

Myofascial Pain Syndromes— Trigger Points

David G. Simons
Jan Dommerholt

IN MEMORIAM

Two weeks before the 2004 MYOPAIN conference in Munich, Lois Statham Simons, PT, PhD [hon], passed away in her hometown of Covington, Georgia. Together with her husband Dr. David Simons, Lois was actively involved in publishing, trigger point research, and teaching workshops. She co-authored the second edition of volume 1 of the *Trigger Point Manual* in addition to several original articles and book chapters. Lois gave new meaning to the old saying “behind every great man is a great woman.” She devoted her life to the advancement of physical therapy. She held many positions throughout her life, where she always emphasized quality of care. She became Assistant Director of the American Physical Therapy Association and later its manager of accreditation. She was instrumental in the development of the physical therapy academic program at Georgia State University, where she was on the faculty. Lois established the first physical therapy department at Newton General Hospital in Covington, Georgia, where ironically, she died many years later. Lois is survived by her husband David G. Simons, MD, and several stepchildren and grandchildren. A more detailed obituary can be found at the web site of the International MYOPAIN Society at www.myopain.org/Inpercent20Memoriam/lois_simons_tribute.htm.

[org/Inpercent20Memoriam/lois_simons_tribute.htm](http://www.myopain.org/Inpercent20Memoriam/lois_simons_tribute.htm).

INTRODUCTION

During the past year, many studies have been published increasing our understanding of the myofascial pain syndrome, trigger points [TrPs], their etiology, and the differences between active and latent TrPs, while expanding available therapeutic options. Lucas and colleagues completed an original study on the effect of latent TrPs on muscle activation patterns and subsequently provided support for treating latent TrPs with dry needling and stretching. Audette and colleagues found that needling of active TrPs frequently elicits motor unit potentials on the contralateral side of the body. Several authors introduced new and promising therapeutic interventions, or expanded upon existing therapies, including high-power pain-threshold ultrasound, dry needling, injections with serotonin receptor antagonists and botulinum toxin, and frequency-specific microcurrent electrotherapy. Based on the number of excellent studies, reviews, and case studies, it appears that TrPs are being considered more and more, not just in the United States, but also in other

David G. Simons, MD, Clinical Professor [voluntary], is affiliated with the Department of Rehabilitation Medicine, Emory University, Atlanta, GA.

Jan Dommerholt, PT, MPS, is affiliated with Pain & Rehabilitation Medicine, Bethesda, MD.

Address correspondence to: Jan Dommerholt, Pain & Rehabilitation Medicine, 7830 Old Georgetown Road, C-15, Bethesda, MD 20814-2432 [E-mail: dommerholt@painpoints.com].

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countries around the world. Most of the articles were reviewed by Jan Dommerholt.

CLINICAL STUDIES

Latent myofascial trigger points: Their effect on muscle activation and movement efficiency. KR Lucas, BI Polus, PA Rich. J Bodywork Movement Ther 8: 160-166, 2004.

Summary

This study examined the effects of latent trigger points [TrPs] on muscle activation patterns [MAP] in the shoulder region. During the first phase of the study, subjects with latent TrPs were compared to healthy control subjects. Trigger points were identified in the trapezius, serratus anterior, rhomboids, levator scapulae, and pectoralis minor muscles. Together with the scapula, these scapular positioning muscles form the segment that links the trunk to the upper limb. Normal scapular movement requires that these muscles are recruited in an optimal MAP. The intra-examiner reliability to assess TrPs was established. Identified TrPs were subsequently examined in a randomized fashion with algometry to determine pressure pain thresholds. Using the normative data developed by Fischer, TrPs were classified as either active or latent (1). Only subjects with latent TrPs were included in this study. Surface electromyography was used to determine the time of onset of muscle activity of the upper and lower trapezius, the serratus anterior, the infraspinatus, and middle deltoid muscles.

During the second phase, the subjects with latent TrPs were randomized into a treatment group and a placebo group. The latent TrP treatment group received dry needling followed by passive stretch to remove the latent TrPs. The placebo group received sham ultrasound, so that latent TrPs remained. Both groups repeated the surface electromyography protocol to investigate whether inactivating latent TrPs would alter the MAP.

The control group was found to have a stable and sequential MAP. The latent TrP group showed significant differences, inconsistencies, and variability. However, after dry nee-

dling and stretching, the MAP of the treated subjects normalized and showed no more significant differences with the control group. The placebo treatment group did not change before and after the sham treatment.

