

REFERENCES

- [1] Kelman L. Migraine changes with age: IMPACT on migraine classification. Headache 2006;46:1161-71.
- [2] Martins KM, Bordini CA, Bigal ME, Speciali JG. Migraine in the elderly: a comparison with migraine in young adults. Headache 2006;46:312-6.
- [3] Solomon GD, Kunkel RS, Frame J. Demographics of headache in elderly patients. Headache 1990;30:273-6.
- [4] Hershey LA, Bednarczyk EM. Treatment of headache in the elderly. Curr Treat Options Neurol 2013;15:56-62.
- [5] Uthaikhup S, Sterling M, Jull G. Cervical musculoskeletal impairment is common in elders with headache. Man Ther 2009;14:636-41.
- [6] Jull G, Amiri M, Bullock-Saxton J, Darnell R, Lander C. Cervical musculoskeletal impairment in frequent intermittent headache. Part 1: subjects with single headaches. Cephalgia 2007;27:793-802.
- [7] Hallgren RC, Greenman PE, Rechtien JJ. Atrophy of suboccipital muscles in patients with chronic pain: a pilot study. J Am Osteopath Assoc 1994;94:1032-8.
- [8] McPartland JM, Brodeur RR, Hallgren RC. Chronic neck pain, standing balance, and suboccipital muscle atrophy-a pilot study. J Manipulative Physiol Ther 1997;20:24-9.
- [9] Mitchell WK, Williams JP, Atherton PJ, Larvin M, Lund J, Narici M. Sarcopenia, dynapenia, and the impact of advancing age on human skeletal muscle size and strength; a quantitative review. Front Physiol 2012;3:1-18.

- [10] Boesch C, Machann J, Vermathen P, Schick F. Role of proton MR for the study of muscle lipid metabolism. *NMR Biomed* 2006;19:968-88.
- [11] Uthaikhup S, Sterling M, Jull G. Widespread sensory hypersensitivity is not a feature of chronic headache in elders. *Clin J Pain* 2009;25:699-704.
- [12] Grossi DB, Chaves TC, Gonçalves MC, Moreira VC, Canonica AC, Florencio LL, et al. Pressure pain threshold in the craniocervical muscles of women with episodic and chronic migraine: a controlled study. *Arq Neuropsiquiatr* 2011;69:607-12.
- [13] Schmidt-Hansen PT, Svensson P, Bendtsen L, Graven-Nielsen T, Bach FW. Increased muscle pain sensitivity in patients with tension-type headache. *Pain* 2007;129:113-21.
- [14] Bendtsen L. Central sensitization in tension-type headache-possible pathophysiological mechanisms. *Cephalalgia* 2000;20:486-508.
- [15] Jull G, Trott P, Potter H, Zito G, Niere K, Shirley D, et al. A randomized controlled trial of exercise and manipulative therapy for cervicogenic headache. *Spine* 2002;27:1835-43.
- [16] Nilsson N, Christensen HW, Hartvigsen J. The effect of spinal manipulation in the treatment of cervicogenic headache. *J Manipulative Physiol Ther* 1997;20:326-30.
- [17] Prencipe M, Casini AR, Ferretti C, Santini M, Pezzella F, Scaldaferrri N, et al. Prevalence of headache in an elderly population: attack frequency, disability, and use of medication. *J Neurol Neurosurg Psychiatry* 2001;70:377-81.
- [18] Braunstein D, Donnet A, Pradel V, Sciortino V, Allaria-Lapierre V, Lantéri-Minet M, et al. Triptans use and overuse: a pharmacoepidemiology study from the French health insurance system database covering 4.1 million people. *Cephalalgia* 2015;35:1172-80.

- [19] Schwartz BS, Stewart WF, Simon DG, Lipton RB. Epidemiology of tension-type headache. *JAMA* 1998;279:381-3.
- [20] Stewart WF, Wood C, Reed ML, Roy J, Lipton RB. Cumulative lifetime migraine incidence in women and men. *Cephalgia* 2008;28:1170-8.
- [21] Lisotto C, Mainardi F, Maggioni F, Dainese F, Zanchin G. Headache in the elderly: a clinical study. *J Headache Pain* 2004;5:36-41.
- [22] Stewart WF, Roy J, Lipton RB. Migraine prevalence, socioeconomic status, and social causation. *Neurology* 2013;81:948-55.
- [23] Benseñor I, Lotufo P, Goulart A, Menezes P, Scauzufca M. The prevalence of headache among elderly in a low-income area of São Paulo, Brazil. *Cephalgia* 2008;28:329-33.
- [24] Srikiatkachorn A. Epidemiology of headache in the Thai elderly: a study in the Bangkae Home for the aged. *Headache* 1991;31:677-81.
- [25] Thomas E, Boardman HF, Croft PR. Why do older people report fewer headaches? *Gerontology* 2005;51:322-8.
- [26] Pearce J. The importance of cervicogenic headache in the over-fifties. *Headache Q Curr Treatment Res* 1995;6:293-6.
- [27] Lang J, Buchfelder M. Radiofrequency neurotomy for headache stemming from the zygapophysial joints C2/3 and C3/4. *Cent Eur Neurosurg* 2010;71:75-9.
- [28] Shah PA, Nafee A. Clinical profile of headache and cranial neuralgias. *J Assoc Physicians India* 1999;47:1072-5.
- [29] Haldeman S, Dagenais S. Cervicogenic headaches: a critical review. *Spine J* 2001;1:31-46.

