Zimmerman, Int J Neurorehabilitation Eng 2018, 5:6
DOI: 10.4172/2376-0281.1000335

International Journal of Neurorehabilitation

Case Report Open Access

Using Motor Reflex Challenge to Identify and Appropriately Treat Nociceptive Sources Offers More Tailored Treatment with Prompt and Durable Outcomes

David Zimmerman*

Stanmore Bay Dental, New Zealand

Abstract

While nociception's role in pain generation is known and understood what is less certain are the processes that drive rapid and profound pain reduction or cessation, particularly when the physical 'causes' are reinstated where orthotic use has seen rapid and durable profound pain reduction. There is a balance between nociceptive and anti-nociceptive systems. This paper looks at unexpectedly rapid and yet durable reduction in pain suffered achieved using non-invasive therapy.

Pain is by definition and neurologically is subject to thresholds, below which pain is not consciously perceived. Context is always relevant and enduring pain and/or impaired sleep poses a threat to health. Noting profound, rapid and durable loss of pain, either in terms of cognition or of afferent signaling there are great benefits clinically.

The questions posed are whether the threshold of perceivable pain increases over time and with conditioning exposure, and secondly asks do pre-treatment thresholds remain high, even when the cause is removed? It is notable that such afferent supply, as demonstrated to be immediately reversible and switch back on, cannot be considered a neuropathic pain as there is no aberrant function of the receptors or nerves, nor is there a pathology associated with involved tissues such as cancer. The cited cases suffer from long term stimulation of these normal and healthy nerves but often misdiagnosed as chronic pain, neuropathic pain or allied to a disease process. Were this case reversal of motor-reflexes would not be related to position of an anatomical structure.

Keywords: Neuropathic load; Temporo-mandibular joint; Afferent signaling; Pain thresholds; Cognition

Abbreviations: BOLD: Blood Oxygen Levels Demonstrated; MRT: Motor Reflex Testing; NL: Neuropathic Load/s; NRS: Numerical Rating Scale; VRS: Verbal Rating Scale; Tx: Treatment; Yr: year.

Introduction

Orthotic use to normalize anatomical relationships and function frequently permits healing of abused tissues and pain reduction. Different to most craniofacial pain recovery which occurs over a period of weeks or months these cases were resolved in brief time periods thereby posing a problem of understanding. A problem compounded by the durability of this relief in light of abandonment of orthotic wear and automatic return of nociceptive load. The plausible answer is while afferent nociceptive signalling is subdued or stopped, the pre-treatment threshold remains high creating a gap between reinstated nociceptive load and original thresholds. Therefore cognizance requires a greater overall nociceptive load to re-trigger this into cognitive recognition [1-5].

Material and Method

Patients drawn from a TMJ (Temporo-mandibular Joint) & Sleep Therapy practice. Controls were those who followed the typical pattern of pain resolution in approximately 12-16 weeks with a low to moderate prospect of recurrence.

Motor control challenge

Where pain is noted, protection of the injured part is often associated with motor diversion, that is recruitment of remote 'nerve power' at the expense of motor control of remote anatomy such as a limb. A simple challenge of this uninvolved limb comparing before/after strength when the injured part is repositioned or rested shows predictably the involvement of both test limb and injured anatomical feature. This allows fast repeatable testing of the benefit of changing anatomical relationships towards or to an anatomically typical relationship.

Pain will generate a protective response in local muscles, [6] be they abdominal muscles as seen in appendicitis or neck and lumbar pain where posture and movement is altered. The hierarchical aspect relates to the value of the injured part to viability of the whole. To protect an 'injured' part, there is a known reallocation of neurological motor resources which can measured using changes in reflexive motor (muscle) strength. This is motor diversion [7] (Put simply muscles can be predictably 'weakened' or 'recovered' by diverting motor input away from the test-muscle into a site engaged in protection. The postural influence is well known, and can be seen in people with low-back pain where movement is carefully carried out with altered postures [8-10]). This was the basis of Travel and Simons' method of locating source (cause) as opposed to site (perceived) pain. Blocking the pain signalling and thereby identifying the source and comparing activity in remote muscles and pain referral patterns [11]. Intra-muscle (I.M) local anaesthetic is cumbersome and unpleasant making a good case for MRT.