Comments

This important study contributes significantly to the understanding of the impact of latent TrPs on muscle coordination and balance. Lucas and colleagues have demonstrated not only that latent TrPs alter normal muscle activation patterns, they also provided support for inactivating latent TrPs using dry needling techniques combined with muscle stretches. As the authors indicate, the presence of latent TrPs negatively impacts motor control prior to the presence of pain. Inactivation of TrPs resulted in an immediate return to normal muscle activation patterns. These findings are especially relevant for training optimal movement efficiency required for sports participation, musical performance, and other motor tasks. For example, it is conceivable that athletes and musicians with latent TrPs in the shoulder muscles may have altered movement activation patterns in the upper extremity that may interfere with athletic and musical performance. Inactivating latent TrPs may be indicated to assure optimum motor performance. The authors also suggest that latent TrPs may contribute to the development of shoulder impingement syndromes when activated by rotator cuff overuse.

TREATMENT

High-power pain threshold ultrasound technique in the treatment of active myofascial trigger points: A randomized, double-blind, case-control study. J Majlesi, H Ünalán. Arch Phys Med Rehabil 85: 833-836, 2004.

Summary

Turkish researchers Majlesi and Ünalán compared the effects of high-power, pain threshold static ultrasound [US] with conventional dynamic US in the treatment of trigger points [TrPs]. Seventy-two subjects meeting the inclusion criteria were randomly assigned to one

of two groups. The inclusion criteria included the presence of at least one TrP in the upper trapezius muscle; symptoms lasting from zero to two weeks; age between 18 and 60; primary myofascial pain syndrome; and no other physical therapy intervention or medication. A trained and blinded physiatrist identified active TrPs, subjective pain ratings, and cervical range of motion. The US treatments for both groups were applied by the same physical therapist, who obviously was not blinded to the treatment intervention. After each treatment the physiatrist re-evaluated each subject without knowledge of the treatment intervention.

With conventional US the applicator was moved over the skin with overlapping sweeps or circles at rates of a few centimeters per seconds over a small area. In this study the intensity was 1.5 W/cm² with a duration of five minutes. With the high-power pain-threshold static technique, the applicator was placed directly over a TrP and held motionless with a gradual increase of the intensity until the subject's pain tolerance was reached. It was kept at that level for four to five seconds and then reduced to the half-intensity for another 15 seconds. The procedure was repeated three times. All subjects in both groups actively stretched the trapezius muscle following the treatment. Follow-up assessments were performed via telephone interviews. Several subjects dropped out of the study leaving a total of 31 subjects in the high-power US group and 29 in the conventional US group. At the end of the study no statistically significant differences were found in range of motion. However, it took only five treatments with high-power pain-threshold US to reach the same increase in range of motion as in 16 treatments of conventional US! The reported pain levels were significantly lower in the high-power US group. Scores on a visual analog scale were reduced from an initial 8.32 to 3.32 for the high-power US group and from 8.48 to 7.72 for the conventional US group. Again, the mean number of sessions in the high-power US group was less than three versus nearly twelve in the conventional US group.

Comments

High-power pain-threshold static ultrasound is a creative application of an old modality,

commonly used in physical therapy and chiropractic. This study demonstrates that high-power pain-threshold static US was clearly more effective in reducing pain from TrPs than conventional US, even though in the end there were no significant differences in range of motion. The decreases in pain levels and increases in range of motion were achieved in far fewer sessions in the high-power US group. A previous study of ultrasound used in the treatment of TrPs showed no significant differences between conventional US and TrP injections (2). In future studies, it would be interesting to compare high-power pain-threshold US to TrP injection or dry needling. Many physical therapists and chiropractic physicians are legally not allowed to use injection therapy or dry needling. High-power threshold US appears to offer a cost-effective, viable non-invasive alternative to quickly reduce patients' pain from TrPs. Clinicians need to be aware that high-power static US should not be used over bony or neural structures as this may lead to the formation of very painful "hot spots." The authors do not recommend this technique in facial or paraspinal muscles, or for muscles adjacent to nerve and bone structures.

Local treatment of tendinopathies and myofascial pain syndromes with the 5-HT₃ receptor antagonist tropisetron. W Müller, T Stratz. *Scand J Rheumatol* 33: 44-48, 2004.

