

# Unilateral facet subluxations: an example of a missed post-traumatic unilateral facet subluxation – a case report

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*Unilateral facet injuries occur in 4-16% of patients with cervical spine injuries, (of which unilateral facet subluxations occur as a subgroup in this population). These injuries arise in motor vehicle accidents because of flexion-distraction forces, or flexion of an already rotated head.*

*Due to the common presentation of a lack of neurological signs and symptoms, delayed diagnosis of unilateral facet subluxations are common. As a result, it is imperative that the proper diagnosis is made so that patient care can be made more effective with ultimately less sequelae. For the clinician, diagnosis can be aided by the use of radiographic analysis.*

*Adequate radiographic analysis is an important tool to accurately assess whiplash associated disorders. Radiographic findings of facet subluxations are subtle on routine views. Utilizing oblique views, the diagnoses are usually evident. Therefore, oblique views are very useful in the clinical setting.*

*This case report will describe a 29-year-old female with a missed unilateral facet subluxation, radiographic findings and characteristics, and the clinical utility of oblique views in patients suffering from whiplash associated disorders.*

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KEY WORDS: unilateral facet subluxation/dislocation, post-traumatic, oblique, radiograph, whiplash associated disorder.

*Les lésions unilatérales des facettes, dont les subluxations, surviennent dans 4 à 16 p. 100 des cas de blessure à la colonne cervicale (les subluxations unilatérales des facettes forment un sous-groupe particulier de cas). Ces lésions se produisent dans les accidents d'automobile sous l'action des forces de flexion et d'écartement ou de la flexion de la tête déjà en rotation.*

*Comme, dans la plupart des cas, les subluxations unilatérales des facettes ne présentent pas de signes ni de symptômes neurologiques, les diagnostics tardifs sont relativement fréquents. Aussi est-il impératif de poser le bon diagnostic pour donner au patient des soins plus efficaces et, indirectement, lui éviter des séquelles. Pour ce faire, le clinicien ou la clinicienne peut avoir recours à l'examen radiologique.*

*Une évaluation appropriée des troubles associés au coup de fouet cervical repose sur une prise adéquate de radiographies. Les signes radiologiques de subluxation cervicale sont peu visibles sur les clichés ordinaires; par contre, les clichés pris en oblique facilitent de beaucoup l'établissement du diagnostic. Ils se révèlent donc d'une grande utilité en clinique.*

*Voici le cas d'une femme de 29 ans dont la subluxation unilatérale d'une facette est passée inaperçue; il sera question, dans le présent article, des observations et des caractéristiques radiologiques, ainsi que le l'utilité clinique des clichés pris en oblique chez les patients souffrant de troubles associés au coup de fouet cervical.*

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MOTS CLÉS : subluxation ou dislocation unilatérale des facettes, post-traumatisme, incidence en oblique, radiographie, troubles associés au coup de fouet cervical.

## Introduction

Unilateral facet injuries are significant since they occur in 4 to 16% of patients with cervical spine injury presenting to hospital clinics.<sup>1,2,3</sup> Facet injuries can present in a range from subtle facet subluxations to overt facet dislocations. A facet joint subluxation does not imply full dislocation. A dislocation is defined as a displacement of a bone in relation to the apposing bone at the joint, resulting in a complete loss of continuity of the joint surfaces.<sup>4</sup> Whereas a subluxation is a partial loss of contiguity of the joint surfaces. Although joint surfaces are incongruous, a significant proportion remains apposed.<sup>4</sup>

Unilateral facet injuries occur in motor vehicle accidents as a result of simultaneous rotation of the head with an accompanying distraction-flexion force or flexion of an already rotated head.<sup>1,2,3,5,6,7,8</sup> These movements create forces that prestress the capsules of the zygapophyseal joints, rendering the joints more susceptible to injury.<sup>9</sup>

As a result, many who suffer from unilateral facet injuries can manifest the associated symptoms commonly found in whiplash-associated disorders due to cervical spine and/or ligamentous injury.<sup>10</sup> Two weeks of delay in treatment due to incorrect diagnoses in unilateral facet injuries occurs in upwards of 40% of cases.<sup>1,11</sup> Frequently, these patients have no neurologic deficit or have an isolated radiculopathy that may be overlooked in a cursory exam.<sup>8</sup> Additionally, unilateral facet injuries are commonly missed on initial films due to the subtlety of radiographic signs.<sup>12</sup> It is only through the persistent complaints from the patient that the correct diagnosis is confirmed.<sup>1,11</sup>