Simply noting muscle strength when sitting compared to standing, standing against and away from a wall; head posture changed; lower jaw repostured or wedges placed under heels and lastly a trochanter belt gives diagnostic insight into nociceptive influence. These are all inexpensive non-invasive and reversible methods of altering nociception afferent

***Corresponding author:** Dr. David Zimmerman, Stanmore Bay Dental, New Zealand; Phone: 0275 230 232; E-mail: david@tfdental.co.nz

Received November 08, 2018; **Accepted** December 26, 2018; **Published** December 31, 2018

Citation: Zimmerman D (2018) Using Motor Reflex Challenge to Identify and Appropriately Treat Nociceptive Sources Offers More Tailored Treatment with Prompt and Durable Outcomes. Int J Neurorehabilitation 5: 335. doi: 10.4172/2376-0281.1000335

flow. MRT (Motor Reflex Testing) is also spinal and reflexive thereby negating conscious involvement of the patient.

MRT was brought to be a diagnostic tool level by the late Dr. John Beck. Refinement by Mehta, Olmos and others have created a tool that can track pain-generation to a myotome or a dermatome also allowing rapid repeated testing on a yes/no interchange. This is not possible with either drugs (Local Anesthetic) or such as cold-spray. By this it is meant that the response can be repeated many times within short periods, often with variation to confirm findings. This is an important diagnostic tool and a compliment to other standard tests.

Common sources of afferent nociception

While the whole body, with exceptions of brain tissue, have some form of pain receptor, there are a few highly responsive regions that can barrage the central nervous system. These are pelvis/SI; Lumbar spine; upper Cervical Vertebrae; Temporo-mandibular Joint (TMJ).

The TMJ, despite its small size, has a vascular bed highly populated with type 4 nociceptors; these are the same receptor type as those populating the sclera, carried by a branch of the same nerve–Trigeminal-to the same spinal complex. This is reflective of it role in personal viability including food, communication and airway.

Nociceptive load

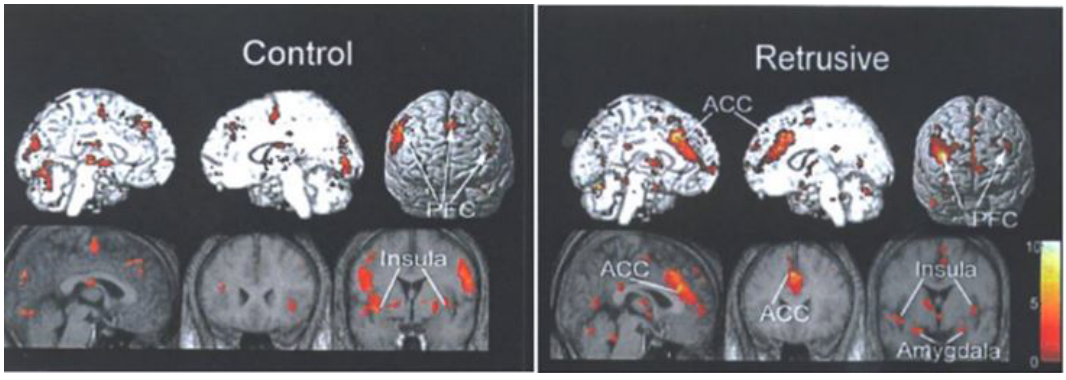
(NL) n the case of the TMJ, which is arguably the most potent of the common NL sites, the multiple branches of the Trigeminal Nerve, frequently interacting with other major nerves, specifically the mixed cranial nerves, and the dorsal roots of upper cervical nerves, activation of any branch of the Trigeminal stimulates the whole nerve complex [12-16]. C.N.5 is the equivalent of a spinal nerve with its hub being the spinal trigeminal nucleus-a three section midbrain complex that is allied to the Nuc. Of the Solitary tract, where all 5 mixed cranial nerves converge. The predictability of using spinal reflexes and thereby avoiding cognitive input, often well intentioned and influenced by psychological factors [17], is of great help in resolving true levels and distinguishing site of pain from source of pain. The importance of separating site and source is a reflection of the scope of interactions and of influence.