Summary

This study is actually a summary of three distinct research projects. The first two studies focused on the treatment of tendinopathies. Injections of tropisetron were compared with injections of local anesthetics prilocaine and lidocaine, respectively. The third study compared injections of tropisetron with injections of prilocaine into trigger points [TrPs]. In the TrP study, the authors used the Simons, Travell and Simons' criteria for TrPs (3). Efforts were made to treat the TrP thought to be the most likely cause of a regional myofascial pain syndrome. Thirty-three patients were included in the study. Seventeen patients were injected with tropisetron; the remaining 16 subjects received prilocaine injections. Outcomes were

determined with repeated measures on a visual analog scale [VAS] before and three hours after the injection, and every following day for a total of seven days. If the symptoms had improved, the treatment was repeated once per week for eight weeks. If there were no changes after the initial seven days, the study was discontinued. Interestingly, those subjects who did not receive benefit after three hours did not benefit within the seven day period either. Eleven out of 17 subjects in the tropisetron group benefited from the intervention versus only two of 16 subjects from the prilocaine group.

Tropisetron subjects reported a statistically relevant decrease in pain with VAS scores decreasing from an average of 75.05 prior to injection to 43.29 seven days after the injection, using a VAS scale from 0 to 100. The prilocaine subjects did not experience a statistically relevant decrease in the same period. The VAS scores decreased from an average of 74.31 to 63.93. Three hours after treatment, 53 percent of the tropisetron group reported a decrease in pain of at least 30 percent on the VAS versus 50 percent of the prilocaine group. However, during the next day the prilocaine subjects already experienced a slow increase of pain. Of these subgroups, prilocaine group reported only a 14.75 percent decrease on the VAS after seven days, versus a 76.47 percent decrease for the tropisetron group. Only two subjects of the prilocaine group continued the study. At the end of the eight-week study protocol, the average value on the VAS was 10.6 for the tropisetron group and 5 and 8, respectively, for the two remaining prilocaine subjects.

Comments

Injecting a serotonin receptor antagonist such as tropisetron into TrPs is intriguing, particularly as Shah and colleagues have measured increased levels of serotonin in active TrPs (4). There are currently four 5-HT₃ receptor antagonists available in Europe, including tropisetron, ondansetron, granisetron, and dolasetron. In the United States, alosetron is the only 5-HT₃ receptor antagonist that has been approved for the treatment of irritable bowel syndrome (5).

This study demonstrates significantly greater analgesic effects of a locally administered 5-HT₃ receptor antagonist compared to an anesthetic.

Most subjects receiving a local anesthetic dropped out of the study due to poor results. Interestingly, the two remaining subjects receiving a local anesthetic reported excellent pain relief. Serotonin is associated with pain and inflammatory reactions in peripheral tissues, including muscles. It is conceivable that the injected 5-HT₃ receptor antagonist causes a long-term blockade of the receptors and a functional disturbance of nociceptors by reducing the production of substance P, calcitonin gene-related peptide, and neurokinins. It is noteworthy that Shah and colleagues found increased levels of substance P and calcitonin gene-related peptide in active TrPs (4). 5-HT₃ receptor antagonists appear to have much potential in the treatment of TrPs.

CASE REPORTS

Trigger point injection treatment with the 5-HT₃ receptor antagonist tropisetron in patients with late whiplash-associated disorder; First results of a multiple case study. T Ettlin. *Scand J Rheumatol* 33: 49-50, 2004.

Summary

In this report, the preliminary results are reviewed of an ongoing study of the effects of trigger point injections with tropisetron in patients with late whiplash-associated disorder. Twenty patients [13 female and seven male] were included in the study. Inclusion criteria included myofascial pain syndrome in the head/neck/shoulder region for more than six months and severity of symptoms consistent with at least a grade 2 according to the Quebec Task Force of Whiplash Associated Disorders (6). The subjects' pain complaints could be elicited by pressure on active trigger points [TrPs]. The TrPs were considered active if pressure produced localized pain, referred pain, and the subject's recognition of the elicited pain after palpation and subsequent insertion of the needle. Optional criteria were listed as edema around TrPs and a local twitch response.

Each patient received a maximum of five injections of tropisetron per muscle into TrPs in the neck, shoulder, and thoracic paravertebral muscles. An average of 15 TrPs were injected

per session. Treatments were repeated on average every four weeks based on patients' reported return of pain. The author reported more than 50 percent pain relief for at least two weeks for 52 percent of a total of 73 treatment sessions. In 16 percent of the treatment sessions, there was no beneficial effect of the injections. Few side effects were reported.

Comments

This report is a multiple case study and does not include any comparison with other treatment interventions or controls. As Ettlin acknowledged, comparison with other treatment methods is difficult because of differences in methodology, level of experience of clinicians, severity of pain, and criteria. In this study, the author did not include the findings of a taut band and an exquisitely tender spot in that taut band as part of the criteria for TrPs (3). In addition, when injecting TrPs, it is important to have local twitch assurance (7). Case reports are an important first step toward well-designed research studies documenting the close association between whiplash symptoms and TrPs.

