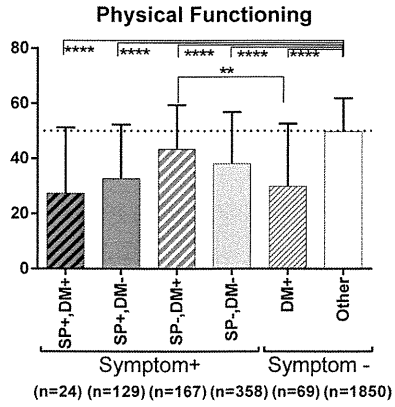
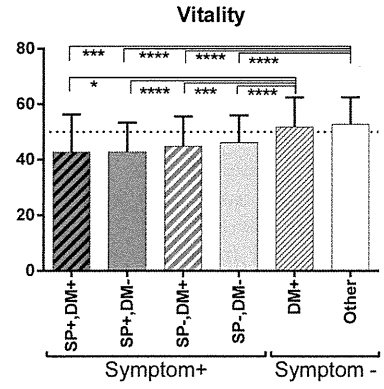

Physical Functioning
80
60
40
20
0
SP+,DM+
SP+,DM-
SP-,DM+
SP-,DM-
DM+
Other
Symptom+
Symptom -
(n=24) (n=129) (n=167) (n=358) (n=69) (n=1850)


Vitality
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60
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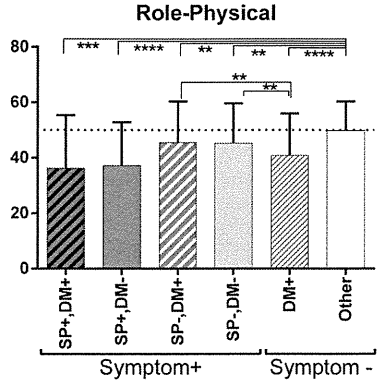
SP+,DM+
SP+,DM-
SP-,DM+
SP-,DM-
DM+
Other
Symptom+
Symptom -


Role-Physical
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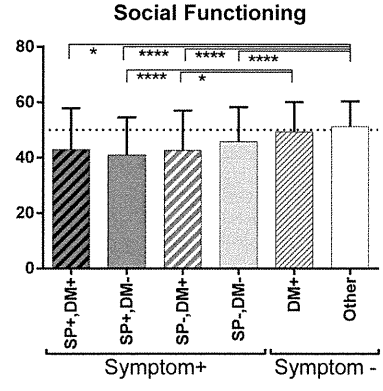
SP+,DM-
SP-,DM+
SP-,DM-
DM+
Other
Symptom+
Symptom -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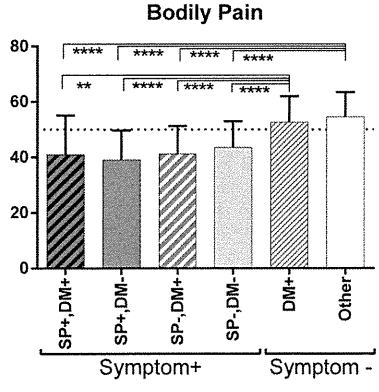
SP+,DM-
SP-,DM+
SP-,DM-
DM+
Other
Symptom+
Symptom -


Bodily Pain
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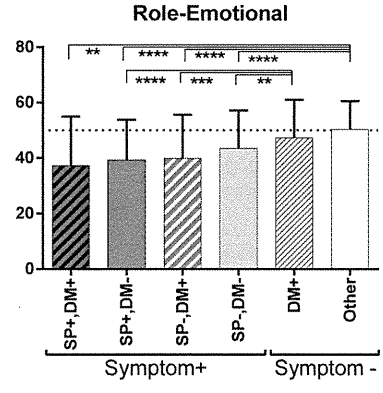
SP+,DM-
SP-,DM+
SP-,DM-
DM+
Other
Symptom+
Symptom -


