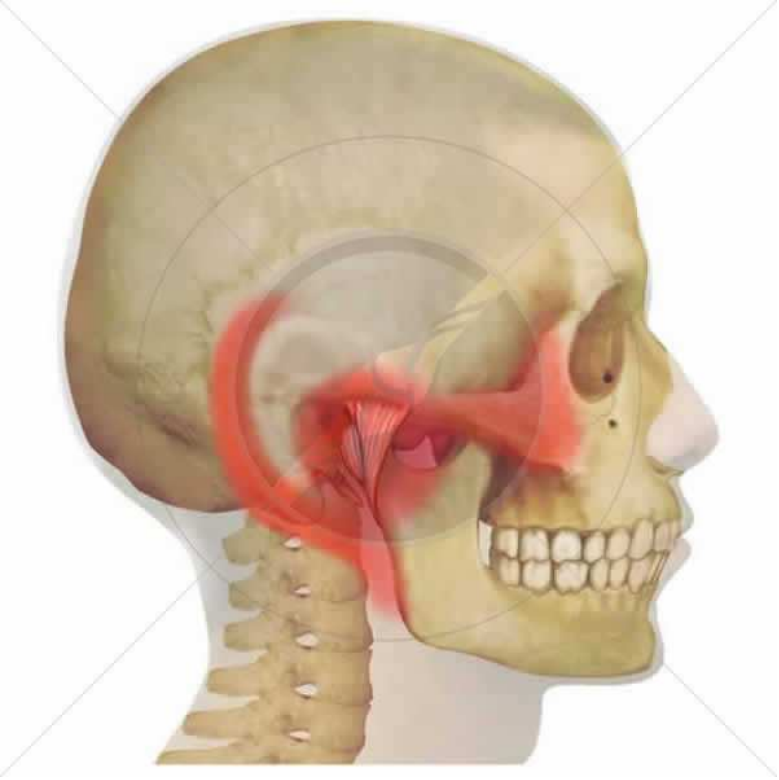
Historically, ligaments were thought to be passive structures that were involved only in providing support to a joint. Although the main function of the ligament, ultimately, is to support and stabilize the joint, its role in the musculoskeletal system goes far beyond this.

Jaap van der Wal states that muscular tissue and ligaments interweave and function mainly in an "in series" arrangement rather than an "in parallel" arrangement creating a joint stability system (van der Wal, 2009). Hauser et al. (2013) describe ligaments as sensory organs having a rich sensory innervation.

On histological examination, mechanoreceptors, such as free nerve endings, Golgi tendon organs, Ruffini endings, and Pacinian corpuscles, have been found in high concentrations at the ligamentoperiosteal and tenoperiosteal enthesis (Solomonow, 2004) (Table 2). These mechanoreceptors provide proprioception and kinesthesia information to the CNS. Proprioception is a sense of awareness of joint position. Kinesthesia refers to the ability to sense movement at the joint (Skinner & Barrack, 1991).

Temporomandibular Joint

- referred pain around temporomandibular joint capsule
- referred pain along maxillary arch
- referred pain down the inferior angle of mandible
- referred pain anterior to ear