- [30] Wang SJ, Fuh JL, Lu SR, Liu CY, Hsu LC, Wang PN, et al. Chronic daily headache in Chinese elderly prevalence, risk factors, and biannual follow-up. *Neurology* 2000;54:314-9.
- [31] Silberstein SD, Lipton RB, Sliwinski M. Classification of daily and near-daily headaches: field trial of revised IHS criteria. *Neurology* 1996;47:871-5.
- [32] Mazzotta G, Gallai V, Alberti A, Billeci AM, Coppola F, Sarchielli P. Characteristics of migraine in an out-patient population over 60 years of age. *Cephalgia* 2003;23:953-60.
- [33] Reinisch VM, Schankin CJ, Felbinger J, Sostak P, Straube A. Headache in the elderly. *Schmerz* 2008;22:22-30.
- [34] Wöber-Bingöl Ç, Wöber C, Karwautz A, Schnider P, Vesely C, Wagner-Ennsgraber C, et al. Tension-type headache in different age groups at two headache centers. *Pain* 1996;67:53-8.
- [35] Blau JN, MacGregor EA. Migraine and the neck. *Headache* 1994;34:88-90.
- [36] Cook NR, Evans DA, Funkenstein HH, Scherr PA, Ostfeld AM, Taylor JO, et al. Correlates of headache in a population-based cohort of elderly. *Arch Neurol* 1989;46:1338-44.
- [37] Lexell J, Taylor CC, Sjöström M. What is the cause of the ageing atrophy?: total number, size and proportion of different fiber types studied in whole vastus lateralis muscle from 15-to 83-year-old men. *J Neurol Sci* 1988;84:275-94.
- [38] Nilwik R, Snijders T, Leenders M, Groen BB, van Kranenburg J, Verdijk LB, et al. The decline in skeletal muscle mass with aging is mainly attributed to a reduction in type II muscle fiber size. *Exp Gerontol* 2013;48:492-8.

- [39] Faulkner JA, Larkin LM, Claflin DR, Brooks SV. Age-related changes in the structure and function of skeletal muscles. *Clin Exp Pharmacol Physiol* 2007;34:1091-6.
- [40] Doherty TJ. Invited review: aging and sarcopenia. *J Appl Physiol* 2003;95:1717-27.
- [41] Kent-Braun JA, Ng AV, Young K. Skeletal muscle contractile and noncontractile components in young and older women and men. *J Appl Physiol* 2000;88:662-8.
- [42] Lexell J. Human aging, muscle mass, and fiber type composition. *J Gerontol A Biol Sci Med Sci* 1995;50:11-6.
- [43] Essen-Gustavsson B, Borges O. Histochemical and metabolic characteristics of human skeletal muscle in relation to age. *Acta Physiol Scand* 1986;126:107-14.
- [44] Janssen I, Heymsfield SB, Wang ZM, Ross R. Skeletal muscle mass and distribution in 468 men and women aged 18–88 yr. *J Appl Physiol* 2000;89:81-8.
- [45] Frontera WR, Hughes VA, Fielding RA, Fiatarone MA, Evans WJ, Roubenoff R. Aging of skeletal muscle: a 12-yr longitudinal study. *J Appl Physiol* 2000;88:1321-6.
- [46] Metter EJ, Conwit R, Tobin J, Fozard JL. Age-associated loss of power and strength in the upper extremities in women and men. *J Gerontol A Biol Sci Med Sci* 1997;52:267-76.
- [47] Skelton DA, Greig CA, Davies JM, Young A. Strength, power and related functional ability of healthy people aged 65–89 years. *Age Ageing* 1994;23:371-7.
- [48] Hurley BF. Age, gender, and muscular strength. *J Gerontol A Biol Sci Med Sci* 1995;50:41-4.

- [49] Doherty TJ. The influence of aging and sex on skeletal muscle mass and strength. *Curr Opin Clin Nutr Metab Care* 2001;4:503-8.
- [50] Vandervoort AA, Kramer JF, Wharram ER. Eccentric knee strength of elderly females. *J Gerontol* 1990;45:125-8.
- [51] Young A, Skelton DA. Applied physiology of strength and power in old age. *Int J Sports Med* 1994;15:149-51.
- [52] Izquierdo M, Hakkinen K, Anton A, Garrues M, Ibanez J, Ruesta M, et al. Maximal strength and power, endurance performance, and serum hormones in middle-aged and elderly men. *Med Sci Sports Exerc* 2001;33:1577-87.
- [53] Bassey E, Short A. A new method for measuring power output in a single leg extension: feasibility, reliability and validity. *Eur J Appl Physiol Occup Physiol* 1990;60:385-90.
- [54] Lindström B, Lexell J, Gerdle B, Downham D. Skeletal muscle fatigue and endurance in young and old men and women. *J Gerontol A Biol Sci Med Sci* 1997;52:59-66.
- [55] Dvorak J, Antinnes JA, Panjabi M, Loustalot D, Bonomo M. Age and gender related normal motion of the cervical spine. *Spine* 1992;17:393-8.
- [56] Chen J, Solinger AB, Poncelet JF, Lantz CA. Meta-analysis of normative cervical motion. *Spine* 1999;24:1571-8.
- [57] Simpson AK, Biswas D, Emerson JW, Lawrence BD, Grauer JN. Quantifying the effects of age, gender, degeneration, and adjacent level degeneration on cervical spine range of motion using multivariate analyses. *Spine* 2008;33:183-6.
- [58] Doriot N, Wang X. Effects of age and gender on maximum voluntary range of motion of the upper body joints. *Ergonomics* 2006;49:269-81.