Role-Emotional
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40
20
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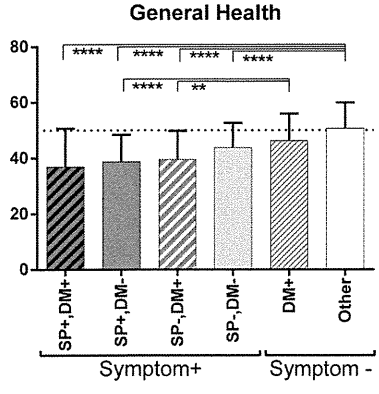
SP+,DM+
SP+,DM-
SP-,DM+
SP-,DM-
DM+
Other
Symptom+
Symptom -


General Health
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60
40
20
0
SP+,DM+
SP+,DM-
SP-,DM+
SP-,DM-
DM+
Other
Symptom+
Symptom -

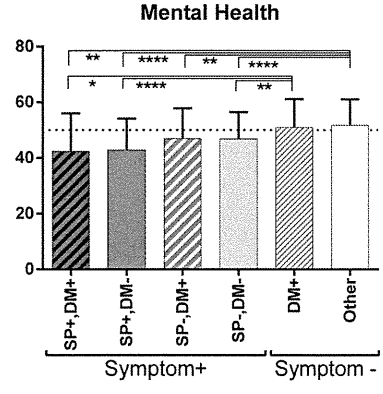
Mental Health
80
60
40
20
0
SP+,DM+
SP+,DM-
SP-,DM+
SP-,DM-
DM+
Other
Symptom+
Symptom -

Figure 3. SF-36 subscale scores for presence or absence of spine/spinal cord-related disorder and diabetes. Diagnosed with spine/spinal cord-disorder (SP+), with diabetes (DM+), positive for numbness or pain (symptom +). Among individuals diagnosed with diabetes and spinal disease, health status was lower in the group with numbness or pain as compared to the group with neither. This trend was strong in those diagnosed with spine/spinal cord disorder. *p<0.05, **p<0.01, ***p<0.001, ****p<0.0001.
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ical findings. These patients were narrowed down to cases of refractory spinal-related pain following spinal cord damage based, when necessary, on the results of specialist examinations and imaging studies. The secondary survey was conducted from August 2010 to December 2010.

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Author Contributions

Conceived and designed the experiments: TU SI MN CK. Performed the experiments: KO TI MK MI TT. Analyzed the data: TU MN CK. Contributed reagents/materials/analysis tools: TU SI MN CK. Wrote the paper: SI MI TU.

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RESEARCH ARTICLE Open Access

Effect of muscle load tasks with maximal isometric contractions on oxygenation of the trapezius muscle and sympathetic nervous activity in females with chronic neck and shoulder pain

Yukiko Shiro[1], Young-Chang P Arai[2*], Takako Matsubara[2,3], Shunsuke Isogai[4] and Takahiro Ushida[2]

Abstract

Background: Sympathetic nervous activity contributes to the maintenance of muscle oxygenation. However, patients with chronic pain may suffer from autonomic dysfunction. Furthermore, insufficient muscle oxygenation is observed among workers with chronic neck and shoulder pain. The aim of our study was to investigate how muscle load tasks affect sympathetic nervous activity and changes in oxygenation of the trapezius muscles in subjects with chronic neck and shoulder pain.

Methods: Thirty females were assigned to two groups: a pain group consisting of subjects with chronic neck and shoulder pain and a control group consisting of asymptomatic subjects. The participants performed three sets of isometric exercise in an upright position; they contracted their trapezius muscles with maximum effort and let the muscles relax (Relax). Autonomic nervous activity and oxygenation of the trapezius muscles were measured by heart rate variability (HRV) and Near-Infrared Spectroscopy.

Results: Oxyhemoglobin and total hemoglobin of the trapezius muscles in the pain group were lower during the Relax period compared with the control group. In addition, the low frequency / high frequency (LF/HF) ratio of HRV significantly increased during isometric exercise in the control group, whereas there were no significant changes in the pain group.