Clinical findings in common

Prolonged pain, frequently termed 'chronic' pain and may be better thought in these situations of as long-term pain, being no different in cause or effect than acute pain, just prolonged. Intractability is arguably more due to inadequate diagnosis and failure to include major nociceptive sources thereby allowing high levels of afferent NL to remain. All of these cases had endured moderate to high levels of pain that posed significant barriers to normal life, frequently threatening existence. Symptom spread is widely varied, from vision disturbance on waking to Cervico-genic headache; severe neck and Headache pain; Low back and Thoracic pain to Unilateral Loss of feeling. Symptoms were consistent and persistent in each case. That is each person had their own symptom set. Temporal pattern was equally individual and consistent. These patterns remained consistent with only changes being the anatomical location and symptom spread. Signs and symptoms involve very different neurology in each case, therefore confounding the concept of a purely anatomical substrate. Yet pain resolution was rapid and durable in these cases and confirmed with MRT showing return to normal motor function as well as patient's reporting. When total afferent NL was reduced to low levels that did not lead to motor diversion perceived pain was 'resolved'. That suggests total NL was lower than triggering threshold. The question now posed is one of clarifying the process.

Speed of process

Otsuka shows that stimulation of large numbers of nociceptors generate an immediate cortical response that can lead to overwhelming psychosomatic levels of brain activity in emotive and pain processing areas. These signals were generated by clenching on a mandibular splint that had an anterior ramp which forced the mandible distally and thereby driving the mandibular condyles onto the distal Glenoid Fossae wall compressing the vascular bed. Each clench took 10 seconds when the MRI was taken (Figure 1). VAS Scale no splint =3.4 (of 10) VAS Scale with compressing splint=6.8 (of 10) ~ within 10 seconds. Participants were young asymptomatic dental students. Images compare no-splint (Control) and ramped splint clenching, (Retrusive). The BOLD image shows radical change of involvement in the second image whereas the first is largely demonstrating motor control; the second involve brain regions responsible for interpreting and responding to pain. Some students participating felt overwhelmed and suicidal, abandoning the experiment before the ten second time span ended. The experiment did not include a cycle of clench-unclench-clench which may have better indicated the speed of change.



T1- weighted MRI for all subjects
Scale: *t* value
VAS Scale no splint=3.4 (of 10)
VAS Scale with splint=6.8 (of 10)~ within 10 seconds

Figure 1: Signal increases associated with clenching the control splint (left) and the retrusion-forcing splint (right).
Upper row: activated areas superimposed on a template
Lower row: activated regions superimposed on the mean

Confirmatory use of MRT (Motor Reflex Testing)

It was demonstrated in all involved study cases, that withdrawal of orthotic and its posture change, saw immediate reversion to the motor diversion noted in pre-treatment (Figures 2 and 3). In each case MRT was carried out routinely at all visits in concert with patient-written/signed NRS pain scale estimation of their recent pain level, which was graphed, in this case ranged from three to zero. Note pre-treatment levels in all cases were 8/10 or above and maintained for more than 12 months at that level (Figure 4).

Figure 2: Rt Condyle positioned high and distally in fossa. Compression of soft tissue.

Arrow indicating bilaminar zone containing the vascular bed.

Figure 3: Rt Condyle positioned using oral orthotic in to Gelb 4:7 position. No Compression of vascular bed.

Case Study

From a series of 120 craniofacial and upper quarter pain cases, five cases are used illustratively. These five patients experienced total and prompt cessation of pain. Usually within hours, some within 2-3 days. These were tracked for two years in telephone interviews and remained pain free. Generally such relief follows a tissue-healing process which takes place in stages over weeks. Indicative cases are set out in appendix below.