C3–4 Facet Capsule

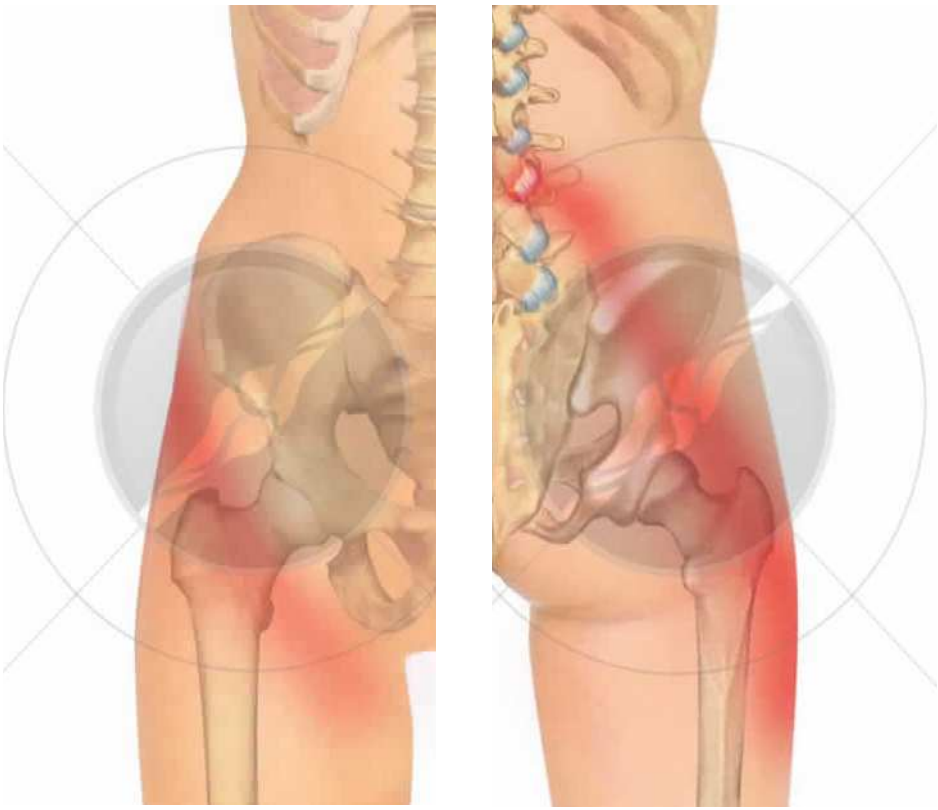
- local pain to the affected vertebral level
- referred pain located over the posterolateral cervical region
- referred pain extending cranially as far as the suboccipital region but not intruding substantially into the occipital region
- referred pain extending caudally over the posterolateral aspect of the neck without entering the region of the shoulder girdle
- referred pain can more or less follow the course of the levator scapulae muscle
- referred pain to the side and, to a lesser degree, front of the head
- referred pain down the anterolateral arm to the index and long finger

T1–2 Supraspinous, Costotransverse, Capsular Ligaments

- local pain to the affected vertebral level
- referred pain that is a deep, dull ache that is nauseating, boring, and cramp-like, or similar to muscle soreness around the paravertebral region, suprascapular, superior angle, and medial region to the scapula and around the region of the upper spine
- referred pain in the paravertebral region extending lateral to the interscapular region and inferiorly to the inferior angle of the scapula
- referred pain toward the superior angle of the scapula and suprascapular region

L3–4 Facet Capsule

- local pain to the affected vertebral level
- referred pain radiating laterally along the posterior flank, anteriorly to the external oblique and groin area and also into the trochanteric area of the femur
- referred pain to the gluteal region
- referred pain unilaterally to the lateral thigh region
- referred pain to the posterior thigh region
- referred pain that is a deep, dull ache that is nauseating, boring, cramp-like, or similar to muscle soreness



Sacrococcygeal Ligament

- referred pain locally
- referred pain to the lower gluteal muscles and deep into the pelvis
- referred pain extending distal to the center of the leg (calf) and beneath the heel

Sternoclavicular Ligaments

Anterior Tissue

- local anterior pain to the joint
- referred pain to the anterior chest wall along the anterior sternum
- referred pain that is a deep, dull ache that is nauseating, boring, cramp-like, or similar to muscle soreness