- [59] Demaille-Wlodyka S, Chiquet C, Lavaste JF, Skalli W, Revel M, Poiradeau S. Cervical range of motion and cephalic kinesthesia: ultrasonographic analysis by age and sex. *Spine* 2007;32:254-61.
- [60] Youdas JW, Garrett TR, Suman VJ, Bogard CL, Hallman HO, Carey JR. Normal range of motion of the cervical spine: an initial goniometric study. *Phys Ther* 1992;72:770-80.
- [61] Kuhlman KA. Cervical range of motion in the elderly. *Arch Phys Med Rehabil* 1993;74:1071-9.
- [62] Castro WH, Sautmann A, Schilgen M, Sautmann M. Noninvasive three-dimensional analysis of cervical spine motion in normal subjects in relation to age and sex. An experimental examination. *Spine* 2000;25:443-9.
- [63] Hole DE, Cook JM, Bolton JE. Reliability and concurrent validity of two instruments for measuring cervical range of motion: effects of age and gender. *Man Ther* 1995;1:36-42.
- [64] Cole LJ, Farrell MJ, Gibson SJ, Egan GF. Age-related differences in pain sensitivity and regional brain activity evoked by noxious pressure. *Neurobiol Aging* 2010;31:494-503.
- [65] Lautenbacher S. Experimental approaches in the study of pain in the elderly. *Pain Med* 2012;13:44-50.
- [66] Jacobs J, Love S. Qualitative and quantitative morphology of human sural nerve at different ages. *Brain* 1985;108:897-924.
- [67] Ceballos D, Cuadras J, Verdú E, Navarro X. Morphometric and ultrastructural changes with ageing in mouse peripheral nerve. *J Anat* 1999;195:563-76.
- [68] Biasibetti E, Bisanzio D, Mioletti S, Amedeo S, Iuliano A, Bianco P, et al. Spontaneous age-related changes of peripheral nerves in cattle:

morphological and biochemical studies. *Anat Histol Embryol* 2016;45:100-8.

- [69] Khalil Z, Ralevic V, Bassirat M, Dusting GJ, Helme RD. Effects of ageing on sensory nerve function in rat skin. *Brain Res* 1994;641:265-72.
- [70] Sandell JH, Peters A. Disrupted myelin and axon loss in the anterior commissure of the aged rhesus monkey. *J Comp Neurol* 2003;466:14-30.
- [71] Hukkanen M, Platts LA, Corbett SA, Santavirta S, Polak JM, Kontinen YT. Reciprocal age-related changes in GAP-43/B-50, substance P and calcitonin gene-related peptide (CGRP) expression in rat primary sensory neurones and their terminals in the dorsal horn of the spinal cord and subintima of the knee synovium. *Neurosci Res* 2002;42:251-60.
- [72] Spokes EG. An analysis of factors influencing measurements of dopamine, noradrenaline, glutamate decarboxylase and choline acetylase in human post-mortem brain tissue. *Brain* 1979;102:333-46.
- [73] Quiton RL, Roys SR, Zhuo J, Keaser ML, Gullapalli RP, Greenspan JD. Age-related changes in nociceptive processing in the human brain. *Ann N Y Acad Sci* 2007;1097:175-8.
- [74] Edwards RR, Fillingim RB, Ness TJ. Age-related differences in endogenous pain modulation: a comparison of diffuse noxious inhibitory controls in healthy older and younger adults. *Pain* 2003;101:155-65.
- [75] Edwards RR, Fillingim RB. Age-associated differences in responses to noxious stimuli. *J Gerontol A Biol Sci Med Sci* 2001;56:180-5.
- [76] Gibson SJ, Farrell M. A review of age differences in the neurophysiology of nociception and the perceptual experience of pain. *Clin J Pain* 2004;20:227-39.

- [77] Jensen R, Rasmussen BK, Pedersen B, Lous I, Olesen J. Cephalic muscle tenderness and pressure pain threshold in a general population. *Pain* 1992;48:197-203.
- [78] Marini I, Bortolotti F, Bartolucci ML, Inelmen EM, Gatto MR, Bonetti GA. Aging effect on pressure pain thresholds of head and neck muscles. *Aging Clin Exp Res* 2012;24:239-44.
- [79] Lautenbacher S, Strian F. Similarities in age differences in heat pain perception and thermal sensitivity. *Funct Neurol* 1991;6:129-35.
- [80] Robinson ME, Bialosky JE, Bishop MD, Price DD, George SZ. Supra-threshold scaling, temporal summation, and after-sensation: relationships to each other and anxiety/fear. *J Pain Res* 2010;3:25-32.
- [81] Harkins SW, Price DD, Martelli M. Effects of age on pain perception: thermonociception. *J Gerontol* 1986;41:58-63.
- [82] Edwards RR, Fillingim RB. Effects of age on temporal summation and habituation of thermal pain: clinical relevance in healthy older and younger adults. *J Pain* 2001;2:307-17.
- [83] Vincent MB, Luna RA. Cervicogenic headache: a comparison with migraine and tension-type headache. *Cephalgia* 1999;19:11-6.
- [84] D'Amico D, Leone M, Bussone G. Side-locked unilaterality and pain localization in long-lasting headaches: migraine, tension-type headache, and cervicogenic headache. *Headache* 1994;34:526-30.
- [85] Bogduk N, Govind J. Cervicogenic headache: an assessment of the evidence on clinical diagnosis, invasive tests, and treatment. *Lancet Neurol* 2009;8:959-68.
- [86] Piovesan EJ, Kowacs PA, Oshinsky ML. Convergence of cervical and trigeminal sensory afferents. *Curr Pain Headache Rep* 2003;7:377-83.

- [87] Bartsch T, Goadsby PJ. Increased responses in trigeminocervical nociceptive neurons to cervical input after stimulation of the dura mater. *Brain* 2003;126:1801-13.
- [88] Bartsch T, Goadsby PJ. The trigeminocervical complex and migraine: current concepts and synthesis. *Curr Pain Headache Rep* 2003;7:371-6.
- [89] Ashina S, Bendtsen L, Ashina M. Pathophysiology of migraine and tension-type headache. *Tech Reg Anesth Pain Manag* 2012;16:14-8.
- [90] Nuseda R, Burstein R. Migraine pathophysiology: anatomy of the trigeminovascular pathway and associated neurological symptoms, cortical spreading depression, sensitization, and modulation of pain. *Pain* 2013;154:44-53.
- [91] Goadsby PJ, Lipton RB, Ferrari MD. Migraine-current understanding and treatment. *N Engl J Med* 2002;346:257-70.
- [92] Williamson DJ, Hargreaves RJ. Neurogenic inflammation in the context of migraine. *Microsc Res Tech* 2001;53:167-78.
- [93] Silberstein SD. Migraine pathophysiology and its clinical implications. *Cephalgia* 2004;24:2-7.
- [94] Nuseda R, Constandil L, Bourgeais L, Chalus M, Villanueva L. Changes of meningeal excitability mediated by corticotrigeminal networks: a link for the endogenous modulation of migraine pain. *J Neurosci* 2010;30:14420-9.
- [95] Sessle BJ, Hu JW, Dubner R, Lucier GE. Functional properties of neurons in cat trigeminal subnucleus caudalis (medullary dorsal horn): II. Modulation of responses to noxious and nonnoxious stimuli by periaqueductal gray, nucleus raphe magnus, cerebral cortex, and afferent influences, and effect of naloxone. *J Neurophysiol* 1981;45:193-207.
- [96] Fields HL, Basbaum AI, Heinricher MM. Central nervous system mechanisms of pain modulation. In: McMahon S, Koltzenburg M, editors.