39 Years old Male

No health issues. Pain; 2+ years 9-10/10 NRS. Suffered mild pain in right face since teens. Since mid 30's noted escalation of pain each year, escalation increased markedly in last two years before orthotic based treatment. First visited European dentists and oral surgeons. All offered treatment of symptoms, none looked to cause. Relocating he noted a space between upper molars. The last tooth was filled to close the space, which recurred and was refilled with a bigger and deeper filling. The nerve died, tooth root filled, the tooth split and was extracted and replaced with an implant. None of this affected the progress of the 'face pain'. His lower jaw was sited somewhat behind his upper so the mandibular condyles sat against the distal wall of the fossae thereby compressing the vascular bed. The (day-wear) mandibular orthotic ensured such compression was avoided by making artificial 'teeth' to maintain both increased vertical and a protrusion. For night there was a maxillary orthotic designed to maintain a patent airway plus a vertical wall preventing mandibular distalising and compression of the innervated vascular bed. Within one hour of wearing the day-guard pain began to reduce, going fully within 24 hours. Weaning off (non-wear) the device pain returned. After time weaning was without return of pain unless he deliberately repositioned his mandible. The question posed is why is the pain not generated when the patient returns to the pre-treatment bite and jaw relationship? This case was added to show in some cases there is the expected return of signs and symptoms when stimulation recurs.

35 Year old woman

Pain:- (neck/shoulder 3+ years of 8-9/10 NRS) Whiplash following a sudden bus-stop when a 140 kg passenger fell on her and twisted her neck . Usual Treatment such as typically physiotherapy, analgesics, and massage proved unsatisfactory. Two separate spinal endplate caps were placed, in two surgeries and neither reduced migrainous and Tension headaches, neck or shoulder pain. Diagnostic LA block of Right Lev Scap. Muscle proved a potential pathway with transient reduction of pain in that muscle. Sectioning of the muscle proved unhelpful in adding a dropped shoulder and carpal tunnel with post-surgical pain to the total pain spectrum. The pharmacological program was not proving easy to balance benefit with adverse impact and was losing ground. Attendance at a general dentist noted there was a large increase in dental decay due to inability to use her dominant hand to clean her teeth. Using the left hand proved unsatisfactory. She could neither hold nor manipulate her tooth brush. The 1960's Chicago engineer Charles Gussay showed that the centre of mechanical load of jaw movement was in the upper cervical spine. Coupled with the pain signalling generated in the TMJ's, both inappropriately placed, this was close to pain threshold. Typical day/night bite altering oral orthotics saw all pain resolved in 24 hours.

Citation: Zimmerman D (2018) Using Motor Reflex Challenge to Identify and Appropriately Treat Nociceptive Sources Offers More Tailored Treatment with Prompt and Durable Outcomes. Int J Neurorehabilitation 5: 335. doi: 10.4172/2376-0281.1000335

TMD PROGRESS REPORT

1. What has been the level of your head, ear or facial pain since your last visit? (1- lowest, 10 P highest)
Circle your choice
0 1 2 3 4 5 6 7 8 9 10
2. What has improved since your last visit? no change - occasional pain
3. What other areas of your body continue to be painful? none
4. What has been your chief complaint(s) since your last visit? none
5. What medications are you taking for relief of pain? none
6. Is it easy to fall asleep? yes Do you wake during the night? Do you feel rested upon AM Waking?
7. On average, in a 24 hour day, I have worn my appliances ___ hours/day ___ hours/night
8. When do you remove your appliance(s)?
9. Do you feel our treatment is helping you? (Please Circle) YES NO
10. If you are presently going to a chiropractor, massage therapist, or physical therapist, do

Figure 4: Post-treatment week end report. NRS pre-treatment was 10/10.

Her typical day scheduled around opiates was radically altered and she began job-hunting that week. Weaning after 2 weeks did not result in symptom return and remains to after 3 years.

60 Years old Female

She suffered pain at level between 7 and 9 units out of a possible 10. Med Hx:- Ca Breast Lupus, some toenails removed suggestive of OSA (Obstructive Sleep Apnea) and T2Diabetes. High levels of fatigue. Taking 11 different medications. Narrowed airway Mallampati Score 4/4. Pharyngometery supported. Both TMJ condyles positioned distally and high in the fossae. Myofascial pain Vertex pain (top of skull) headaches, typically generated by intense bilateral tension in Temporalis and Massetter muscles. OSA is suggested with Epworth score and Harvard (David White) Scores both supportive. Typical dual day-night orthotics used as MRT showed repositioning of mandible and condyles was improved in a protrusive position. Pain at oral orthotic delivery was 8-9/10 and 4-5/10 in 1 week. Intolerant of oral appliances due to bulk which further impairs an already narrowed oral airway (Lavigne) intermittent wear resulted in slow progress. But in the remaining 18 weeks pain resolved. This proved durable, even in the light of Lupus.