Conclusions: Subjects with neck and shoulder pain showed lower oxygenation and blood flow of the trapezius muscles responding to isometric exercise, compared with asymptomatic subjects. Subjects with neck and shoulder pain also showed no significant changes in the LF/HF ratio of HRV responding to isometric exercise, which would imply a reduction in sympathetic nervous activity.

Keywords: Chronic neck and shoulder pain, Sympathetic nervous activity, Muscle oxygenation

* Correspondence: arainon@aichi-med-u.ac.jp
[2]Multidisciplinary Pain Centre, Aichi Medical University, School of Medicine, Nagakute, Japan
Full list of author information is available at the end of the article

Background

Chronic neck and shoulder pain is very common symptom especially in females. A systematic review reports that arm force, arm posture, duration of sitting, work place design [1], repetitive hand and finger movements and monotonous work task [2] cause neck and shoulder disorders. In particular, a correlation has been identified between neck and shoulder pain and the trapezius muscle [3,4]. The trapezius muscle is well capillarized [4,5]. Most hypotheses for the development and maintenance of work-related muscle pain propose that muscle-cell activity produces energy demands that are not met by circulation, thereby resulting in hypoxia, energy crisis, and accumulation of metabolites in the muscle [6]. Several studies showed that metabolic insufficiencies are related to pain perception of workers with trapezius myalgia [7,8]. Furthermore, impaired regulation of microcirculation occurs in the trapezius muscle in cases of chronic neck pain [4,5] and insufficient muscle blood flow and oxygenation have been observed among workers with chronic neck and shoulder complaints [7,8]. In contrast, activation of skeletal muscle fibers by somatic nerves leads to vasodilation. A previous study showed that low-level static contraction did increase trapezius muscle blood flux [9]. A lot of the results in an association between muscle activity and pain are not consistent. The pathogenic mechanisms of chronic neck and shoulder pain development are likely to be multifactorial.

Sympathetic nerve activity contributes to vasoconstriction and the maintenance of arterial blood pressure [10]. However, several studies have demonstrated autonomic dysfunction in chronic pain syndromes. Impaired function of sympathetic nerves was observed in patients with complex regional pain syndrome (CRPS) [11]. Furthermore, patients with fibromyalgia showed autonomic dysfunction characterized by persistent autonomic nervous system hyperactivity at rest and hypo-reactivity during stress [12]. Thus, we speculate that there may be autonomic dysfunction in subjects with chronic neck and shoulder pain.

Heart rate variability (HRV) has been used as a biomarker of autonomic nervous system function. HRV is a reliable method to obtain information on sympathetic and parasympathetic contributions to heart rate, and several studies have shown that pain increases sympathetic activity [13]. Frequency fluctuations of HRV in the range of 0.04-0.15 Hz (low frequency, LF) are considered to be markers of sympathetic and parasympathetic nerve activity, and high frequency (HF) fluctuations in the range of 0.15-0.4 Hz are considered markers of parasympathetic nerve activity. Thus, the LF/HF ratio is considered to be an index of sympathetic nerve activity [13,14].

We hypothesized that subjects with chronic neck and shoulder pain would have autonomic dysfunction to muscle load, thereby leading to insufficient muscle blood flow and oxygenation of the trapezius muscle. The aim of the present study was to see how heart rate variability and oxygenation of the trapezius muscle respond to muscle load tasks with maximal isometric contraction in subjects with chronic neck and shoulder pain.