Microcurrent therapy: A novel treatment method for chronic low back myofascial pain. CR McMakin. J Bodywork Movement Ther 8: 143-153, 2004.

Summary

In this case review, Dr. McMakin describes her extensive experience with frequency-specific micro-current electrotherapy for patients with chronic low back pain in which trigger points [TrPs] were thought to be major contributing factors. The treatment techniques are based on published lists of frequencies that were promoted in the early 1900s, which subsequently have been further refined for TrP applications based on clinical experience of "thousands of patient visits involving treatment of more than 300 patients." Dr. McMakin has developed specific sequences of treatment parameters that empirically are reported to produce immediate results, including pain relief. She speculates that signal patterns generated by specific frequencies may cause alterations in

cell membrane configuration and its electromagnetic qualities. Thermodynamic theory suggests that when organic tissues have been treated with frequency-specific micro-current electrotherapy, they remain in a stable configuration. Indeed, clinical experience suggests that the immediate changes in tissue tension and pain levels are maintained. Dr. McMakin describes several case series with excellent results, where other treatments including drug therapy, chiropractic manipulation, physical therapy, and acupuncture had failed. Twenty-two patients with chronic low back pain and TrPs of 8.8 years average duration experienced a statistically significant 3.8 fold reduction in pain intensity using a visual analog scale over an average treatment period of nearly six weeks. Overall the treatment approach has few transient side effects including slight to moderate nausea, flu-like aching, and occasionally increased pain, which Dr. McMakin attributes to a "post-treatment detoxification reaction."

Comments

Case reports are an important contribution to the scientific literature and may stimulate further research. As with most new therapies, the theoretical foundations and clinical applications need to be further developed and subjected to scientific study. McMakin is cautious not to overstate the underlying mechanisms. The therapeutic effects of frequency-specific microcurrent electrotherapy may be explained by its effects on cell membrane-linked signal transduction mechanisms (8,9). Oshman described two physiological processes that permit small amounts of power, as used in frequency-specific micro-current electrotherapy, to have large effects on specific tissues, namely cellular amplification and stochastic resonance (10). At the same time, the empirical results seem to justify randomized controlled clinical trials. Frequency-specific micro-current electrotherapy appears a very promising new therapeutic modality available in the treatment of persons with myofascial pain syndrome. This retrospective case review includes many interesting observations. However, subjects were not randomized. There was no control group and subjects were treated with a variety of other modalities.

Case report of tension pneumothorax related to acupuncture. E Peuker. *Acupunct Med* 22(1): 40-43, 2004.

Summary

This report describes a case of tension pneumothorax associated with acupuncture. The author provided expert testimony during legal hearings. Following needling of a paravertebral acupuncture point [BL 13] at the level of the spinous process of vertebra T3, the patient reported a sharp pain in the left side of her chest and difficulty breathing. The clinician assumed that the symptoms were due to “tension in the meridians” and advised the patient to relax. When the symptoms worsened, the clinician suggested seeing a radiologist and ordered a taxi. Chest X-ray revealed a nearly complete pneumothorax of the left lung. The patient was transferred to the hospital where she required intensive care for one week. The patient sued the acupuncturist who denied any wrong-doing and argued that the patient had experienced a spontaneous pneumothorax unrelated to the acupuncture treatment. The author concluded that the tension pneumothorax resulted from the acupuncture treatment. The patient should have been transferred immediately to a hospital with appropriate medical attention.

Comments

Although this case is not directly related to myofascial pain syndrome or trigger points [TrPs], it is nevertheless relevant for this column. As more clinicians become familiar with the myofascial pain syndrome and its various treatment techniques, astute awareness of the risks related to dry needling and injection techniques for TrPs in the thorax region is very important. This case suggests that incorrect placement of an acupuncture needle for example during dry needling of a TrP in a thoracic multifidus or longissimus muscle, may result in pneumothorax. In case of possible pneumothorax, proper medical care is always indicated.

There are no studies of the frequency of pneumothorax associated with dry needling. Pneumothorax occurs extremely infrequently in association with acupuncture. The clinical documentation did not include any information

about depth and direction of the needle procedure. The author suggests informing patients of the risks of needling procedures prior to the treatment. He emphasized that pneumothorax and other possible complications of acupuncture [and of dry needling—JD] are not a specific risk of acupuncture, but are caused by negligent application. In other words, pneumothorax is not “caused by acupuncture” but may be “related to acupuncture.”

