

## PAIN UPDATE

# Preventing chronic pain after acute jaw sprain or strain

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## CLINICAL PROBLEM

**C**hronic pain conditions, including temporomandibular disorders, constitute the primary reason for seeking health care, the most common reason for disability and opioid addiction, and the highest driver of health care costs.<sup>1-5</sup> For this reason, the Institute of Medicine (now known as the National Academy of Medicine)<sup>1</sup> and the Interagency Pain Research Coordinating Committee<sup>2</sup> have made efforts to address this problem and made preventing chronic pain among their highest priorities for health care. From a dental perspective, acute jaw joint and muscle sprain and strain (JAMSS), often resulting from dental and orofacial trauma, can lead to chronic orofacial pain, temporomandibular disorders, and headache. All dental health care professionals need to know how to provide prompt and appropriate treatment of jaw JAMSS to prevent this progression.<sup>6-20</sup> Three cases treated by the first author (J.F.) illustrate the dilemma that acute jaw JAMSS can present to the dental health care professional.

## CASES

**Case 1.** A 34-year-old woman returned to her dentist (J.F.) 1 week after onset of acute jaw pain, earache, and temple headache that began immediately after an endodontic procedure in a maxillary right first molar. Examination results revealed that the patient had a diminished mandibular incisal range of motion of 36 millimeters and tenderness of the masseter and temporalis muscles and the temporomandibular joint on the right side. By means of history and clinical examination, the dentist confirmed a diagnosis of acute jaw muscle strain.<sup>21,22</sup>

**Case 2.** A 52-year-old man returned to his dentist (J.F.) for an urgent visit with severe jaw pain and limited range of motion 1 day after a mandibular nerve block was used to complete crown preparations for a 3-unit bridge in the left mandibular arch. Examination revealed a diminished incisal range of motion of 22 mm with stiffness and tenderness in the masseter and medial

pterygoid on the left side. By means of history and clinical examination, the dentist confirmed a diagnosis of acute medial pterygoid trismus due to needle penetration.<sup>21,22</sup>

**Case 3.** A 32-year-old man sought care from his dentist (J.F.) for acute jaw pain that gradually came on several days after a motor vehicle accident during which the patient struck his jaw on the door. Examination revealed severe tenderness, swelling, and limited range of motion of the right temporomandibular joint with an incisal range of motion of 28 mm. By means of history and clinical examination, the dentist confirmed a diagnosis of acute right temporomandibular joint sprain.<sup>21,22</sup>

In each case, dentists are required to know the appropriate management of these acute jaw problems with a protocol that improves rapid resolution of symptoms while preventing chronic pain and prolonged limitation of jaw function.<sup>23,24</sup> The speed-to-treat jaw JAMSS protocol is recommended immediately after onset of pain to improve this potential and prevent delayed recovery. The delayed-recovery chronic pain protocol is recommended when the pain does not resolve within the first 4 weeks because of risk factors for chronic pain.<sup>24,25</sup> In both protocols, integrating patient training with evidence-based treatments will help prevent the development of chronic pain. In this article, we present the clinical indications, protocols, and rationale for these protocols.

## BACKGROUND

Study results have indicated that trauma during dental care can result in acute jaw JAMSS to the temporomandibular joint and masticatory muscles with the associated pain, limitation of jaw function, and difficulty chewing.<sup>6-20</sup> This may occur after local anesthetic injections, opening the mouth too wide or for too long a period, or placing excessive force on the jaw during dental procedures. In 1 study of 164 patients with temporomandibular disorders, trauma was the initiating factor in 51% of cases, with 61% of these cases coming from trauma during dental treatment.<sup>6</sup> In another study of 588 young adult patients who underwent third-molar extraction, 23% developed new-onset jaw pain after the extractions.<sup>7</sup> Other causes of trauma to the jaw that may cause JAMSS include motor vehicle accidents, intubation during general anesthesia, yawning, blows to the jaw,

sexual activity, biting on a hard object, or sustained hard chewing.<sup>16-20</sup> In each of these situations, rapid resolution of the acute pain after the original injury should be the primary focus for the dentist to encourage healing and maintain the patient's jaw function, quality of life, and comfort with future dental care.<sup>14</sup>