Textbook of Pain. 5th ed. Burlington, Massachusetts, USA: Elsevier Health Sciences; 2005. p. 125-42.

- [97] Bendtsen L, Fernández-de-la-Peñas C. The role of muscles in tension-type headache. *Curr Pain Headache Rep* 2011;15:451-8.
- [98] Jensen R, Bendtsen L, Olesen J. Muscular factors are of importance in tension-type headache. *Headache* 1998;38:10-7.
- [99] Jensen R. Peripheral and central mechanisms in tension-type headache: an update. *Cephalgia* 2003;23:49-52.
- [100] Fernández-de-las-Peñas C, Cuadrado ML, Arendt-Nielsen L, Simons DG, Pareja JA. Myofascial trigger points and sensitization: an updated pain model for tension-type headache. *Cephalgia* 2007;27:383-93.
- [101] Ashina S, Bendtsen L. Pathophysiology of TTH: current status and future directions. In: Ashina M, Geppetti P, editors. *Pathophysiology of headaches: from molecule to man*. New York: Springer international publishing; 2015. p. 235-46.
- [102] Pielsticker A, Haag G, Zaudig M, Lautenbacher S. Impairment of pain inhibition in chronic tension-type headache. *Pain* 2005;118:215-23.
- [103] Bogduk N. The neck and headaches. *Neurol Clin* 2004;22:151-71.
- [104] International Headache Society. The international classification of headache disorders 2nd edition. *Cephalgia* 2004;24:1-151.
- [105] Sjaastad O, Fredriksen TA, Pfaffenrath V. Cervicogenic headache: diagnostic criteria. *Headache* 1998;38:442-5.
- [106] Sjaastad O, Saunte C, Hovdahl H, Breivik H, Grønbæk E. Cervicogenic headache. An hypothesis. *Cephalgia* 1983;3:249-56.

- [107] Sjaastad O, Bovim G, Stovner L. Laterality of pain and other migraine criteria in common migraine. A comparison with cervicogenic headache. *Funct Neurol* 1992;7:289-94.
- [108] Bovim G, Sand T. Cervicogenic headache, migraine without aura and tension-type headache. Diagnostic blockade of greater occipital and supraorbital nerves. *Pain* 1992;51:43-8.
- [109] Terzi T, Karakurum B, Üçler S, İnan LE, Tulunay C. Greater occipital nerve blockade in migraine, tension-type headache and cervicogenic headache. *J Headache Pain* 2002;3:137-41.
- [110] Zito G, Jull G, Story I. Clinical tests of musculoskeletal dysfunction in the diagnosis of cervicogenic headache. *Man Ther* 2006;11:118-29.
- [111] Zwart JA. Neck mobility in different headache disorders. *Headache* 1997;37:6-11.
- [112] Hall T, Robinson K. The flexion-rotation test and active cervical mobility-a comparative measurement study in cervicogenic headache. *Man Ther* 2004;9:197-202.
- [113] Gijsberts T, Duquet W, Stoekart R, Oostendorp R. Pain-provocation tests for C0-4 as a tool in the diagnosis of cervicogenic headache. *Cephalgia* 1999;19:436.
- [114] Watson DH, Trott PH. Cervical headache: an investigation of natural head posture and upper cervical flexor muscle performance. *Cephalgia* 1993;13:272-84.
- [115] Dumas JP, Arsenault AB, Boudreau G, Magnoux E, Lepage Y, Bellavance A, et al. Physical impairments in cervicogenic headache: traumatic vs. nontraumatic onset. *Cephalgia* 2001;21:884-93.

- [116] Amiri M, Jull G, Bullock-Saxton J, Darnell R, Lander C. Cervical musculoskeletal impairment in frequent intermittent headache. Part 2: subjects with concurrent headache types. *Cephalgia* 2007;27:891-8.
- [117] Jull G, O'Leary S, Falla D. Clinical assessment of the deep cervical flexor muscles: the craniocervical flexion test. *J Manipulative Physiol Ther* 2008;31:525-33.
- [118] Falla D, Jull G, Dall'Alba P, Rainoldi A, Merletti R. An electromyographic analysis of the deep cervical flexor muscles in performance of craniocervical flexion. *Phys Ther* 2003;83:899-906.
- [119] O'Leary S, Falla D, Jull G. The relationship between superficial muscle activity during the cranio-cervical flexion test and clinical features in patients with chronic neck pain. *Man Ther* 2011;16:452-5.
- [120] Armijo-Olivo S, Silvestre R, Fuentes J, da Costa BR, Gadotti IC, Warren S, et al. Electromyographic activity of the cervical flexor muscles in patients with temporomandibular disorders while performing the craniocervical flexion test: a cross-sectional study. *Phys Ther* 2011;91:1184-97.
- [121] Abaspour O, Javanshir K, Amiri M, Karimloo M. Relationship between cross sectional area of longus colli muscle and pain laterality in patients with cervicogenic headache. *J Back Musculoskelet Rehabil* 2015;28:393-9.
- [122] Danneels LA, Vanderstraeten GG, Cambier DC, Witvrouw EE, De Cuyper HJ. CT imaging of trunk muscles in chronic low back pain patients and healthy control subjects. *Eur Spine J* 2000;9:266-72.
- [123] Elliott J, Pedler A, Jull G, Van Wyk L, Galloway G, O'Leary S. Differential changes in muscle composition exist in traumatic and nontraumatic neck pain. *Spine* 2014;39:39-47.
- [124] Elliott J, Jull G, Noteboom JT, Galloway G. MRI study of the cross-sectional area for the cervical extensor musculature in patients with persistent whiplash associated disorders (WAD). *Man Ther* 2008;13:258-65.