ETIOLOGICAL MECHANISMS

Evoked pain in the motor endplate region of the brachial biceps muscle: An experimental study. E Qerama, A Fuglsang-Frederiksen, H Kasch, FW Bach, TS Jensen. *Muscle Nerve* 29: 393-400, 2004.

Summary

Motor endplate activity identified electromyographically by spontaneous low-amplitude noise-like [seashell noise] activity sometimes with biphasic or triphasic negative-first action potentials has been identified with trigger points [TrPs]. The authors induced pain in the brachial biceps muscles of 21 healthy, non-medical subjects by injecting on separate occasions capsaicin and hypertonic NaCl solution in the motor endplate region and at an electrically silent site. Needle and evoked pain were measured by a visual analog scale [VAS, 0-10] and by the short form McGill Pain Questionnaire. Needle pain in a motor endplate region [activity present] was observed in 83 percent of sites were spontaneous electrical activity compared to 34 percent of sites without activity [$P < 0.001$]. No difference appeared in VAS reports between responses to capsaicin and hypertonic saline. The VAS scores were higher at sites with activity than at sites without activity [$P < 0.001$]. Pain was described more frequently as throbbing, shooting, stabbing, and cramping at electrically active sites compared to tender and sharp pain at inactive sites. Peak pain was higher in response to hypertonic saline, but the total pain [area under the VAS curve] was greater for capsaicin because it lasted longer. Before injection, tenderness by algometry was greater [lower algometer readings] at active

sites than at control sites [$P < 0.001$] and was significantly increased at both sites following both injections, and capsaicin produced a greater increase in sensitivity at control sites than did normal saline. The authors concluded that the motor endplate region might be an important site for eliciting muscle pain.

Comments

This landmark study is the first research paper on the subject of TrPs to be accepted by this prestigious, authoritative journal. The results are consistent with what is known of TrPs. Since the subjects were non-medical [not seeking health care] most if not all of the TrPs would have been latent, not active. Of 21 subjects examined, one exhibited no TrPs, which is consistent with the DeKalb Medical Center unpublished data that a few normal subjects have few or no latent TrPs, a few have them in most muscles and nearly everyone has some latent TrPs. Since the presence of endplate noise and spikes is indicative of a motor endplate exhibiting TrP dysfunction and TrPs are characterized by spot tenderness, it fits that sites exhibiting spontaneous electrical activity were much more sensitive and had a different quality of pain than other sites (11). The observation that the cramping, throbbing type pain rather than sharp pain was characteristic of sites of electrical activity and was more likely to be referred, fits the pain usually associated with TrPs and emphasizes that the difference may be due to different kinds of nociceptors or due to the agents that have sensitized the nociceptors in the TrP. It should be no surprise that nociceptors are in close proximity to motor endplates. The motor nerve terminal supplying it branches from a neurovascular bundle that includes motor nerves, sensory nerves, and blood vessels with their accompanying autonomic nerves (12). The differences in the responses elicited by hypertonic saline and capsaicin are noteworthy and deserves further investigation. It is hoped that this pioneering study will stimulate further research along these lines [DGS].

A proposed experimental model of myofascial trigger points in human muscle after slow eccentric exercise. K Itoh, K Okada, K Kawakita. *Acupunct Med* 22(1): 2-12, 2004.

Summary

This is a somewhat complicated but interesting study comparing the localized tenderness of experimentally induced muscle pain to known characteristics of trigger points [TrPs]. Fifteen healthy volunteers were assigned to one of two groups. Group 1 consisted of five males and two females; group 2 consisted of eight females. Group 1 participated in three different experiments, spaced at least six months apart. During the first experiment, pain thresholds were measured without exercise. During the second experiment, pain thresholds were measured after exercise. During the third experiment, the distribution of pain thresholds was measured after exercise. Group 2 underwent a single series of electromyographic [EMG] readings daily after exercise using both indwelling and surface electrodes.

Throughout the study, subjects were seated with one forearm supported. A 475 g weight was placed on the middle finger of one hand with the initial position determined by the ability of each subject to hold the finger in a horizontal position for at least ten seconds. Subjects were asked to maintain the finger in a horizontal position. Each time the finger bent 20 degrees downward at the metacarpophalangeal joint, the finger was manually reset to the original horizontal position by the experimenter. The exercise was repeated until exhaustion of the extensor muscle for a total of three sets. During the exercise, EMG measurements were taken to determine when other muscles were being recruited. Pressure and electrical pain thresholds were measured. On the second day after exercise, the forearm extensor muscles were examined by an experienced clinician for the presence of a palpable taut band. If present, the pattern of referred pain was determined following manual pressure on the most tender region of the palpable band.