Because most people with jaw pain that persists for at least 1 month continue to report pain 5 years later, successful early management is the key to preventing chronic pain.<sup>26-28</sup> The lack of long-term success in resolving jaw pain often is due to not taking appropriate steps early in treatment to encourage healing and recovery. These steps must not only provide adequate treatment of the injury but also train the patient to reduce risk factors that delay recovery.<sup>29-32</sup> Clinicians who rely only on analgesic medications such as opioids may not resolve the underlying causes, thus leading to persistence of the pain and dependency on the analgesics.<sup>33-37</sup> When pain persists, peripheral and central sensitization leads to chronic pain due to neuroplastic changes in the nervous system. Additional agonist muscles are recruited, leading to expansion of the pain region, increased muscle tenderness, and sensitivity to function.<sup>38-43</sup> Central sensitization leads to signs such as soft-tissue allodynia (increased tenderness to normal pressure) and hyperalgesia (an increased response to painful pressure).<sup>38-43</sup> Initial symptoms can increase with expansion of the scope of pain to include headaches, earaches, neck pain, jaw dysfunction such as clicking and locking, and a clinically significant personal effect.<sup>10,44-46</sup> Because oral and facial structures are essential for mastication, communication, and hearing and strongly influence appearance, self-esteem, and personal expression, chronic pain in this region can affect a person's function, quality of life, emotional status, and dental care deeply.<sup>10,39-51</sup> Long-term pain management becomes increasingly difficult if the pain persists. Patients with chronic jaw pain often have clinically significant personal suffering, including disability, addiction to opioids, work loss and disability, high health care costs, and avoidance of routine dental care, resulting in the deterioration of oral health.<sup>20</sup>

## NATIONAL PAIN STRATEGY

The Interagency Pain Research Coordinating Committee's National Pain Strategy<sup>2</sup> was developed to decrease the prevalence of pain across its continuum from acute to severe chronic pain and its associated morbidity, disability, and addiction across the life span. The intent is to reduce the burden of chronic pain and dependency on analgesics for patients, their families, and society as a whole. It is hoped that this strategy will lay the foundation to help all people with a pain condition be assured of receiving needed preventive, assessment, treatment, and self-management interventions, regardless of their background and personal characteristics. In this regard,



**Figure 1.** Magnetic resonance image of a jaw that demonstrates damage to the muscle and nerve tissue from an injection needle track abscess (red circle). Photograph courtesy of Dr. Dominik Ettlin.

the Campaign for Preventing Pain and Addiction ([www.preventingchronicpain.org](http://www.preventingchronicpain.org)) has been developed to begin to recognize and develop broad-based strategies to prevent chronic pain. In this article, we support the goals of the National Pain Strategy<sup>2</sup> and the Campaign for Preventing Pain and Addiction ([www.preventingchronicpain.org](http://www.preventingchronicpain.org)) by suggesting strategies for preventing chronic pain after acute jaw strain or sprain.

## DIFFERENTIAL DIAGNOSIS OF JAW JAMSS

JAMSS is just 1 of several conditions that can result from trauma to the jaw during dental procedures. For example, temporomandibular joint disk disorders can result from opening too wide or for too long, resulting in anterior disk displacement and a closed lock. In addition, mandibular or lingual nerve injuries, needle track abscesses, and hematoma formation can result from needle injection trauma.<sup>52-55</sup> Direct trauma of the mandibular or lingual nerve by means of a local anesthetic needle injection can rupture the perineurium, herniate the endoneurium, and cause transection of multiple nerve fibers, resulting in pain. Local anesthetic can be toxic in some people and lead to localized chemical damage to the muscle and nerve tissue that may leave a needle track abscess (Figure 1).<sup>54</sup> The injection needle also may traumatize the intraneural blood vessels, creating bleeding and an intraneural hematoma.<sup>52,53</sup> In each of these cases, it is important for the dentist to establish an

accurate diagnosis to understand the prognosis and best management strategy for the condition. Because needle traumas typically injure soft-tissue structures, the diagnostic method of choice if symptoms progress is magnetic resonance imaging.