Beyer and Cabanela<sup>8</sup> summarize three reasons for delay in diagnosis of unilateral facet injuries. First, there is inadequate radiographic evaluation. Second, associated injuries may lead the concern of the physician away from the cervical spine. Third, there is usually a lack of serious symptoms associated with unilateral facet dislocation or fracture-dislocation.<sup>8</sup>

The case of a 29-year-old female patient with neck pain resulting from a motor vehicle accident is presented.

## Case report

A 29-year-old female bank manager presented to our clinic with recent reaggravation of right neck pain of six days duration. The complaint was sudden in onset without recent trauma. However, she was involved in a motor vehicle accident that occurred seven months prior to this presentation.

Seven months before, the patient was in the front passenger seat of a car on an expressway. Road conditions were wet due to snow. The patient was wearing a three-point seat belt but did not have airbag protection. The car went out of control, slid into a ditch, rolled several times, and landed upright. She had immediate pain in her neck and right hand. She also noticed swelling of the right wrist and forearm. The patient felt that she hit her head but could not recall the specific details of the accident. She felt that she did not lose consciousness.

She was transferred via an ambulance to the local hospital where she was assessed. Radiographs of her head, neck and hand were taken and reported as normal. She was then given a neck brace and discharged. The next day she saw her physician whereupon she was prescribed Advil and physiotherapy, which included two weeks of wearing a soft cervical collar and four months of electrotherapy.

The presenting complaint was described as a dull ache, with an intensity of 2/10, occurring with neck movement. The pain was aggravated by rotating her head to the right and became more intense with increased neck activity. The relieving factors included massage. There were no other associated symptoms such as weaknesses or paraesthesiae in the upper limbs.

Gross active range of motion of the cervical spine on right rotation was limited by 20° by mild pain in the upper right trapezius fibres. Passive and active right lateral flexion produced pain in the upper right trapezius at the end range of motion. Left lateral flexion elicited a pulling sensation on the right side. Forward flexion produced mild pain while all other ranges were full and pain free. Resisted ranges were full and pain free except for right lateral

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flexion which reproduced her presenting complaint.

Neurological examination revealed intact upper and lower limb sensation, full motor strength, and 2+ reflexes. Spurling's (lateral flexion with light overpressure), Jackson's (rotation with light overpressure) and maximal foraminal compression (lateral flexion, extension and rotation with slight overpressure) on the right reproduced the patient's symptoms with pain into the upper right trapezius fibres. Facet rub produced pain at the right C4–C5 level. Valsalva's and Doorbell's were negative. Motion palpation revealed mild restrictions at C6–T1 on the right.

Based upon the presentation and clinical findings at the time of this work-up, this patient was tentatively diagnosed as having a Whiplash Associated Disorder (WAD) Type II according to the parameters set out by the Quebec Task Force<sup>13</sup> and facet irritation and associated restriction of the cervical spine.

Radiographs taken at the time of the accident were obtained from the hospital for reassessment by our radiology department (Figures 1, 2). These included APOM, AP, lateral and oblique views of the cervical spine. On close inspection of the oblique films, a misalignment of the right C5–C6 facet joint was noted with the C5 inferior facet perched on the C6 superior facet. Only one-third of the facet was still in contact. A post-traumatic facet subluxation of C5 on C6 on the right had been missed.

Additional films were obtained at our clinic to assess for any progression (Figures 3, 4, 5 and 6). They confirmed the partial dislocation. Additionally, a 4 mm anterolisthesis of C4 on C5 was detected which was not present on the initial films. This would indicate disruption likely involving the supraspinous, interspinous and facet capsular ligaments. Based upon these findings, the diagnosis was changed to a Whiplash Associated Disorder (WAD) Type IV because of the facet subluxation, as well as the ligamentous tear at C4–C5. The patient was referred to a rehabilitation clinic for further assessment and was lost to follow-up.