Methods

After receiving approval from the Nagoya Gakuin University Board of Ethics and obtaining written informed consent, 30 female participants were recruited for the present study. Exclusion criteria were serious conditions such as previous trauma to the neck or shoulder, cardiovascular or neurological disease, diabetes, menstruation, or administration of sedatives, analgesics, or other medication. Participants were assessed on pain intensity using a verbal rating scale (VRS) and visual analogue scale (VAS), pain-related disability using Neck Disability Index (NDI). For the VRS, the intensity of neck pain was rated on a numerical scale from 0 to 3 (0 = no pain, 1 = mild pain, 2 = moderate pain, and 3 = severe pain). For the VAS, the pain intensity was assessed using a horizontal 100-mm line with the words "no pain" at one end and "worst pain imaginable" at the other. The participants were assigned into two groups; a pain group consisting of subjects who scored higher than 1 on VRS and more than 10 mm on VAS, the control group consisting of subjects who answered 0 for both VRS and VAS. Subsequently, a clinical neck and shoulder examination was performed with the pain group. After a positive clinical diagnosis of tightness of the upper trapezius muscle and palpable tenderness of the upper trapezius muscle was confirmed, the patient was assigned to the pain group. In the present study, ultimately 14 females qualified for the pain group and 12 females qualified for the control group (Table 1). The pain group subjects complained of the pain bilaterally, although there was laterality for pain intensity.

All measurements were performed in the afternoon. Trapezius muscles oxygenation were measured using Near-

Table 1 Characteristics of the control group and the pain group

	Control group (n = 12)	Pain group (n = 14)	*P* value
Age (yr)	28.7 (4.6)	29.5 (4.1)	0.625
Height (cm)	157.3 (3.8)	157.9 (5.7)	0.898
Weight (kg)	49.3 (6.2)	50.9 (9.4)	0.939
BMI	20.0 (1.9)	20.5 (3.6)	0.430
VRS	0 (0)	Rt. 1.8 (0.7) Lt. 1.7 (0.8)	-
VAS (mm)	0 (0)	Rt. 44.7 (23.2) Lt. 44.0 (21.2)	-
NDI	1.5 (1.6)	5.8 (4.8)	0.006

Values expressed as mean (SD). BMI: body mass index, VRS: verbal rating scale, VAS: visual analogue scale, NDI: neck disability index.

Infrared Spectroscopy (NIRS) (NIRO 200, Hamamatsu Photonics, Japan) bilaterally. Probes were placed at the transverse section on both sides of the upper trapezius muscles at the midpoint between the spinous process of the seventh cervical vertebrae and the acrominon. Measurements were given as concentration change in μM of oxyhemoglobin (ΔO_2Hb), deoxyhemoglobin (ΔHHb), and total hemoglobin ($\Delta THb = \Delta O_2Hb + \Delta HHb$) from baseline [15]. The electrocardiogram (ECG) signals were obtained from a portable ECG recorder (AC301A, GMS, Tokyo, Japan) and transferred to a computer loaded with HRV analysis software (TARAWA/WIN; Suwa Trust, Tokyo, Japan). The R-R intervals (RRIs) were obtained every 10 seconds. The two components of power of the RRI (ms.ms), LF (0.04-0.15 Hz) and HF (0.15-0.4 Hz), were calculated. The participants were allowed to sit comfortably on a chair in a quiet environment for 10 minutes. Then, the record of the trapezius muscles oxygenation and the ECG signal for heart rate variability (HRV) analysis started. After a five-minute measurement of the first rest period, the participants were instructed to perform three sets of isometric exercise in an upright position; while wearing wrist weights (2 kg on each side), they contracted their bilateral trapezius muscles with maximum effort (MAX) for 1 minute and let the muscles relax (Relax) for 2 minutes. Participants were directed, where necessary to make more effort of contraction. Participants were coached to use only the trapezius muscles without extending their neck and abducting their shoulder and flexing their elbow. After three