### CLINICAL IMPLICATIONS FOR DENTAL HEALTH CARE PROFESSIONALS

When trauma leads to jaw sprain or strain, it is important for the dentist to diagnose accurately and treat promptly—if possible, on the same day. Expedient treatment may prevent unnecessary progression to chronic pain and its long-term consequences and complexity in management. There is a clear need for a well-defined evidence-based protocol for successful early management of acute jaw JAMSS that all dental and other health care professionals can apply easily.

Acute sprains and strains can occur to any joint and muscle group throughout the body, and many of the principles are also generalizable to the jaw. Sprains and strains can vary from first-degree injuries (slight muscle or ligamentous tear with mild pain and functional limitation) to second-degree injuries (partial muscle or ligament tear with blood clot formation, moderate pain, and functional impairment) and third-degree injuries (total separation of the muscle or ligament, with severe pain and loss of function and stability) (Table 1).<sup>55-61</sup> Signs and symptoms in each degree include increasingly more severe pain, tenderness, swelling, limited range of motion, and functional loss.

To encourage rapid healing of sprain and strain injuries in first- and second-degree injuries, we recommend using the movement, exercise, analgesics, and treatment (MEAT) protocol.<sup>60,61</sup> The treatment of a third-degree injury requires using the rest, ice, compression, and elevation (RICE) protocol. Although the RICE protocol historically has been used to treat all types of sprain and strain injuries, research results suggest the MEAT protocol is more successful in first- and second-degree injuries such as in the clinical cases.<sup>55-62</sup> Table 2 illustrates the differences between the MEAT and RICE protocols. Study results have demonstrated that using the MEAT protocol during the first week after a first- or second-degree sprain or strain will encourage more rapid healing and return to normal function and activity levels than will using the RICE protocol.<sup>60-62</sup> This is especially true of jaw conditions because of the unique characteristics of the masticatory muscles and temporomandibular joint with regard to frequency of use of the jaw, the difficulty in resting the jaw, and its bilateral rotational and translational movements.<sup>63-65</sup> By using the speed-to-treat jaw JAMSS and delayed-recovery chronic pain protocols, we have the best opportunity to resolve acute pain without development of chronic pain, limitation of jaw function, and long-term consequences.

TABLE 1

Comparison of different degrees of acute muscle sprain or strain.			
VARIABLE	FIRST DEGREE	SECOND DEGREE	THIRD DEGREE
<b>Injury</b>	Slight muscle or ligamentous strain and subclinical fiber tearing	Partial muscle or ligament tear with blood clot formation and bruising	Total separation of the muscle or ligament with visible morphologic change
<b>Pain</b>	Mild	Moderate	Severe
<b>Limitation</b>	Slight functional limitation	Moderate functional impairment	Loss of function and stability