45 Years old female

Med Hx of Pain 10/10 over 2 years with tolerance and health declining. Three contributing injuries. i. Fall upwards on concrete steps. ii. Forced opening of mouth by dentist; iii. slip/fall onto occiput. Combined total included inappropriate (distalised condyle) mandibular joint relationships with very limited mouth opening-12 mm. Early treatment was typically a flat plane splint. Lund and Westesson [18] (n=120) compared temporary gold onlays to increase vertical and slight changes in bite altered condylar-fossae relationships. These 30 patients were compared to Flat Plane Splints (FPS) and to 30 patients with no treatment. The splint proved no better than no treatment group which formed the control group. Treatment in this case was series of corrective orthotics each improved as pain reduced and mouth could open further allowing better appliances. Successive orthotics allowed refinement of mandibular position and inclusion of the oral airway consideration when pharyngometery became available when her cognitive ability returned. Pain slowly reduced over time, but when low enough, weaning took the form of altering the day-orthotic so there was no overlay remaining to alter the bite. Pain remained resolved. Without the prospect of jaw repositioning it was expected some symptoms would recur but up until a further accident with a puncture wound to the left Zygoma, followed by a few weeks or replacement orthotic use, pain remains resolved and Jo P returned to the workforce.

45 Years old female

Decade long escalating TMJ pain including face, jaw neck and shoulder muscles. Pain 7-10 NRS 10 yr.+ multiple health providers. Tx. had been based on symptoms, and not helped. Admitted that pain was so intrusive that despite happy family she had reached a point where 'she did not want to be here'. Typical assessment including radiographs, muscle palpation and 0-3 pain scoring with MRT to isolate and confirm effect of motor inhibition and redirection was carried out. Day and night guards provided and pain reduction followed and reached successful weaning. Weaning off appliances dictates an automatic return to pre-treatment anatomical relationships, but there was no return of pain.

Result

In each of these cases there has been a spectrum of signs and symptoms, unique to each patient, but consistent and persistent as well as resistant to previous treatment. Identification of the primary source of NL was made, challenged and confirmed prior to treatment using MRT and radiographs. It is evident that reversal of localised stimulation of nociceptors is a predictable source of NL which has a predictable consequence. What was not predictable was the rapid reduction in pain levels and motor impact as shown in patient's reports and graphically. Equally the withdrawal of orthotic support, where a pain-free patient self-weans off orthotics, be they oral, pedal or pelvic, would be expected to see return of symptoms as is more typical until associated injury and tissue damage has healed. In these cases there is no time for such events thereby sponsoring the concept of cessation of NL and thereby remaining below the awareness threshold.

Follow-up:- Both clinical assessment and telephone follow up. Clinical assessment involved self-reporting (Figures 5 & 6) plus muscle palpation using 0-3 Verbal Rating Scale plus MRT screening.

Discussion

Motor Reflex Testing (MRT) allows identification of suspect joints as sources of Nociception. MRT permits rapid interchange of state, too rapid to be confused with normal healing and/or loss of inflammation of damage. Such a rapid return to normal function eliminates indicators of neuropathology, such as Neuropathic pain as rapid switching in real time between normal and weakened muscle tone in the remote test