Posterior Tissue

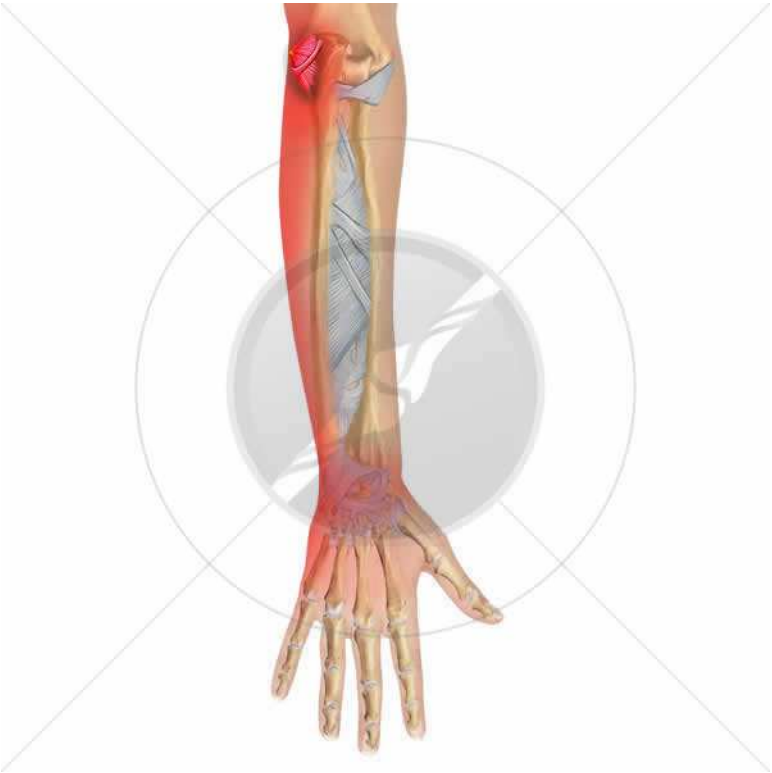
- local posterior pain to the joint
- referred pain deep within the upper thorax and posterior sternum
- referred pain that is a deep, dull ache that is nauseating, boring, cramp-like, or similar to muscle soreness

Medial Ulnar Collateral Ligament

- referred vague pain extending distally to the medial aspect of the forearm to the wrist and carpal area
- referred pain to the fourth and fifth fingers

Lateral Ulnar Collateral Ligament

- referred vague pain extending distally to the lateral forearm along the extensors to the dorsum of the carpals
- referred pain to the fourth and fifth fingers



Distal Interosseous Membrane Anterior

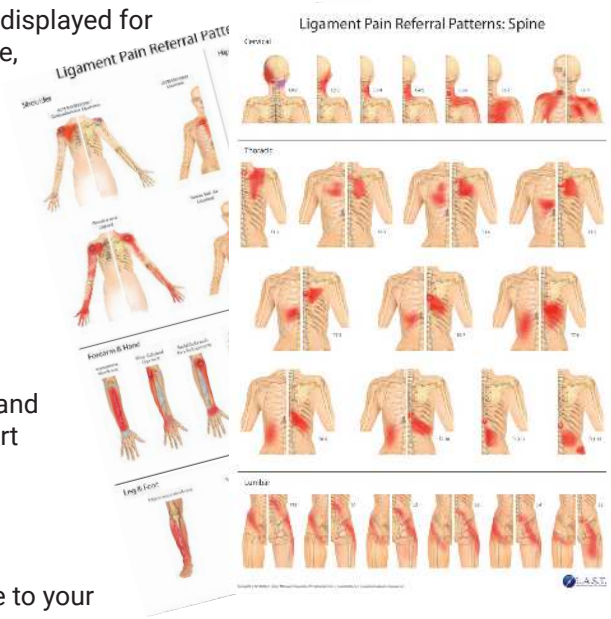
- referred pain to the anterior distal tibiofibular joint
- anterior deep, dull ache that is nauseating, boring, and cramp-like
- referred pain superior to the mortis joint of the ankle and to the dorsum of the foot

LIGAMENT PAIN REFERRAL PATTERN POSTERS

THESE ARE GOING TO LOOK AMAZING IN YOUR PRACTICE!

These two posters graphically demonstrate **sixty-eight** ligament pain referral patterns for the **spine and extremities.**

Multiple referral patterns are displayed for each region of the body: spine, shoulder, forearm and hand, hip, pelvis, knee, leg and foot.



If you have patients complaining of referred pain that you just can't figure out;

if you treat joint dysfunction and want to explain the discomfort your patients are feeling in more depth;

if you want to add more value to your practice and your patients...

YOU'RE GOING TO LOVE THESE POSTERS!

Each poster is Printed on 24" x 36" 100lb high gloss paper with protective UV coating providing high impact!

These visually stunning, full-color, high-gloss charts are an invaluable diagnostic and educational tool for you and your patients.

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ABOUT ROBERT

Robert Libbey has been a registered massage therapist (RMT) for over twenty-five years and an educator for over twenty years.