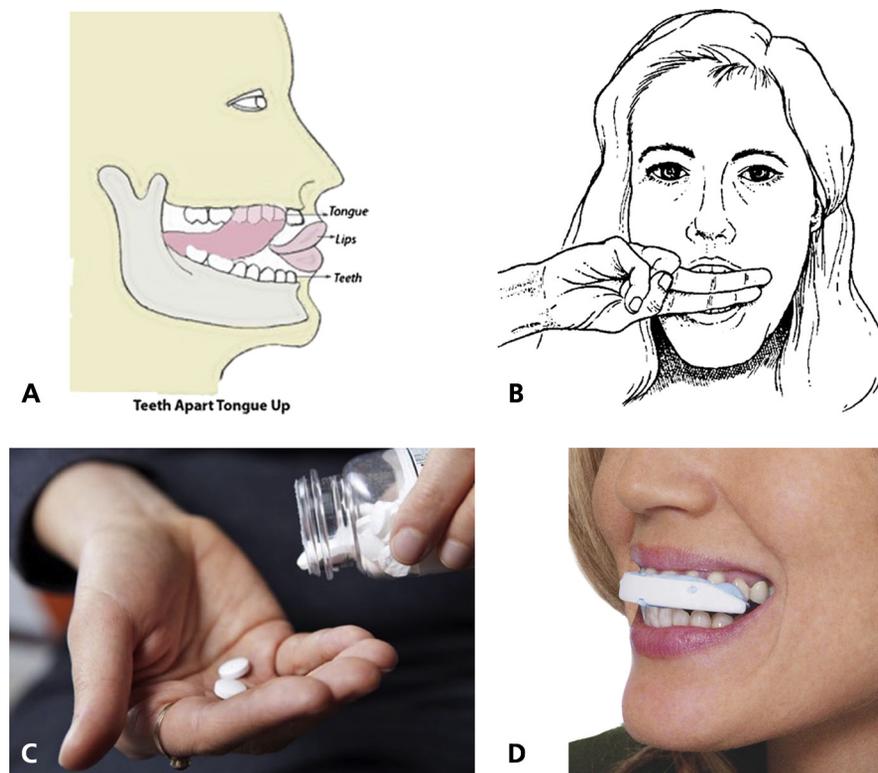
TABLE 2

Comparison of RICE* versus MEAT† protocols for acute muscle sprain or strain.		
CHARACTERISTIC	RICE PROTOCOL	MEAT PROTOCOL
<b>Type of Injury</b>	Third degree	First and second degree
<b>Goals</b>	RICE	MEAT
<b>Characteristic</b>	Major tear of muscle or ligament	Mild to moderate tear of muscle or ligament
<b>Pain Level</b>	Severe	Mild to moderate
<b>Timing</b>	Weeks to month	Same day
<b>Immune System Response</b>	Decreased	Increased
<b>Blood Flow to Injured Area</b>	Decreased	Increased
<b>Collagen Formation in Healing</b>	Delayed	Enhanced
<b>Speed to Recovery and Normal Function</b>	Long term	Rapid
<b>Range of Motion of Muscles and Joints</b>	Compromised	Quick return to normal
* RICE: Rest, ice, compression, and elevation. † MEAT: Movement, exercise, analgesics, and treatment.		

### SPEED-TO-TREAT JAW JAMSS PROTOCOL

To prevent chronic jaw pain, earaches, temple headaches, and jaw dysfunction, a speed-to-treat jaw JAMSS protocol is recommended as soon as possible, and, as noted earlier, preferably on the same day. By completing these 4 steps, the potential for success in reducing pain and dysfunction at this acute stage is maximized.<sup>55-62</sup> The protocol includes the following 4 steps (Figure 2).

**Movement.** This includes self-care training on the proper use of the jaw and avoiding risk factors such as oral habits that delay recovery. Encourage return to normal movement with gentle use of the jaw during chewing, talking, and other activities while reducing parafunction such as clenching, jaw bracing, and hard chewing. Proper jaw posture and oral habits can be improved by replacing negative habits with the positive



**Figure 2.** Speed-to-treat jaw joint and muscle sprain and strain protocol for acute jaw sprain and strain by means of movement, exercise, analgesics, and treatment. **A.** Movement. Encourage return to normal jaw movement and rest posture by keeping the jaw relaxed, the teeth apart, and the tongue up gently resting on the palate. **B.** Exercise. Perform gentle jaw stretching, rotation, and relaxation exercises to achieve normal range of motion and function. **C.** Analgesics. Use acetaminophen, ibuprofen, aspirin, topical analgesics, or hydrotherapy to reduce pain and facilitate movement, exercise, and healing. **D.** Treatment. A same-day immediate splint worn at night can reduce oral habits, reduce forces on the muscles and joints, and encourage healing.