The study revealed significantly decreased pressure thresholds by the second day, which recovered seven days after the experiment. On the second day after exercise, a "clear ropy palpable band" could be detected in all subjects. The taut bands softened in subsequent days and could not be detected by day seven. Referred pain patterns were more readily established with application of pressure over the most ten-

der part of the taut band. Referred pain patterns were felt mostly in the hand and in a line over the dorsum of the wrist and forearm. Electromyography revealed sustained activity when the recording needle was placed close to the fascia at the tender locus of the taut band. Local twitch responses were frequently observed during the insertion of the needle electrode. The electrical threshold was significantly lower for fascia only; no differences were seen in electrical thresholds of the skin and muscle.

Comments

The similarities between pain following eccentric exercise and pain associated with TrPs are interesting areas of research. Eccentric exercise is associated with muscle damage and delayed onset of muscle soreness. The authors documented the formation of palpable taut bands following eccentric exercise. Repeated eccentric exercise has been shown to lead to segmental disruption of muscle fibers, a loss of cellular integrity, and an increase in fiber size caused by segmental hyper-contractions of muscle fibers associated with very short sarcomere lengths (13). Following eccentric exercise the muscle fiber cytoskeleton is disrupted, Z-band streaming occurs and the A-band is disorganized (13). Histological studies of TrPs have shown similar findings (14).

It is questionable whether the subjects performed eccentric contractions throughout the experiment. The subjects were instructed to keep their finger horizontally, which requires an isometric contraction. They had to eccentrically contract their muscles only after fatigue set in and they were no longer able to maintain the finger horizontally. By definition, an eccentric contraction is a contraction of a lengthening muscle.

The authors raised the possibility that a palpable taut band after eccentric exercise is due to localized edema in deep tissues. Eccentric exercise produces local muscle fiber damage with an increase of intra-tissue pressure, which "may be detected as a taut band." While the presence of local edema is certainly possible, it is unlikely that taut bands associated with TrPs are due to edema. In clinical practice, needling of a taut band frequently results in local twitch responses. Although the authors quoted recent

EMG research of TrPs which supports that TrPs are associated with abnormal motor endplate activity, they contributed the finding of sustained EMG activity to nociceptive input produced by the insertion of the EMG needle into the painful region of the muscle and its fascia.

White and Cummings, editors of *Acupuncture in Medicine* at the time this article was published, prepared an accompanying editorial in which they questioned whether it is possible to differentiate taut bands from post-exercise swelling. They also wondered whether the clinical picture of delayed onset of muscle soreness is similar enough to the symptoms associated with TrPs. Delayed onset of muscle soreness is thought to affect the entire muscle, while TrPs are localized painful loci.

On the other hand, it is likely that following eccentric exercise the normal balance between the release of acetylcholine and its subsequent breakdown by acetylcholinesterase is disturbed. Eccentric exercise leads to hypoperfusion of the muscle caused by contraction-induced capillary constriction. The resultant ischemia and hypoxia leads to a local acidic pH, and the release of nociceptive substances, such as bradykinin, substance P, and calcitonin gene-related peptide, which can alter the activity of the motor endplate due to increased acetylcholine release, and a simultaneous inhibition of acetylcholinesterase and up-regulation of acetylcholine receptors. Hypothetically eccentric exercise could indeed lead to the development of persistent muscle fiber contractures as seen with TrPs.

Bilateral activation of motor unit potentials with unilateral needle stimulation of active myofascial trigger points. JF Audette, F Wang, H Smith. Am J Phys Med Rehabil 83(5): 368-374, 2004.

Summary

Following the clinical observation that during injections or dry needling of trigger points [TrPs] muscles on the opposite site of the body would react and exhibit a local twitch response, the authors hypothesized that the perpetuation of pain and dysfunction associated with active TrPs may be due to changes in the central ner-

vous system. Thirteen subjects with myofascial pain syndromes in the neck were included in this prospective controlled study with eight subjects functioning as a control group. Inclusion criteria included age between 18 and 75 years, unilateral neck pain for more than six months, and active TrPs, characterized by unilateral neck pain at rest, reproduction and recognition of pain with palpation of taut bands in either the trapezius or levator scapulae muscle, a local twitch response with manual, snapping palpation of that taut band, and restricted side bending to the opposite side. The healthy control subjects were found to have taut bands in the trapezius or levator scapulae muscles with mild to moderate pain on deep palpation, but no pain at rest, and restricted side bending to the opposite side, indicating a latent TrP.