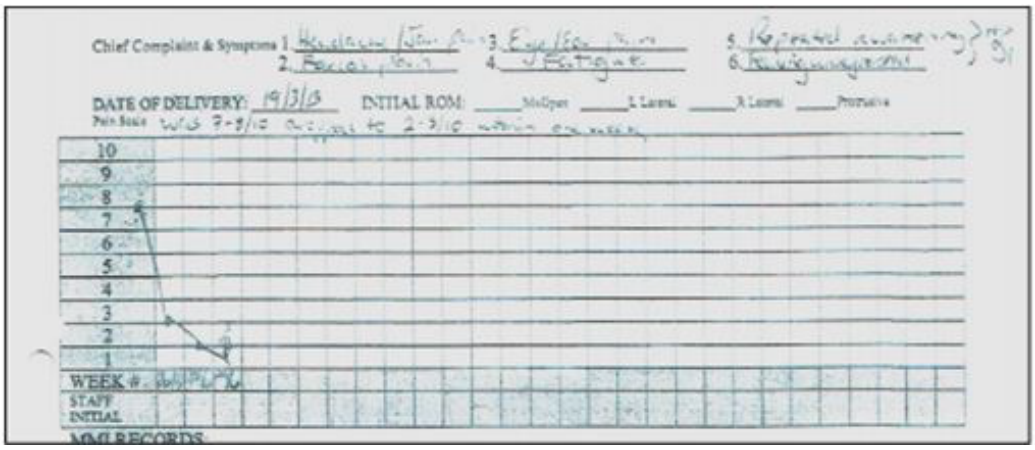


Figure 5: Male 3 years of escalating pain right face-jaw. Resolved following oral orthotic use.

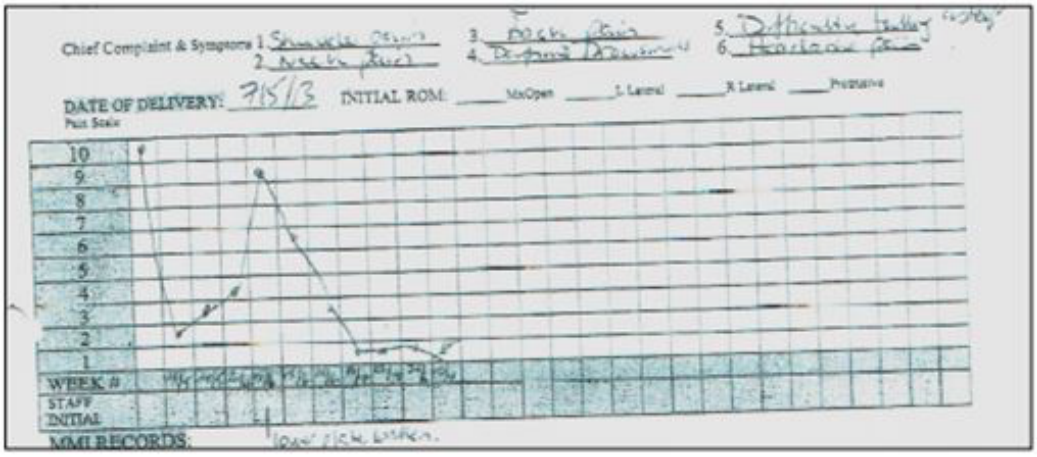


Figure 6: Female 3 years of upper quarter pain associated with 'whiplash'. C/spine fusions and sectioning of Levator Scapulae all of which compounded pain spectrum without benefit. Both cases followed up for two years or more and remained symptom free. The spike was due to pain remained low or zero for at least 2 years.

limb is dependent upon the compression (or decompression) of the site of afferent pain signalling and is immediate. As the free nerve endings are not injured, but are highly stimulated and function accordingly.

The questions posed are those of process of setting and maintaining pain thresholds and how might this assist clinicians and benefit patients. There appears to be little clarity surrounding the re-setting of pain-awareness thresholds following, in these cases, orthotic therapy.

The unanswered questions are:-

1. Is the lingering of the level of pre-treatment pain threshold valid?
2. Why when in brief periods of NL reduction is the threshold seemingly lowered and does not return to pre-treatment level?
3. These questions suggest closer and more rigorous investigation is required.

In short the question posed is 'did we close the gate?"

Setting the pain threshold:- It has been defined International Association for the Study of Pain (IASP) that pain is an emotive response to afferent noxious signalling. It requires a threshold above which pain can be perceived. The threshold will alter with some forms of repeated conditioning Hoegh M [19] where pain is induced with a pressure cuff, equally Fields [20] and Henry Belcher in WWII show that expectations can influence pain experienced. These are not situations of nerve damage but of high levels of stimulation and while the white-coat impact can alter response to signalling, given a standardized setting, such rapid and durable results are not seen in most cases. This then begs clarity of the process where a chronic pain is subdued. The determining factors are those of discrete and identifiable sources of nociception.