## Discussion

The Quebec Task Force<sup>13</sup> recommendations for clinical practice states that patients who present with a Whiplash Associated Disorder (WAD) of Grade II and III, should obtain a three-view baseline radiologic examination of the cervical spine. These baseline radiologic films include the antero-posterior, lateral and open mouth views. These rou-



**Figure 1** Lateral cervical radiograph demonstrates vertebral rotation with suggestion of anterolisthesis of C4 on C5.

tine views are usually adequate, and is substantiated by numerous investigators.<sup>14,15,16,17,18,19</sup> In patients having a Grade II or III WAD, flexion/extension views may occasionally be indicated.<sup>13</sup> If there is any clinical suspicion of more serious injuries, then other appropriate radiographs should be obtained.

The three-view baseline studies may be incomplete in that significant ligamentous instability may exist in the absence of an obvious vertebral column fracture or dislocation.<sup>14,15,16</sup> Certain investigators have found a 23% to 26% false-negative rate for their lateral views, and as a



**Figure 2** Oblique views of the cervical spine show unilateral rotation displacement of the right C5 articular pillar with C5 inferior facet perched on C6 superior facet.

result state that the lateral view is not adequate to screen for cervical spine injury.<sup>10,20</sup> Doris et al.<sup>20</sup> state that if the three views prove positive for fracture or dislocation, then no further radiographic screening is necessary. However, if the three views are negative, then the patient undergoes the five-view standard series which includes the oblique views.<sup>20</sup> The oblique views are obtained to search for possible posterior laminar fracture, unilateral facet dislocation, and facet subluxation.<sup>20</sup>

**Additionally, extended radiographic evaluation of cases involving cervical spine trauma should also be considered. Further sequelae such as delayed instability can occur at a later date which can be detected through radiographic studies.**

The radiographic characteristics (Table 1) can individually or collectively aid in the diagnosis of a unilateral facet subluxation. Some of these findings are not immediately obvious, but should routinely be sought in cases of cervical spine trauma.

A lateral cervical radiograph yields the most valuable information in regards to unilateral facet subluxations. If anterolisthesis is present on the lateral view, it is regarded as an auxiliary sign of facet subluxation/dislocation. The body of the dislocated vertebra may be anteriorly displaced less than or equal to one-half the sagittal diameter of the inferior vertebral body.<sup>1,7,21</sup> Fanning or widening of the interspinous distances may also be visualized on the lateral view and suggest tearing of the interspinous liga-



**Figure 3** Lateral radiograph of the cervical spine obtained at our clinic at a later date shows a horizontally oriented C5 articular pillar with a 4mm anterolisthesis of C4 on C5.

ment and facet capsule. Loss of cervical lordosis may suggest hyperflexion injuries likely resulting from torn nuchal and interspinous ligaments with disruption of the zygapophyseal capsules.<sup>22</sup> Increased height and asymmetry of the intervertebral discs posteriorly may also indicate a flexion injury.<sup>22</sup>

Rotational injuries are more apparent if a double contour of the posterior margins of the vertebral bodies is seen.<sup>22</sup> Another radiographic sign indicating possible facet subluxation is displacement of the interfacetal joint.<sup>3</sup> If the



**Figure 4** Pen marking demonstrates the altered orientation of the C5 articular pillar.

rotational component is severe, then full dislocation arises and produces the “bow tie sign” which is seen on the lateral view. The bow tie sign arises from the combination of the anteriorly displaced articular pillar relative to its former opposing pillar.<sup>3,5</sup> Abrupt changes of the interlaminar space at the level of the injury also correlate well with rotational-flexion trauma producing facet subluxation/dislocation.<sup>3</sup>

**When viewing the oblique radiographs, the cervical facets should overlap each other and appear similar to**



**Figure 5** Right anterior oblique



**Figure 6** Left anterior oblique

**Figures 5 and 6** Obliques films of the cervical spine from our clinic illustrate the different appearances of the “shingles on the roof.” On the right anterior oblique view (Figure 5), disruption of the “shingle” is evident at C5-6 when compared to the left anterior oblique view (Figure 6).