At the beginning of his career, Robert recognized that many of his patients were describing pain referral patterns that did not conform to established central or peripheral neuropathies or Travell trigger point patterns.

His investigations lead him to research documenting ligament pain referral patterns. He compiled the descriptions of the referral patterns for the axial and appendicular spine and created new vibrant images.

During this time Robert also researched Ligamentous Articular Strain Technique to better provide treatment to patients suffering with ligamentous joint tissue injuries and conditions.

Robert instructs Ligamentous Articular Strain Technique globally and through online education.

Robert believes therapists and clinicians have a great opportunity to improve their patients' quality of life. He has always felt that understanding of the ligamentous articular system has been insufficient.

Robert's desire is to create greater awareness of this system's role in neuro-musculoskeletal injuries and disorders and provide information that will enhance therapists' and clinicians' capacity to help their patients.

Robert maintains a full-time practice while he continues investigating, developing, training, and educating clinicians around the globe.

Robert can be contacted at:
info@ligamentpain.com
ligamentpain.com
lastsite.ca

LIGAMENTOUS ARTICULAR STRAIN TECHNIQUES

If you have been looking for a more precise, effective and less invasive way to treat ligamentous and joint tissues injuries and conditions...**you'll love these courses!**

I've developed these courses to give you a greater understanding of the evidence-informed research supporting treatment of ligamentous and joint tissues.

Ligamentous articular strain techniques (LAST) are derived from general osteopathic techniques, developed from the work of osteopathic physicians including, but not limited to A.T Still, W. Sutherland, H. Lippincott, R. Becker, A. Wales, and C. Speece.

These courses represent an attempt to blend and update the original principles with the research and science of today.

Ligamentous articular strain technique is primarily an indirect (slow melting pressure) manual application utilized in the treatment of joint soft tissue injuries, conditions and dysfunctions. The technique influences biotensegral physiology (fascia, ligaments, tendons, and indirectly lymphatic and blood flow) and CNS modulation.

- **LEARN WHY** peripheral joint injuries should be viewed as neuropsychophysiological dysfunctions.
- **GAIN CONFIDENCE** in determine and distinguish functional and dysfunctional neurofascial force-coupling patterns.
- **UNDERSTAND** how fascial mechanoreceptors influence communication from fascia to the CNS
- **LEARN TO RECOGNIZE** the differences between referred pain and radiating pain
- **UNDERSTAND** how referred pain occurs according to the Neurophysiological Model
- **LEARN TO RECOGNIZE** the typical Ligamentous Pain Referral Patterns

ENROLL NOW FOR YOUR LIFE-TIME ACCESS!
LIGAMENTOUS ARTICULAR STRAIN TECHNIQUES
LASTSITE.CA

ABOUT THE BOOK
This book is intended to give you information that may have been missing from your formal medical education.

Understanding the basic mechanisms of pain, how referred pain occurs, and the pain referral patterns from ligamentous and joint tissues is an integral part of understanding someone's experience with pain or discomfort, how it affects their quality of life, and possibly on what areas to focus treatment.

KEY FEATURES
- Understanding the basic physiology of pain
- Understanding the basic physiology of joint tissue and ligament pain
- Neurophysiological model of referred pain
- Sclerotomes: fact or fiction?
- Biopsychosocial approach to pain
- Enactive approach to pain
- Eighteen original full-colour neurological joint innervation images for axial and appendicular joints
- Neurological joint innervation charts for axial and appendicular joints
- Ninety-eight full-colour joint tissue and ligament pain referral pattern images with descriptions
- All information contained in this book was acquired from published research and medical texts believed to be reliable sources

LIGAMENT PAIN REFERRAL PATTERNS is applicable for all levels: from the student to the most experienced therapists and clinicians.

Professionals who will find this book beneficial and significant to their practice include all manual and movement therapists:
- Acupuncturists
- Chiropractors
- Kinesiologists
- Massage Therapists
- Medical Physicians
- Naturopathic Physicians
- Osteopaths
- Physiotherapists
- Structural Integration Practitioners
- Yoga Teachers and Therapists

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"For anyone interested in understanding or treating persons suffering with persistent pain, this book is a must-read."

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