Conclusions

It appears that profound and durable pain reduction happens where the primary nociceptive signalling sources are identified and shown to be reversible. That is each source of nociceptive signalling is identified and then physically altered, usually by limiting adverse movement or by orthotic use that places reduces compression of nociceptors. Failure to identify such sources of afferent nociception leads to poor outcomes [21].

Understanding of the processes should lead to better outcomes in long-term pain for patients.

References

1. Bayat M, Shariati M, Rakhshan V, Abbasi M, Fateh A, et al. (2016) Cephalometric risk factors of obstructive sleep apnea. Cranio 35: 321-326.
2. Carvalho Ade M, Lima Mde D, Silva JM, Neta NB, Moura Lde F (2015) Bruxism and quality of life in schoolchildren aged 11 to 14. Cien Saude Colet 20: 3385-3393.
3. Ghurye S, McMillan R (2015) Pain-related temporomandibular disorder-current perspectives and evidence-based management. Dent Update 42: 533-536.
4. Hobzova M, Prasko J, Vanek J, Ociskova M, Genzor S, et al. (2017) Depression and obstructive sleep apnea. Neuro Endocrinol Lett 38: 343-352.
5. Khalid S, Simonds E, Loukas M, Tubbs RS (2018) The clinical anatomy of fibromyalgia. Clin Anat 31: 387-391.
6. Ambalavanar R, Moutanni A, Dessem D (2006) Inflammation of craniofacial muscle induces widespread mechanical allodynia. Neurosci Lett 399: 249-254.
7. van der Hulst M, Vollenbroek-Hutten MM, Rietman JS, Schaake L, Groothuis-Oudshoorn KG, et al. (2010) Back muscle activation patterns in chronic low back pain during walking: A "guarding" hypothesis. Clin J Pain 26: 30-37.
8. Fryer G, Morris T, Gibbons P (2004) Paraspinal muscles and intervertebral dysfunction: Part two. J Manipulative Physiol Ther 27: 348-357.
9. Geraghty JG (1992) Abdominal guarding. Ir Med J 85: 49.
10. Wagner JM, McKinney WP, Carpenter JL (1996) Does this patient have appendicitis? JAMA 276: 1589-1594.
11. Bogduk N (1981) Local anesthetic blocks of the second cervical ganglion: A technique with application in occipital headache. Cephalalgia 1: 41-50.
12. Borkum JM (2010) Chronic headaches and the neurobiology of somatization. Curr Pain Headache Rep 14: 55-61.
13. Bogduk N (1992) The anatomical basis for cervicogenic headache. J Manipulative Physiol Ther 15: 67-70.
14. Bogduk N (1982) The clinical anatomy of the cervical dorsal rami. Spine (Phila Pa 1976) 7: 319-330.
15. Bogduk N (2005) Diagnosing lumbar zygapophysial joint pain. Pain Med 6:139-142.
16. Dreyfuss P, Henning T, Malladi N, Goldstein B, Bogduk N (2009) The ability of multi-site, multi-depth sacral lateral branch blocks to anesthetize the sacroiliac joint complex. Pain Med 10: 679-688.
17. Bogduk N (2004) Diagnostic blocks: A truth serum for malingering. Clin J Pain 20: 409-414.
18. Lundh H, Westesson PL, Jisander S, Eriksson L (1988) Disk-repositioning onlays in the treatment of temporomandibular joint disk displacement: Comparison with a flat occlusal splint and with no treatment. Oral Surg Oral Med Oral Pathol 66: 155-162.
19. Hoegh M, Petersen KK, Graven-Nielsen T (2018) Effects of repeated conditioning pain modulation in healthy volunteers. Eur J Pain 22: 1833-1843.
20. Fields HL (2018) How expectations influence pain. Pain 159: S3-S10.
21. Carvalho FR, Lentini-Oliveira DA, Prado LB, Prado GF, Carvalho LB (2016) Oral appliances and functional orthopaedic appliances for obstructive sleep apnoea in children. Cochrane Database Syst Rev 10: CD005520.