- [125] Marcus DA, Scharff L, Mercer S, Turk DC. Musculoskeletal abnormalities in chronic headache: a controlled comparison of headache diagnostic groups. *Headache* 1999;39:21-7.
- [126] Fernández-de-las-Peñas C, Cuadrado ML, Pareja JA. Myofascial trigger points, neck mobility and forward head posture in unilateral migraine. *Cephalgia* 2006;26:1061-70.
- [127] Fernández-de-las-Peñas C, Cuadrado ML, Pareja JA. Myofascial trigger points, neck mobility, and forward head posture in episodic tension-type headache. *Headache* 2007;47:662-72.
- [128] Fernández-de-las-Peñas C, Bueno A, Ferrando J, Elliott J, Cuadrado ML, Pareja JA. Magnetic resonance imaging study of the morphometry of cervical extensor muscles in chronic tension-type headache. *Cephalgia* 2007;27:355-62.
- [129] Hwang JH, Choi CS. Use of in vivo magnetic resonance spectroscopy for studying metabolic diseases. *Exp Mol Med* 2015;47:139.
- [130] Schrauwen-Hinderling VB, Hesselink MK, Schrauwen P, Kooi ME. Intramyocellular lipid content in human skeletal muscle. *Obesity* 2006;14:357-67.
- [131] Boesch C, Kreis R. Observation of intramyocellular lipids by ^1H -magnetic resonance spectroscopy. *Ann N Y Acad Sci* 2000;904:25-31.
- [132] Mengiardi B, Schmid MR, Boos N, Pfirrmann CW, Brunner F, Elfering A, et al. Fat content of lumbar paraspinal muscles in patients with chronic low back pain and in asymptomatic volunteers: quantification with MR spectroscopy. *Radiology* 2006;240:786-92.
- [133] Arendt-Nielsen L, Yarnitsky D. Experimental and clinical applications of quantitative sensory testing applied to skin, muscles and viscera. *J Pain* 2009;10:556-72.

- [134] Sterling M, Jull G, Vicenzino B, Kenardy J. Sensory hypersensitivity occurs soon after whiplash injury and is associated with poor recovery. *Pain* 2003;104:509-17.
- [135] Fernández-de-las-Peñas C, Arendt-Nielsen L, Cuadrado ML, Pareja JA. Generalized mechanical pain sensitivity over nerve tissues in patients with strictly unilateral migraine. *Clin J Pain* 2009;25:401-6.
- [136] Fernández-de-las-Peñas C, Cuadrado ML, Arendt-Nielsen L, Pareja JA. Side-to-side differences in pressure pain thresholds and pericranial muscle tenderness in strictly unilateral migraine. *Eur J Neurol* 2008;15:162-8.
- [137] Palacios-Ceña M, Lima Florencio L, Natália Ferracini G, Barón J, Guerrero ÁL, Ordás-Bandera C, et al. Women with chronic and episodic migraine exhibit similar widespread pressure pain sensitivity. *Pain Med* 2016;17:2127-33.
- [138] Jensen R, Rasmussen BK, Pedersen B, Olesen J. Muscle tenderness and pressure pain thresholds in headache. A population study. *Pain* 1993;52:193-9.
- [139] Jensen K, Tuxen C, Olesen J. Pericranial muscle tenderness and pressure-pain threshold in the temporal region during common migraine. *Pain* 1988;35:65-70.
- [140] Mørk H, Ashina M, Bendtsen L, Olesen J, Jensen R. Induction of prolonged tenderness in patients with tension-type headache by means of a new experimental model of myofascial pain. *Eur J Neurol* 2003;10:249-56.
- [141] Ashina S, Babenko L, Jensen R, Ashina M, Magerl W, Bendtsen L. Increased muscular and cutaneous pain sensitivity in cephalic region in patients with chronic tension-type headache. *Eur J Neurol* 2005;12:543-9.
- [142] Schoenen J, Bottin D, Hardy F, Gerard P. Cephalic and extracephalic pressure pain thresholds in chronic tension-type headache. *Pain* 1991;47:145-9.

- [143] Langemark M, Jensen K, Jensen TS, Olesen J. Pressure pain thresholds and thermal nociceptive thresholds in chronic tension-type headache. *Pain* 1989;38:203-10.
- [144] Buchgreitz L, Lyngberg AC, Bendtsen L, Jensen R. Frequency of headache is related to sensitization: a population study. *Pain* 2006;123:19-27.
- [145] Bovim G. Cervicogenic headache, migraine, and tension-type headache: pressure-pain threshold measurements. *Pain* 1992;51:169-73.
- [146] Chua NH, van Suijlekom HA, Vissers KC, Arendt-Nielsen L, Wilder-Smith OH. Differences in sensory processing between chronic cervical zygapophysial joint pain patients with and without cervicogenic headache. *Cephalalgia* 2011;31:953-63.
- [147] Anthony M. Cervicogenic headache: prevalence and response to local steroid therapy. *Clin Exp Rheumatol* 2000;18:59-64.
- [148] Sand T, Zhitniy N, Nilsen KB, Helle G, Hagen K, Stovner LJ. Thermal pain thresholds are decreased in the migraine preattack phase. *Eur J Neurol* 2008;15:1199-205.
- [149] Schwedt TJ, Krauss MJ, Frey K, Gereau RW. Episodic and chronic migraineurs are hypersensitive to thermal stimuli between migraine attacks. *Cephalalgia* 2011;31:6-12.
- [150] Schwedt TJ, Zuniga L, Chong CD. Low heat pain thresholds in migraineurs between attacks. *Cephalalgia* 2015;35:593-9.
- [151] Kitaj MB, Klink M. Pain thresholds in daily transformed migraine versus episodic migraine headache patients. *Headache* 2005;45:992-8.
- [152] Jensen R. Mechanisms of spontaneous tension-type headaches: an analysis of tenderness, pain thresholds and EMG. *Pain* 1996;64:251-6.