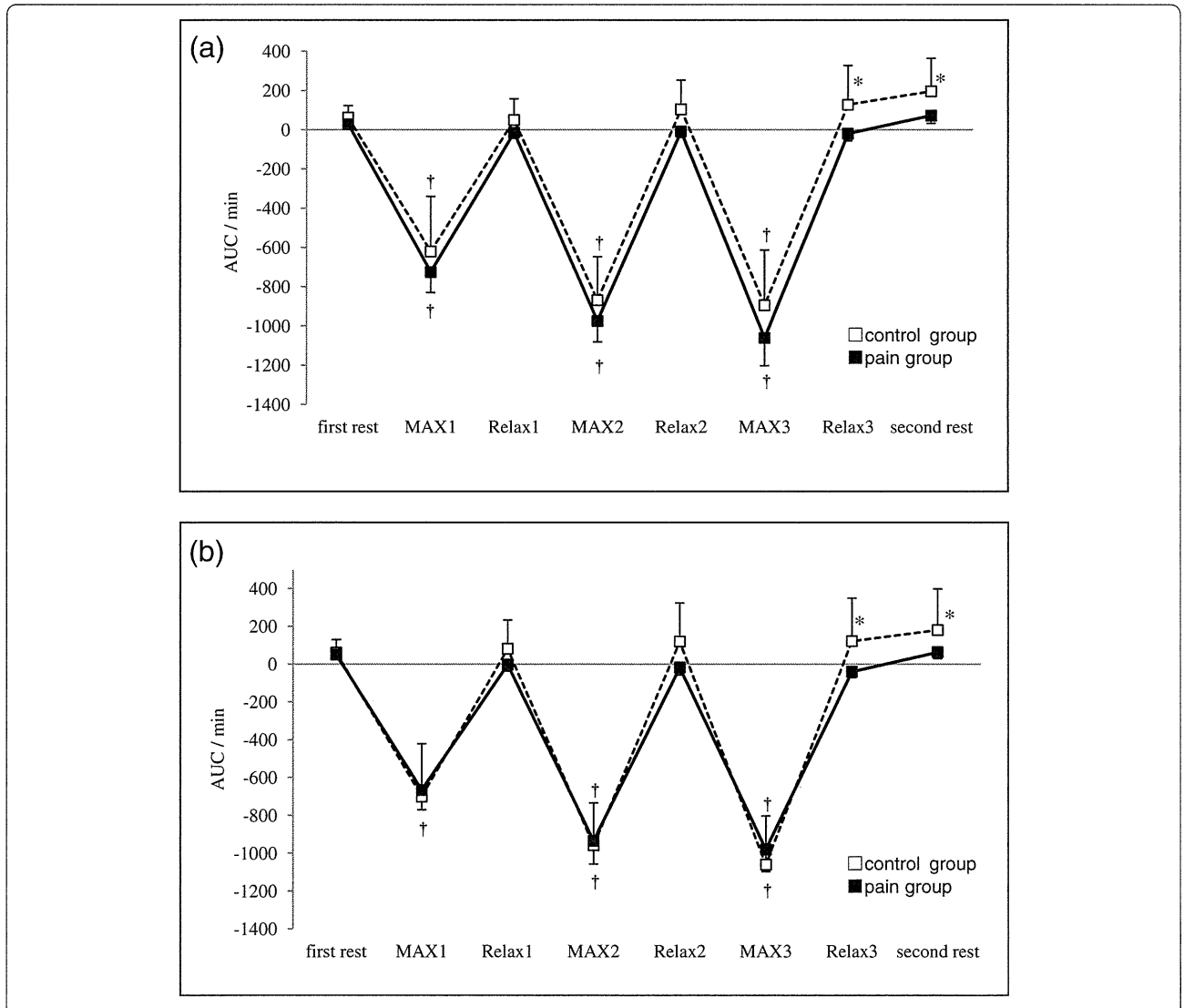

Figure 1 Change in oxyhaemoglobin (ΔO_2Hb) at: (a) the right and (b) the left trapezius muscle. AUC: area under the curve. MAX 1~MAX 3: the trapezius muscles contract with maximum effort for 1 min. Relax 1~Relax 3: the trapezius muscles relax for 2 min. Values are presented as mean, SE. †, different from the ΔO_2Hb first rest ($p < 0.01$). *, different from the ΔO_2Hb of the control group ($p < 0.05$).