habit of keeping the teeth apart and tongue up gently resting on the palate. The proper tongue position is illustrated in Figure 2A by having the patient saying the *n* sound. With first- or second-degree injuries, a MEAT protocol with continuing careful use of the jaw will increase blood flow, encourage healing, and restore jaw function. With third-degree sprain and strain injuries, a RICE protocol with a liquid diet and no jaw function is appropriate. In both cases, risk factors such as oral habits, muscle bracing, and jaw overuse should be avoided.

**Exercise.** Restoration of normal function can be achieved with exercises that focus on stretching and rotation to restore normal range of motion (Figure 2B). In addition, posture and relaxation exercises will reduce strain to the muscles and encourage healing.<sup>66-70</sup> Stretching is performed by placing 2 fingers horizontally between the front teeth, holding to a count of 10, and then gradually progressing to 3 fingers over time. Rotation is performed by slowly opening and closing the jaw (while keeping the tongue on the roof of the mouth

where the *n* sound is made) and stopping when the condyle (ball) of the joints move forward against the fingers. Relaxation is performed by using a gentle pulling down massage of the masseter and temporalis muscles with the fingers to gain awareness of any muscle tension and provide some counterstimulation. These exercises should be performed for 10 seconds 6 times per day. Online training programs are also available at [www.preventingchronicpain.org](http://www.preventingchronicpain.org), if needed, to provide this training.

**Analgesics.** Achieving pain relief includes the use of acetaminophen, anti-inflammatories, topical medication, or hydrotherapy (alternate heat and cold) to reduce pain and facilitate movement, exercise, and healing (Figure 2C). Topical medication such as a 5% lidocaine patch or anti-inflammatory solutions overlying the muscle and joint may be particularly helpful in alleviating acute jaw JAMSS

for patients who are medically compromised or cannot tolerate systemic side effects of oral medications.<sup>71</sup> Opioid medication use, if done at all, should be short term (< 7 days) to prevent long-term opioid dependency if acute problems become chronic. Results from several cohort studies indicated that opioid therapy prescribed for acute pain was associated with greater likelihood of long-term use.<sup>3,4,72-73</sup> Thus, the Centers for Disease Control and Prevention has developed guidelines for prescribing opioids to prevent abuse, misuse, and complications associated with their use.<sup>74</sup>

**Treatment.** The immediate use of a protective intraoral splint that can be placed chairside on the same day to help protect the jaw is similar to a protective elastic bandage for an ankle or wrist injury.<sup>75-78</sup> Figure 2D shows an example of an inexpensive, convenient, easy-to-use immediate appliance for immediate protection of the muscles and joints that can be assembled by staff members for the patient within minutes. The quick splint, worn at night, can reduce jaw-closing muscle activity (for example, jaw clenching or tooth

TABLE 3

**Results of using the speed-to-treat protocol for jaw sprain or strain at 1 month in a randomly selected group of patients with acute jaw pain (N = 40).**

OUTCOME MEASURE	FOLLOW-UP AT 1 MONTH
<b>Pain Level</b>	Reduced = 92% (n = 37) Same = 8% (n = 3) Worse = 0% (n = 0)
<b>Satisfaction</b>	High = 52% (n = 21) Moderate = 38% (n = 15) Low = 10% (n = 4)
<b>Complications</b>	8% (n = 3) included some mouth soreness and difficulty sleeping
<b>Exercise Compliance</b>	High use = 68% (n = 27) Low use = 32% (n = 13)

grinding), inhibits the maximum bite force, and helps encourage healing of acute temporomandibular pain and related restricted jaw opening.<sup>75-78</sup> The flat occlusal surface allows the mandible to move freely in various directions instead of closing into a specific dental relationship and encourages healing and normal function. The advantages over a traditional laboratory-based splint include immediate placement with no impression needed; custom fit to each person’s occlusal, range of motion, and orofacial features; being large enough to avoid aspiration or swallowing; and being temporary (up to 4 weeks) to minimize occlusal changes and allow time to place a long-term splint.