**the traditional rooftop shingles of a house. If there is an interruption of this pattern, then it is indicative of the “shingles on the roof” sign.** A disruption of the “shingles on the roof” appearance will confirm the presence of a unilateral facet dislocation<sup>23</sup> or facet subluxation on the oblique view. It must also be emphasized that there are associated fractures affecting the zygapophyseal joints or laminae in 35% of patients with unilateral facet subluxations/dislocations.<sup>2</sup>

On the anteroposterior view, the spinous processes may

be displaced to the side of the facet injury superior to the facet that was subluxated/dislocated.<sup>7,24</sup> Tracheal or laryngeal deviation is also indicative of ligamentous disruption in the cervical spine and rotational injury.<sup>22</sup>

In unilateral facet dislocation/subluxation, computerized tomography (CT) is useful to detect and assess associated fractures of the neural arch, disc herniations, prevertebral hematomas, and the relationship of any bony fragments to the spinal cord.<sup>25</sup> Axial CT can be utilized to identify the “naked facet” sign,<sup>26</sup> if there is an absence of

**Table 1**  
**Suggestive Radiographic Findings**  
**of Unilateral Facet Subluxations**

<b>A Lateral Radiograph</b>
1. Anterolisthesis
2. Disc (increase in posterior disc height)
3. Vertebral body (anterior wedge deformity)
4. Double posterior contour
5. Rotation (abrupt narrowing of the distance between articular pillar and spinolaminar line)
6. "Bowtie" sign
<b>B Oblique Radiographs</b> (Definitive diagnostic film)
1. "Shingles on roof" sign
<b>C Anteroposterior Radiograph</b>
1 Deviated spinous processes

one facet surface due to a unilateral facet subluxation/dislocation.<sup>27</sup> Magnetic resonance imaging (MRI) can be utilized for the detection of soft tissue injuries in acute and chronic cases. MRI can reveal lesions involving the ligaments, discs, spinal cord, muscles and prevertebral tissues.<sup>25,28,29</sup>

The priority in treating a subluxation or full unilateral facet dislocation is preservation of the continuity and function of the spinal cord. Other goals of treatment are the relief of neurological compression, spinal stabilization and speedy restoration of a patient's neurological condition. Thus, medical referral is necessary for subluxations or full unilateral facet dislocations.

There are two schools of thought regarding the appropriate treatment of facet subluxations/dislocations. One feels that nonoperative treatment is adequate, the other feels that operative treatment is necessary. In Beatson's<sup>21</sup> study, dislocations could be left in unreduced positions with little or no symptoms. Cotler et al.<sup>30</sup> found that closed reduction was safe and effective. This is further supported by Braakman et al.,<sup>1</sup> who found that spontaneous stabilization would occur regardless of whether reduction was carried out or not. Rorabeck et al.<sup>11</sup> found that unreduced dislocations would eventually develop pain; sponta-

neous fusion occurred in only 20% of patients in the study. Beyer et al.<sup>8</sup> found that open reduction provided fewer complaints of stiffness and pain, and resolution happened more frequently. O'Brien<sup>31</sup> found that there was a late instability rate of 17% after closed treatment of these injuries.

### Conclusion

The radiographs of this patient's head, neck and hand were read and interpreted as normal by radiologists at the hospital. Seven months after the accident, this patient continued to experience symptoms related to the cervical spine. Certain pathologies such as ligamentous disruptions may be missed and may not be evident soon after trauma resulting in a delayed instability. Therefore, follow-up x-rays are recommended, particularly if the patient is nonresponsive to treatment.

An adequate radiographic series is crucial for an accurate diagnosis of whiplash associated disorders. As demonstrated in our case report, radiographic findings of facet subluxation are subtle on routine radiographs but more evident on oblique films.

This case report emphasizes the importance of reviewing any previous radiographs, regardless of their source, by the treating chiropractor. The facet subluxation was missed and the delayed ligamentous laxity was not evident until the follow-up radiographic study. Delayed diagnosis of facet subluxation is common due to its frequent lack of neurological symptoms and signs. However it represents disruption of the stabilizing ligaments of the cervical spine, and it impacts upon the prognosis of the patient's condition. Thus, early proper diagnosis and early management are crucial.

Despite its limitations, a plain film radiographic study remains a crucial component of a proper assessment of patients with related injury to the neck in motor vehicle accidents. It is only through this awareness and course of action that whiplash patients can be appropriately diagnosed and properly treated.

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