After locating an active TrP in either trapezius or levator scapulae muscle, an electromyogram needle was inserted into a point at exactly the same location, but on the opposite side of the body. A second EMG needle was inserted in the ipsilateral muscle but 3 cm away from the TrP to avoid recording movement artifacts. In the control group, a point of maximum palpatory tenderness was identified and EMG needles placed as described for the experimental group. Next, local twitch responses were elicited using a 30 mm long, 0.20 mm in diameter acupuncture needle in the active TrP [experimental group] or in the most tender spot [control group].

Motor unit potentials were observed on the ipsilateral side in all subjects. Interestingly, the researchers were able to identify motor unit potentials on the contralateral side in 61.5 percent of the active TrP group, but never in the control group with latent TrPs.

Comments

Audette and colleagues have documented for the first time, that needling of active TrPs can elicit motor unit potentials on the contralateral side of the body. As they suggested, active TrPs may be associated with a central nervous system abnormality involving segmental changes. Since latent TrPs did not feature contralateral motor unit potentials, the question arises whether the difference between active and latent TrPs is partially characterized by the

degree of a loss of central inhibition of both nociceptive input and heterosynaptic sensory-motor connections to the contralateral side of the spinal cord. Thirty-eight percent of active TrPs did not feature contralateral motor unit potentials, offering further support that there may be degrees of central sensitization, perhaps dependent upon chronicity and maybe even the degree of neural plasticity. The authors speculate that selective glial activation may be responsible for the contralateral spread (15). Considering the previously reviewed study by Lucas and colleagues it may be necessary to treat both active and latent TrPs in the clinic (16). This study demonstrates another recordable pathophysiological distinction that emphasizes the validity and importance of the clinical distinction between active and latent TrPs.

REVIEWS

Neurobiological basis for the use of botulinum toxin in pain therapy. S Mense. *J Neurol* 251(Suppl 1): 1/1-1/7, 2004.

Summary

Mense provided a focused review of the mechanisms of action of botulinum toxin and its application in the treatment of trigger points, spasm, and dystonia. According to the "integrated trigger point hypothesis," the formation of a trigger point starts with a muscle lesion that results in excessive release of acetylcholine into the cleft of the neuromuscular junction. Botulinum toxin interferes with the release of acetylcholine from cholinergic nerve endings, which suggests that a botulinum toxin injection is in fact a treatment of the cause of the pain, not just the symptom.

Pain in chronically contracted muscles appears to result from ischemia due to compression of the muscle's blood vessels. Several factors play a role in ischemic muscle pain, such as the release of bradykinin, excitation of vanilloid receptors [subtype VR 1] by protons due to a lowering of the pH, and finally, activation of purinergic receptors by adenosine triphosphate.

The article concluded with a brief review of possible mechanisms of the immediate pain relief experienced by some patients before the on-

set of muscle relaxation. Mense suggested that botulinum toxin may prevent the release of other chemicals in addition to acetylcholine, such as substance P and calcitonin gene-related peptide. Other possible mechanisms may involve the ability of botulinum toxin to reduce neurogenic inflammation, or the effect on the postganglionic sympathetic nerve by blocking the release of norepinephrine and adenosine triphosphate.

Comments

This is one of the most succinct and knowledgeable reviews of the various applications of botulinum toxin and the possible mechanisms of pain in chronically contracted muscles. The possible mechanisms of pain relief by botulinum toxin are clinically relevant and require further study.

Botulinum toxin (BoNT) and back pain. M Porta, G Maggioni. J Neurol 251(Suppl 1): 1/15-1/18, 2004.

Summary

In this brief paper, Porta and Maggioni described their clinical techniques for botulinum toxin injections in the piriformis, psoas, paravertebral, and quadratus lumborum muscles. For the psoas and piriformis muscles, the authors recommended using computerized tomography scan guidance for accurate needle placement. They described using both a local anesthetic [bupivacaine] and botulinum toxin. For the paravertebral and quadratus lumborum muscles, they suggested performing the injections under electromyographic [EMG] guidance or by manual palpation.

The authors suggested that immediate pain relief from botulinum toxin injections could possibly involve inhibition of gamma motor endings, and a direct or indirect effect on spinal cord pain neurons, in addition to inhibition of the release of neurotransmitters.

Comments

Although the authors mentioned that EMG guidance permits the localization of motor endplates, which have been associated with

trigger points [TrP], they did not appear to consider TrPs as a direct target in their protocols of botulinum toxin injections. When clinicians use EMG guidance to locate motor endplates, they may be able to more accurately inject botulinum toxin in the vicinity of TrPs. Electromyographic guidance can be used for the psoas and piriformis muscles in many patients.

