

# **Spinal Ligament Damage**

## **An Identifiable Component of *Soft Tissue* Damage When Using Motion X-Ray**

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In an article written for ICBC's quarterly journal, *Recovery*, Nikoai Bogduk M.D states that "In the Western societies, the annual incidence of whiplash claims is about 1 per 1000 people, but a claim does not equal a case.... Most patients recover, usually in a matter of months. Some 20% of patients still have symptoms after a year, but only about 5% are severely disabled."<sup>1</sup> For the 10-20% of victims who develop chronic symptoms, the available data indicates that their condition is not imaginary or fictitious. Although cases of fraud and malingering do occur, they are rare.<sup>2</sup> The biomechanics data, the postmortem data, and the clinical data agree that injuries can and do occur.<sup>3</sup> These injuries are typically categorized as "soft tissue injury".

Soft tissue injury is most commonly trivialized as a sprain/strain that should self resolve within weeks to months. Dr. Michael Freeman, co-editor of the *Journal of Whiplash and Related Disorders* states the following: "The term 'soft tissue injury' is so nebulous and trivializing of a wide variety of injury types ranging in severity from symptoms of a few days to a lifetime of debilitating pain that it should be completely abandoned."<sup>4</sup>

It is this writer's opinion that the term "soft tissue injury" serves only the insurance industry by encapsulating a wide range of injuries under one easily dismissed umbrella. The pain suffered by chronic whiplash victims cannot and should not be so easily dismissed. However, as many doctors, lawyers and frustrated accident victims know, finding the source of chronic pain following whiplash has been very difficult using conventional technologies. This article will discuss some reasons for the difficulty and how visible evidence of whiplash damage can be determined through the advanced technology of Digital Motion X-ray.

### **Common Sources of Pain Following Whiplash**

Three common sources of pain following a whiplash event are the disc, the facet, and the alar ligaments.<sup>5</sup>

#### **1) Discs**

Spinal discs are the cartilage between each vertebra. Typically there are 23 cartilaginous discs in the spine with five in the cervical spine (neck) and an additional disc uniting C7 with T1 for a potential of 6 discs in the neck region. The disc has been nicknamed the great retaining ligament of the spine due to its tremendous inherent strength.

Discs can be injured in a whiplash event however actual damage to the nucleus pulposus (the centre gel of the disc) is quite rare.<sup>6</sup>

The imaging modality of choice for disc injury is MRI and the incidence of disc injury is accepted to be around 20 cases per 1000 imaged patients. Rarely is MRI beneficial in proving other injuries in the neck. Although many hold MRI as the gold standard most researchers find routine MRI studies of patients injured in a whiplash event to be of no value.<sup>7</sup>

#### **2) Facet Joint – also known as zygapophyseal or “z” joints**

Facet joints are comprised of two zygapophyseal surfaces from two adjacent vertebrae encapsulated by a (capsular) ligament. Essentially the facet capsule limits the range of motion of the zygapophyseal joint surfaces (facets) on both sides of the neck. There are 5 facet capsules on each side of the neck for a total of 10 facet capsules. There are two additional facet capsules between C7-T1 which are often considered when discussing facet joint injury to the neck creating a possible total of 12 facet joints that can be considered for potential injury in the neck region after a whiplash or other trauma.

The predominant symptom of facet joint damage is neck pain in a somewhat predictable pattern.<sup>8</sup> Headaches from neck injury also follow somewhat predictable pain patterns.<sup>9</sup> At least 60% of chronic pain whiplash victims have facet joint damage. The diagnostic procedure of choice is an anesthetic block<sup>10</sup> but many injured patients are not managed to the point of receiving this approach. A facet block is an invasive procedure that is not easily or quickly accessed. Hence, the typical therapeutic approach for patients with soft tissue injury is to receive months of physiotherapy, months of massage therapy and/or instructions for continued use of anti-depressant medications along with exercise and stretching, rather than ongoing diagnostic efforts being made to find the source of chronic pain and treat it more specifically.