**OUTCOMES OF SPEED-TO-TREAT JAW JAMSS PROTOCOL**

To evaluate the effectiveness of the jaw JAMSS protocol, we evaluated the clinical data from a random series of 40 patients at 1 month after treatment. The University of Minnesota Institutional Review Board reviewed and approved the protocol for secondary use of data. We used a random selection of charts from patients who had first- or second-degree acute jaw pain regarding their outcomes associated with use of the protocol to improve their pain (N = 40). The assessment included pain relief, satisfaction, complications, and compliance. Each was noted in the chart. The results demonstrated that 92% of these patients with acute jaw pain had improved their pain within 4 weeks with 90% moderate to excellent satisfaction (Table 3). The complication rate was 8% with the quick splint that included difficulty sleeping with the device and tissue contact discomfort due to friction or contact sensitivity. The compliance rate with the exercises was 68%. Results from this preliminary study suggest that the speed-to-treat jaw JAMSS protocol was able to prevent chronic pain and dysfunction in most cases to the satisfaction of the patient. However, compliance with each step is key.

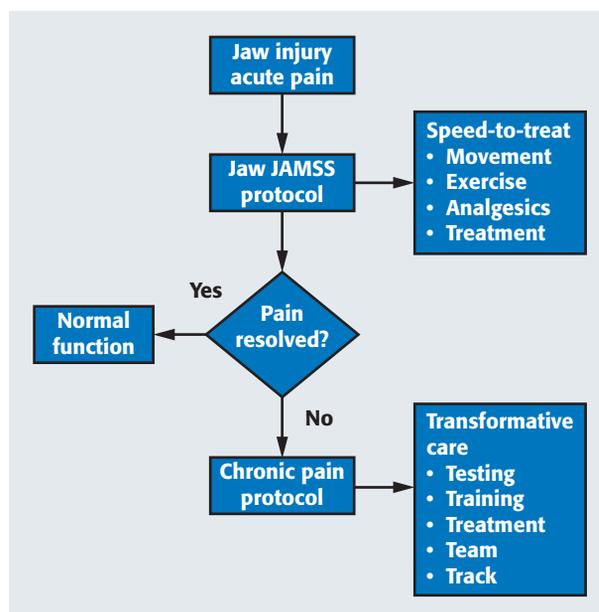


Figure 3. Decision making for management of acute jaw sprain or strain to prevent chronic pain. JAMSS: Joint and muscle sprain and strain.

**BOX**

**JAMSS\* 12: Risk assessment for jaw JAMSS.†‡**

Do you often have jaw or facial pain?	O Yes O No
Do you often have headaches?	O Yes O No
Do you have difficulty opening your mouth wide?	O Yes O No
Does it hurt to open your mouth wide?	O Yes O No
Does it hurt to chew hard or chewy foods?	O Yes O No
Does it hurt during or after dental work is done?	O Yes O No
Are your jaw and temple muscles tender when you press on them?	O Yes O No
Do you often have aches and pain in your body?	O Yes O No
Do you often notice yourself clenching or holding your teeth together?	O Yes O No
Do you often feel depressed, downhearted, or blue due to pain?	O Yes O No
Do you often feel anxiety or nervousness?	O Yes O No
Do you often feel like you have a lot of stress?	O Yes O No

\* JAMSS: Joint and muscle sprain and strain.  
 † Source: Friction and Oleson.<sup>48</sup>  
 ‡ Any yes answers suggest there is some risk of jaw JAMSS during dental care.