Consensus statement: Botulinum toxin in myofascial pain. P Reilich, K Fheodoroff, U Kern, S Mense, S Seddigh, J Wissel, D Pongratz. J Neurol 251(Suppl 1); 1/36-1/38, 2004.

Summary

The authors of this consensus statement are experienced clinicians and researchers who have contributed much to the current understanding of trigger points [TrPs]. After briefly reviewing the integrated trigger point hypothesis, they concluded that botulinum toxin should be considered in the management of patients with myofascial pain syndrome who have demonstrated poor clinical outcomes after at least a month of physical therapy, including dry needling, and oral pharmacotherapy. Botulinum toxin may prevent the development of maladaptive neuroplastic changes associated with chronic pain syndromes.

Two techniques are described: the so-called “near by” technique and the “into” technique. With the “near by” technique, the injection needle is placed as close as possible near a TrP after careful palpation. The needle placement should elicit both a local twitch response and a referred pain pattern. With the “into” technique, the needle is placed directly into a TrP using electromyographic and ultrasonography guidance. The authors included guidelines for dosage. They concluded that there is no consensus as to the question if simultaneous injection of local anesthetic is recommended.

Comments

Botulinum toxin has a distinct place in the management of persons with myofascial pain syndrome and persistent TrPs. The authors emphasized that the injections should only be performed by experienced clinicians in both the

identification and management of TrPs and utilization of botulinum toxin. We agree that botulinum toxin injections should always be integrated into a multimodal therapeutic management strategy, including medical management, physical therapy, relaxation exercises, and functional exercise training.

Myofascial trigger points: The current evidence. LK Huguenin. *Phys Ther Sport* 5: 2-12, 2004.

Trigger points [TrPs] are not commonly discussed in the international physical therapy literature. Therefore, this scholarly review is a welcome contribution. The article reviews current definitions and theories of TrPs, and addresses some of the different opinions in the literature. Simons' integrated trigger point hypothesis is well explained as is Gunn's radiculopathic model for myofascial pain syndrome (11,17). Arguments in favor of or against various research findings are discussed in detail. At times, the author used references and drew conclusions about TrPs, when the actual references related to fibromyalgia tender points. In a section on muscle pain, the author stated that substance P and calcitonin gene-related peptide are not relevant as algescic compounds in muscle. However, recent preliminary data by Shah and colleagues suggest that these substances are in fact present in the micro-milieu of active TrPs (4). The final section on trigger point therapy includes subheadings on stretching, transcutaneous electrical nerve stimulation, ultrasound, laser, and invasive therapies. The author concludes with "regardless of the treatment chosen, it is imperative to remember that trigger points are rarely an isolated phenomenon, and the key to successful long-term outcomes of any treatment regime is addressing the precipitating and predisposing factors for each particular patient." We agree.

BRIEF REVIEWS

Myofascial pain syndrome of the abdominal wall for the busy clinician. HT Sharpe. *Clin Obstet Gynecol* 46(4): 783-788, 2003.

The American College of Obstetrics and Gynecology recommends an assessment of the musculoskeletal system prior to surgical interventions for chronic pelvic pain. In spite of this, most obstetricians and gynecologists have not received any training in the evaluation and management of musculoskeletal pain. This article aims to enable the clinician to differentiate between myofascial pain syndrome of the abdominal wall and intra-abdominal causes for chronic pelvic pain. Sharpe provides a brief overview of the characteristics of myofascial pain syndrome and trigger points [TrPs]. He suggests that the evaluation of the anterior abdominal wall for TrPs is a relatively simple procedure and suggests primarily trigger point injections and a home stretching program. Unfortunately, the article does not mention any other muscles and TrPs that can cause or contribute to chronic pelvic pain, such as the adductor magnus, the quadratus lumborum, the levator ani, and the gluteal muscles, among others (18).

Dry needling in orthopedic physical therapy. J Dommerholt. *Orthop Pract.* 16(3): 15-20, 2004.

This is the first report in the American physical therapy literature that highlights dry needling within physical therapy practice. Realizing that it may be a bit unusual to review one's own article, this article provides pertinent background information and emphasizes that dry needling by physical therapists is gaining ground in several countries. In the United States, physical therapy state boards of Maryland, New Hampshire, New Mexico, South Carolina, Kentucky, and Virginia have already determined that dry needling of trigger points falls within the scope of practice of physical therapists. The article includes an overview of three different schools of dry needling, the trigger point, radiculopathy, and spinal segmental sensitization models. In addition to examining possible mechanisms of dry needling, the article features a review of statutory considerations for different states.

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