- [153] Ashina S, Bendtsen L, Ashina M, Magerl W, Jensen R. Generalized hyperalgesia in patients with chronic tension-type headache. *Cephalgia* 2006;26:940-8.
- [154] Gierse-Plogmeier B, Colak-Ekici R, Wolowski A, Gralow I, Marziniak M, Evers S. Differences in trigeminal and peripheral electrical pain perception in women with and without migraine. *J Headache Pain* 2009;10:249-54.
- [155] Lindelof K, Ellrich J, Jensen R, Bendtsen L. Central pain processing in chronic tension-type headache. *Clin Neurophysiol* 2009;120:1364-70.
- [156] Ylinen J, Nikander R, Nykänen M, Kautiainen H, Häkkinen A. Effect of neck exercises on cervicogenic headache: a randomized controlled trial. *J Rehabil Med* 2010;42:344-9.
- [157] Fumal A, Schoenen J. Tension-type headache: current research and clinical management. *Lancet Neurol* 2008;7:70-83.
- [158] Miller S. The acute and preventative treatment of episodic migraine. *Ann Indian Acad Neurol* 2012;15:33-9.
- [159] Holroyd KA, O'Donnell FJ, Stensland M, Lipchik GL, Cordingley GE, Carlson BW. Management of chronic tension-type headache with tricyclic antidepressant medication, stress management therapy, and their combination: a randomized controlled trial. *JAMA* 2001;285:2208-15.
- [160] Bevilacqua-Grossi D, Gonçalves MC, Carvalho GF, Florencio LL, Dach F, Speciali JG, et al. Additional effects of a physical therapy protocol on headache frequency, pressure pain threshold, and improvement perception in patients with migraine and associated neck pain: a randomized controlled trial. *Arch Phys Med Rehabil* 2016;97:866-74.
- [161] Posadzki P, Ernst E. Spinal manipulations for the treatment of migraine: a systematic review of randomized clinical trials. *Cephalgia* 2011;31:964-70.

- [162] Biondi DM. Physical treatments for headache: a structured review. Headache 2005;45:738-46.
- [163] Bove G, Nilsson N. Spinal manipulation in the treatment of episodic tension-type headache: a randomized controlled trial. JAMA 1998;280:1576-9.
- [164] Boline PD, Kassak K, Bronfort G, Nelson C, Anderson AV. Spinal manipulation vs. amitriptyline for the treatment of chronic tension-type headaches: a randomized clinical trial. J Manipulative Physiol Ther 1995;18:148-54.
- [165] Elliott J, Jull G, Noteboom JT, Darnell R, Galloway G, Gibbon WW. Fatty Infiltration in the cervical extensor muscles in persistent whiplash-associated disorders: a magnetic resonance imaging analysis. Spine 2006;31:847-55.
- [166] Elliott J, O'Leary S, Sterling M, Hendrikz J, Pedler A, Jull G. Magnetic resonance imaging findings of fatty infiltrate in the cervical flexors in chronic whiplash. Spine 2010;35:948-54.
- [167] David K, Philip P. Ultrasound. In: Richard AW, Philip GC, Chris D, Helen F, John I, Müller-Ladner U, editors. Oxford textbook of rheumatology. 4 ed. Oxford: UK: Oxford university press; 2013. p. 492-505.
- [168] Kratz A, Ferraro M, Sluss PM, Lewandrowski KB. Normal reference laboratory values. N Engl J Med 2004;351:1548-63.
- [169] Uthaikhup S, Paungmali A, Pirunsan U. Validation of Thai versions of the neck disability index and neck pain and disability scale in patients with neck pain. Spine 2011;36:1415-21.
- [170] Vernon H, Mior S. The Neck Disability Index: a study of reliability and validity. J Manipulative Physiol Ther 1991;14:409-15.

- [171] Tiplady B, Jackson SH, Maskrey VM, Swift CG. Validity and sensitivity of visual analogue scales in young and older healthy subjects. *Age Ageing* 1998;27:63-6.
- [172] Murphy WA, Totty WG, Carroll JE. MRI of normal and pathologic skeletal muscle. *AJR Am J Roentgenol* 1986;146:565-74.
- [173] Elliott J, Jull G, Noteboom JT, Durbridge GL, Gibbon WW. Magnetic resonance imaging study of cross-sectional area of the cervical extensor musculature in an asymptomatic cohort. *Clin Anat* 2007;20:35-40.
- [174] Elliott J, Galloway GJ, Jull G, Noteboom JT, Centeno CJ, Gibbon WW. Magnetic resonance imaging analysis of the upper cervical spine extensor musculature in an asymptomatic cohort: an index of fat within muscle. *Clin Radiol* 2005;60:355-63.
- [175] Wilson M, Reynolds G, Kauppinen RA, Arvanitis TN, Peet AC. A constrained least-squares approach to the automated quantitation of in vivo ¹H magnetic resonance spectroscopy data. *Magn Reson Med* 2011;65:1-12.
- [176] Hockings PD, Changani KK, Saeed N, Reid DG, Birmingham J, O'Brien P, et al. Rapid reversal of hepatic steatosis, and reduction of muscle triglyceride, by rosiglitazone: MRI/S studies in Zucker fatty rats. *Diabetes Obes Metab* 2003;5:234-43.
- [177] Fernández-De-Las-Peñas C, Albert-Sanchís JC, Buil M, Benítez JC, Alburquerque-Sendín F. Cross-sectional area of cervical multifidus muscle in females with chronic bilateral neck pain compared to controls. *J Orthop Sports Phys Ther* 2008;38:175-80.
- [178] Hodges PW, Tucker K. Moving differently in pain: a new theory to explain the adaptation to pain. *Pain* 2011;152:90-8.
- [179] Martelletti P. Inflammatory mechanisms in cervicogenic headache: an integrative view. *Curr Pain Headache Rep* 2002;6:315-9.