**DELAYED-RECOVERY CHRONIC PAIN PROTOCOL**

In some cases of acute jaw JAMSS, patients may not respond to a speed-to-treat protocol because of risk factors that lead to delayed recovery and persistent pain beyond 4 weeks (Figure 3). The box provides a risk assessment for delayed recovery after jaw JAMSS. In these cases, moving promptly to a delayed-recovery chronic pain protocol using a transformative care model

is necessary and can be implemented by dentists who are trained in the field of orofacial pain.<sup>23,24</sup> Transformative care includes the 5 Ts: testing, training, treatment, team, and track.

**Testing.** Ask the patient to complete a risk assessment to identify factors that contribute to delayed recovery and can be reduced to promote healing and resolution of the problem. Common risk factors include behavioral (for example, repetitive oral habits, muscle tension, jaw postural habits, diet, sleep), emotional (for example, anxiety, depression, fear), cognitive (for example, poor understanding, unrealistic expectations, coping strategies, catastrophizing), social (for example, lack of social support, secondary and tertiary pain, conflict, abuse), and comorbid (for example, fibromyalgia, migraine, back pain) conditions that are important in the progression to chronic persistent pain.<sup>23-32,79-85</sup> Risk assessment that can help identify risk factors for delayed recovery can be found at [www.preventingchronicpain.org](http://www.preventingchronicpain.org).

**Training.** Educate the patient about how to reduce personal risk factors and strengthen protective factors that contribute to peripheral or central sensitization. Use cognitive-behavioral training such as relaxation training and mindfulness-based stress reduction to reduce oral habits, repetitive strain, sleep problems, stress, and emotional challenges. Web-based patient cognitive-behavioral training programs are also available to help patients reduce these risk factors and encourage normal healing and function at [www.preventingchronicpain.org](http://www.preventingchronicpain.org).

**Treatment.** The use of evidence-based treatment strategies, such as full-coverage splints, physical therapy, medication, and occasionally surgery if structural joint disease is present, can support the patient training to improve the chronic pain long term.<sup>77,78,86</sup> The Centers for Disease Control and Prevention guidelines generally do not recommend the use of opioids for chronic pain because of the potential for abuse, misuse, addiction, and adverse events.<sup>74</sup>

**Team.** Transformative care requires implementation with a team that may include an orofacial pain dentist, a health psychologist, and a physical therapist to implement the long-term treatment plan. The focus is on ensuring patients understand that their success is based on implementing self-management on an equal and integrated basis as the treatments to achieve resolution of the pain.<sup>23,24</sup>

**Track.** We need to follow the progress of improvement closely in all protocols by using outcomes measures such as pain, range of motion, and return to function, as well as compliance monitoring with self-management protocols.

Thus, the chronic pain protocol shifts to more long-term care over months instead of weeks and relies on engaging, empowering, and educating the patient about reducing the risk factors for delayed recovery to improve the condition. Tailored treatment strategies have more

predictable outcomes in reducing pain and the underlying peripheral and central pain sensitization. Because of the challenge in modifying risk factors with chronic pain, successful outcomes are more dependent on patient-related than treatment-related factors. Because of the persistent nature of the chronic pain, it is also important to track the progress of improvement in both the speed-to-treat and delayed-recovery protocols by using outcome measures such as pain and return to function, as well as compliance monitoring with self-management protocols.<sup>87-89</sup> Knowing where the patient is in recovery is the key to preventing further chronic pain.

## CONCLUSIONS

All dental health care professionals need to know how to manage a jaw sprain or strain by using a speed-to-treat jaw JAMSS protocol to help resolve the acute symptoms. If the pain persists because of risk factors for chronic pain, implementing a delayed-recovery chronic pain protocol can help prevent the development of chronic pain. In patients with a more complex history of chronic pain, obtaining a consultation with an orofacial pain dentist to provide a more comprehensive interdisciplinary rehabilitation treatment program may be necessary to improve the pain in the long term. ■

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