Researchers have compared conventional imaging with tissue slices harvested at autopsy. Those findings show ligament and or facet joint capsule (ligament) damage in each whiplash case even when conventional imaging (plain x-ray, routine CT, MRI) appeared normal.<sup>11</sup>

Fortunately, a motion x-ray exam will easily reveal facet injury<sup>12</sup> and it is definitely easier on the patient than an autopsy. With a motion x-ray, the interpreter is able to compare the movement in the patient's normal joints with those that gap or move aberrantly. A digital motion x-ray of the neck will yield approx 2700 images (increasing diagnostic ability) while exposing the patient to about the same dose of radiation as a standard neck x-ray of 3-6 images.

### 3) Alar Ligaments

The anatomy of the neck and base of the skull is complex and would require a dedicated article just for the introduction. Suffice to say that ligaments stabilize the area while allowing the complex integrated range of motion of the skull and bones of the neck.

The paired alar ligaments stabilize from the second vertebra (C2) to the base of the skull restricting C1 and C2 in lateral flexion and rotation. These joints are so restricting that in normal lateral bending of the neck there should be no movement between C1 and C2. Consequently if motion translation (sliding) is seen on a motion x-ray, the instability can be documented.

Alar ligament injury is more commonly in suspicion when the mechanism of injury includes a rear end accident while the victims head is turned at impact.<sup>13</sup> The many variables and forces at work during the split second of a motor vehicle crash make it very possible for these stabilizing ligaments to be injured.

Total failure of a ligament (rupture) is likely to result in dislocation, surgery or death. The term sub failure is applied to fraying, stretching or weakening of ligaments. Sub failures are rarely surgical. However, "sub failure injuries to the cervical soft tissues may lead to cervical spine instability and clinical symptoms".<sup>14</sup> Instability of the alar ligaments is a common basis for ongoing complaints such as headache, neck pain, and shoulder pain. Often these victims cannot sleep on their stomach or turn their head from side to side without triggering neck pain, headaches, or other symptoms.

Only the worst instabilities will obtain surgical stabilization. Individuals who don't require surgery tend to have their complaints minimized and trivialized (it's only soft tissue) even though resolution is unlikely and permanent injury likely. Prolotherapy and the use of a limiting cervical collar for certain activities are partial solutions to the challenge of alar ligament damage. Although permanent injury cannot be confirmed until 2 years post trauma, the outcome of ligament injury can be predicted at 3 months.<sup>15</sup>

In most clinical practices the alar ligaments are rarely imaged or considered as components of whiplash injury. They are so uncommonly reported that in 31 years I have seen only one incidence reported in the many medical and IME reports that have crossed my desk. Although "ligament injury is extremely common"<sup>16</sup> they are obviously not being diagnosed or reported. In a study conducted by J. Krakenes, et al, it is stated that alar ligament injury is apparent in as many as 9 out of 10 late whiplash candidates (over two years since injury).<sup>17</sup> In another study 66.3% of whiplash victims (6 years post-trauma) demonstrated evidence of alar ligament injury.<sup>18</sup>

### Determining Ligament Injury

While a complete rupture of spinal ligaments may show on an MRI; stretching, fraying or laxity of these ligaments (instability of varying degrees) does not image on the typical MRI protocol used for diagnosing whiplash injuries. However, there are imaging processes being used in Europe<sup>19</sup> and North America<sup>20</sup> that can reveal ligament damage such as the proton density-weighted MRI which images the ligament quality; and dynamic or functional x-ray, MRI, and CT which reveal ligament damage by examining how the ligament functions. Functional x-rays such as the **digital motion x-ray will not specifically image spinal ligaments, but it will image the function of the ligaments while they are trying to do their job of stabilizing the neck.**

Fluoroscopic, dynamic or functional x-ray evaluation for instability is an accepted procedure in Canada used by the medical and chiropractic<sup>21</sup> professions. One has to wonder why they are not utilized more routinely for diagnosing whiplash injuries. Routine plain film, CT, and MRI commonly used are more effective for evaluating injuries that are apparent while the patient refrains from all movement. Functional/motion studies, on the other hand, should be used for evaluating injuries that are symptomatic when the patient moves. They are also effective when evaluating a patient who continues to experience chronic pain six weeks or more following a whiplash event.