- [180] Tachihara H, Kikuchi S, Konno S, Sekiguchi M. Does facet joint inflammation induce radiculopathy?: an investigation using a rat model of lumbar facet joint inflammation. *Spine* 2007;32:406-12.
- [181] Panjabi MM, Cholewicki J, Nibu K, Grauer J, Babat LB, Dvorak J. Critical load of the human cervical spine: an in vitro experimental study. *Clin Biomech* 1998;13:11-7.
- [182] O'leary S, Jull G, Van Wyk L, Pedler A, Elliott J. Morphological changes in the cervical muscles of women with chronic whiplash can be modified with exercise-a pilot study. *Muscle Nerve* 2015;52:772-9.
- [183] Pfirrmann CW, Schmid MR, Zanetti M, Jost B, Gerber C, Hodler J. Assessment of fat content in supraspinatus muscle with proton MR spectroscopy in asymptomatic volunteers and patients with supraspinatus tendon lesions. *Radiology* 2004;232:709-15.
- [184] Blüml S. Magnetic resonance spectroscopy: basics. In: Blüml S, Panigrahy A, editors. *MR spectroscopy of pediatric brain disorders*. New York: Springer 2013. p. 11-23.
- [185] Saupe N, Prüssmann KP, Luechinger R, Bösiger P, Marincek B, Weishaupt D. MR imaging of the wrist: comparison between 1.5-and 3-T MR imaging-preliminary experience. *Radiology* 2005;234:256-64.
- [186] Hwang JH, Pan JW, Heydari S, Hetherington HP, Stein DT. Regional differences in intramyocellular lipids in humans observed by in vivo ^1H -MR spectroscopic imaging. *J Appl Physiol* 2001;90:1267-74.
- [187] Dager SR, Corrigan NM, Richards TL, Posse S. Research applications of magnetic resonance spectroscopy (MRS) to investigate psychiatric disorders. *Top Magn Reson Imaging* 2008;19:81-96.
- [188] Candow DG, Chilibeck PD. Differences in size, strength, and power of upper and lower body muscle groups in young and older men. *J Gerontol A Biol Sci Med Sci* 2005;60:148-56.

- [189] Bartsch T, Goadsby PJ. Anatomy and physiology of pain referral patterns in primary and cervicogenic headache disorders. *Headache Curr* 2005;2:42-8.
- [190] Sjaastad O. Cervicogenic headache: comparison with migraine without aura; Vågå study. *Cephalgia* 2008;28:18-20.
- [191] Koltzenburg M. Neural mechanisms of cutaneous nociceptive pain. *Clin J Pain* 2000;16:131-8.
- [192] Mørch CD, Hu JW, Arendt-Nielsen L, Sessle BJ. Convergence of cutaneous, musculoskeletal, dural and visceral afferents onto nociceptive neurons in the first cervical dorsal horn. *Eur J Neurosci* 2007;26:142-54.
- [193] Sessle BJ, Hu JW, Amano N, Zhong G. Convergence of cutaneous, tooth pulp, visceral, neck and muscle afferents onto nociceptive and non-nociceptive neurones in trigeminal subnucleus caudalis (medullary dorsal horn) and its implications for referred pain. *Pain* 1986;27:219-35.
- [194] Vernon H, Sun K, Zhang Y, Yu XM, Sessle BJ. Central sensitization induced in trigeminal and upper cervical dorsal horn neurons by noxious stimulation of deep cervical paraspinal tissues in rats with minimal surgical trauma. *J Manipulative Physiol Ther* 2009;32:506-14.
- [195] Thomas E, Mottram S, Peat G, Wilkie R, Croft P. The effect of age on the onset of pain interference in a general population of older adults: prospective findings from the North Staffordshire Osteoarthritis Project (NorStOP). *Pain* 2007;129:21-7.
- [196] Fingleton C, Smart K, Moloney N, Fullen BM, Doody C. Pain sensitization in people with knee osteoarthritis: a systematic review and meta-analysis. *Osteoarthr Cartilage* 2015;23:1043-56.
- [197] Riley JL, Cruz-Almeida Y, Glover TL, King CD, Goodin BR, Sibille KT, et al. Age and race effects on pain sensitivity and modulation among middle-aged and older adults. *J Pain* 2014;15:272-82.

- [198] Pickering G, Jourdan D, Eschalier A, Dubray C. Impact of age, gender and cognitive functioning on pain perception. *Gerontology* 2002;48:112-8.
- [199] Lautenbacher S, Kunz M, Strate P, Nielsen J, Arendt-Nielsen L. Age effects on pain thresholds, temporal summation and spatial summation of heat and pressure pain. *Pain* 2005;115:410-8.
- [200] Kose N, Ekici G, Karakaya MG, Suvalci S, Demir B, Otman AS. The assessment of the pressure pain threshold and its correlation with depression and anxiety in geriatric nursing home residents with cognitive impairment. *Pain Clin* 2004;16:201-6.
- [201] Leong IY, Farrell MJ, Helme RD, Gibson SJ. The relationship between medical comorbidity and self-rated pain, mood disturbance, and function in older people with chronic pain. *J Gerontol A Biol Sci Med Sci* 2007;62:550-5.
- [202] Pavlaković G, Petzke F. The role of quantitative sensory testing in the evaluation of musculoskeletal pain conditions. *Curr Rheumatol Rep* 2010;12:455-61.
- [203] Bartley EJ, Fillingim RB. Sex differences in pain: a brief review of clinical and experimental findings. *Br J Anaesth* 2013;111:52-8.
- [204] Javanshir K, Ortega-Santiago R, Mohseni-Bandpei MA, Miangolarra-Page JC, Fernández-de-las-Peñas C. Exploration of somatosensory impairments in subjects with mechanical idiopathic neck pain: a preliminary study. *J Manipulative Physiol Ther* 2010;33:493-9.
- [205] Train the Brain Forum Committee. Thai Geriatric Depression Scale-TGDS. *Siriraj Hosp Gaz* 1994;46:1-9.
- [206] Scott D, Jull G, Sterling M. Widespread sensory hypersensitivity is a feature of chronic whiplash-associated disorder but not chronic idiopathic neck pain. *Clin J Pain* 2005;21:175-81.

- [207] Latremoliere A, Woolf CJ. Central sensitization: a generator of pain hypersensitivity by central neural plasticity. *J Pain* 2009;10:895-926.
- [208] Kemp J, Després O, Pebayle T, Dufour A. Differences in age-related effects on myelinated and unmyelinated peripheral fibres: a sensitivity and evoked potentials study. *Eur J Pain* 2014;18:482-8.
- [209] Wahren LK, Torebjörk E, Jörum E. Central suppression of cold-induced C fibre pain by myelinated fibre input. *Pain* 1989;38:313-9.
- [210] Baron R, Hans G, Dickenson AH. Peripheral input and its importance for central sensitization. *Ann Neurol* 2013;74:630-6.
- [211] Kobayashi A, Shinoda M, Sessle BJ, Honda K, Imamura Y, Hitomi S, et al. Mechanisms involved in extraterritorial facial pain following cervical spinal nerve injury in rats. *Mol Pain* 2011;7:12.
- [212] Svensson P, Wang K, Arendt-Nielsen L, Cairns BE, Sessle BJ. Pain effects of glutamate injections into human jaw or neck muscles. *J Orofac Pain* 2005;19:109-18.
- [213] Pincus T, Burton AK, Vogel S, Field AP. A systematic review of psychological factors as predictors of chronicity/disability in prospective cohorts of low back pain. *Spine* 2002;27:109-20.
- [214] Johnston V, Jimmieson NL, Jull G, Souvlis T. Quantitative sensory measures distinguish office workers with varying levels of neck pain and disability. *Pain* 2008;137:257-65.
- [215] Buchman AS, Shah RC, Leurgans SE, Boyle PA, Wilson RS, Bennett DA. Musculoskeletal pain and incident disability in community-dwelling older adults. *Arthritis Care Res* 2010;62:1287-93.
- [216] Wang H, Fischer C, Chen G, Weinsheimer N, Gantz S, Schiltenwolf M. Does long-term opioid therapy reduce pain sensitivity of patients with

chronic low back pain? Evidence from quantitative sensory testing. *Pain Physician* 2012;15:135-43.

- [217] Yarnitsky D. Role of endogenous pain modulation in chronic pain mechanisms and treatment. *Pain* 2015;156:24-31.
- [218] Van Ettekoven H, Lucas C. Efficacy of physiotherapy including a craniocervical training programme for tension-type headache; a randomized clinical trial. *Cephalgia* 2006;26:983-91.
- [219] Maitland GD, Hengeveld E, Banks K, English K, editors. Maitland's vertebral manipulation. 6th ed. Edinburgh, New York: Butterworth-Heinemann; 2005.
- [220] Jull G, Sterling M, Falla D, Treleaven J, O'Leary S. Whiplash, headache, and neck pain. Edinburgh: Churchill Livingstone; 2008.
- [221] Wegner S, Jull G, O'Leary S, Johnston V. The effect of a scapular postural correction strategy on trapezius activity in patients with neck pain. *Man Ther* 2010;15:562-6.
- [222] Caneiro JP, O'Sullivan P, Burnett A, Barach A, O'Neil D, Tveit O, et al. The influence of different sitting postures on head/neck posture and muscle activity. *Man Ther* 2010;15:54-60.
- [223] WHO Collaborating Centre for Drug Statistics and Methodology. Guidelines for ATC classification and DDD assignment. Oslo, Norway 2013.
- [224] Hall TM, Robinson KW, Fujinawa O, Akasaka K, Pyne EA. Intertester reliability and diagnostic validity of the cervical flexion-rotation test. *J Manipulative Physiol Ther* 2008;31:293-300.
- [225] Audette I, Dumas JP, Côté JN, De Serres SJ. Validity and between-day reliability of the cervical range of motion (CROM) device. *J Orthop Sports Phys Ther* 2010;40:318-23.

- [226] Cohen J. Statistical power analysis for the behavior science. New York: Routledge Academic; 1988.
- [227] Silberstein SD, Tfelt-Hansen P, Dodick DW, Limmroth V, Lipton RB, Pascual J, et al. Guidelines for controlled trials of prophylactic treatment of chronic migraine in adults. *Cephalalgia* 2008;28:484-95.
- [228] Biondi DM, Sape JR. Geriatric headache: how to make the diagnosis and manage the pain. *Geriatrics* 2000;55:40-50.
- [229] Young BA, Walker MJ, Strunce JB, Boyles RE, Whitman JM, Childs JD. Responsiveness of the Neck Disability Index in patients with mechanical neck disorders. *Spine J* 2009;9:802-8.
- [230] Bogduk N. Cervicogenic headache: anatomic basis and pathophysiologic mechanisms. *Curr Pain Headache Rep* 2001;5:382-6.
- [231] Ylinen J, Takala EP, Kautiainen H, Nykänen M, Häkkinen A, Pohjolainen T, et al. Effect of long-term neck muscle training on pressure pain threshold: a randomized controlled trial. *Eur J Pain* 2005;9:673-81.

ลิขสิทธิ์มหาวิทยาลัยเชียงใหม่
Copyright© by Chiang Mai University
All rights reserved