In a motion study the patient is asked to move through a specific protocol designed to stress specific ligaments. Ligaments normally restrain or hold joints within a certain range of motion. If this range is excessive it can be measured or compared to other similar joints to determine ligament injury/damage/sub-failure.

The image clarity obtained in a digital motion x-ray<sup>22</sup> makes this comparison relatively easy. Unlike standard x-ray or fluoroscopic images, digital motion x-ray images (see image) show the bones in shades of black with black cortical margins on a white background making the function of ligaments during motion easier to assess.



## Why is Ligament Injury Commonly Overlooked?

It may be challenging to accept the fact that there are significant gaps in medical education. The data shows that “There is a marked discrepancy between the musculoskeletal knowledge and skill requirements of a primary care physician and the time devoted to musculoskeletal education in Canadian Medical Schools”.<sup>23</sup> In simplest terms, primary care physicians have about two weeks of training in all musculoskeletal disorders (muscle, bone and joint) most of it relative to surgical need like hip and knee replacement or multiple trauma follow up. Almost none of their few hours of musculoskeletal training are related to the topic of this article.

The injured public and lawyers rely on these ‘experts’ (with virtually no training in this area) to understand and properly manage many whiplash victims with chronic pain. Early in this article, research was quoted that suggests ligament injury is extremely common. If this is the case, why don’t the findings and reports of doctors reflect this fact? From an experienced practitioner’s perspective, evaluating instability or the subtle nuances of sub failure of ligaments following trauma is an advanced topic unsuited to novices in musculoskeletal disorders. And yet reports and diagnosis from the ill trained, continue to direct the management of whiplash victims with chronic pain.

Not so long ago, one of my worst cases (advanced instability) was reviewed by a two doctors in Vancouver. One doctor who viewed the x-ray images declared the patient to be normal saying “I see this all the time”. The other doctor felt the study supported his original diagnosis of ligament damage. How can the first doctor say the images of someone with advanced instability are “normal”? Was this doctor trained in musculoskeletal studies with the knowledge to interpret the subtleties of a motion x-ray? One can only assume not. Although the diagnostic value of the x-ray was obvious to the second doctor it went unrecognized by the first doctor. Ignorance is no excuse for overlooking an obvious diagnosis.

## In Conclusion

Research and experience demonstrate that spinal ligament (soft tissue) damage is an identifiable component in whiplash injury. The incidence of long term sufferers is around 20% of cases. The pain that persists in these cases must not be trivialized under the “soft tissue injury” umbrella. The injury will not spontaneously resolve if it has not done so within 2-3 months post-trauma. At 3 months permanent injury can be predicted and confirmed at two years. Disc injury in the neck is rare while facet injury and alar ligament injury are common and may be permanent. The biomechanical data, post mortem data and clinical data objectively show that these injuries are not imaginary. Ligament sub failures can be imaged with functional motion x-ray however referral for motion x-ray has yet to become routine in chronic cases. Some in the medical and chiropractic profession in Europe, and North America utilize motion x-ray in diagnosing these injuries. Pain Management, a Practical Guide for Clinicians published in 2002 states that “Digital motion radiography is currently a valuable diagnostic method in evaluating painful hyper mobility and instability due to posttraumatic and degenerative pathology of the capsular and axial ligaments”.<sup>24</sup> It is this writer’s hope that the knowledge and use of digital motion x-ray in diagnosing spinal ligament sub failure will become the norm and give patients, doctors, and lawyers the accurate assessment needed to secure proper treatment and appropriate remuneration for subsequent lifestyle changes and ongoing treatment.

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