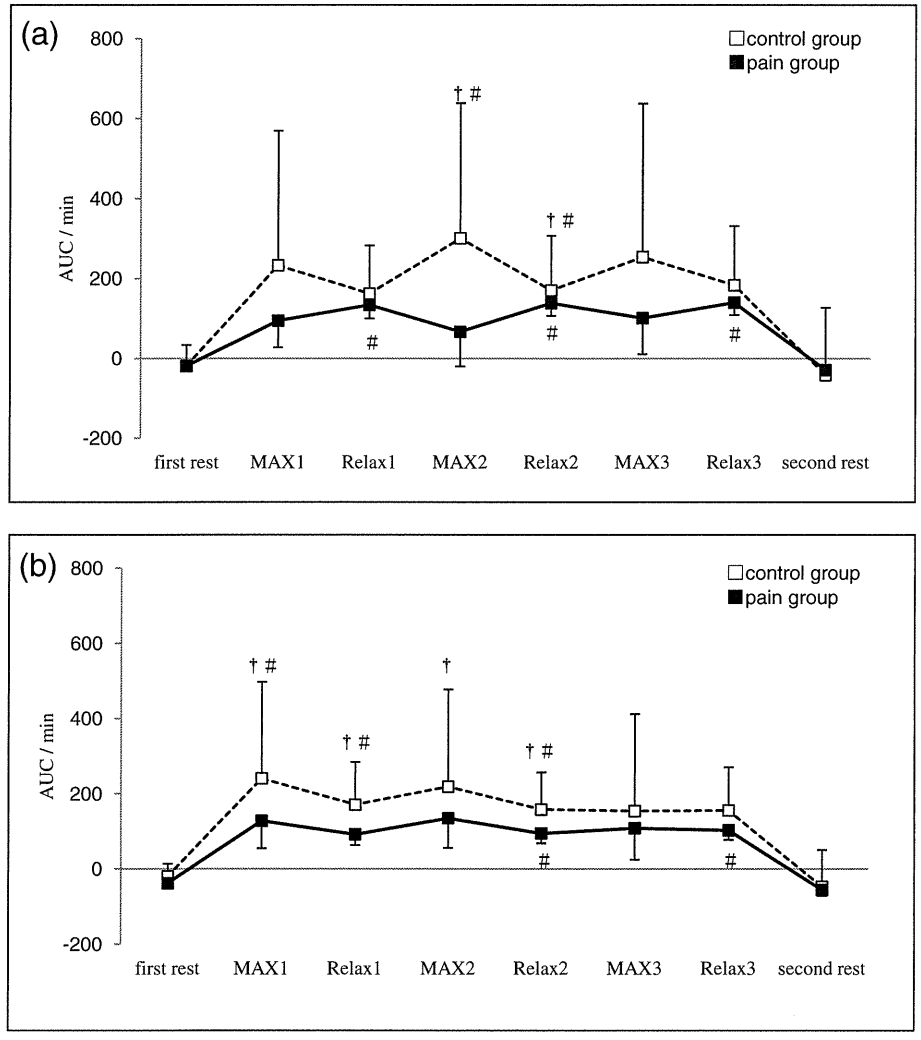

Figure 2 Change in deoxyhemoglobin (ΔHHb) at: (a) the right and (b) the left trapezius muscle. AUC: area under the curve. MAX 1~MAX 3: the trapezius muscles contract with maximum effort for 1 min. Relax 1~Relax 3: the trapezius muscles relax for 2 min . Values are presented as mean, SE. †, different from the ΔHHb first rest ($p < 0.01$). #, different from the ΔHHb second rest ($p < 0.05$).

sets of isometric exercise, the participants were observed for another 5 minutes while sitting (the second rest).

For data evaluation, the areas under the curve (AUC) of NIRS values and LF/HF ratio were measured for the first rest period, each of three sets of MAX and Relax period, and the second rest period [16]. Data were presented as mean (SE). Data were analyzed using Mann–Whitney test or Friedman test, where appropriate. After Friedman test for repeated measure analysis, *post hoc* multiple comparison tests were performed with Tukey. A p value < 0.05 was considered statistically significant.

Results

There were no significant differences in age, height, and weight between the two groups (Table 1). NDI was higher in the pain group than in the control group (Table 1).

ΔO_2Hb significantly decreased during each MAX period compared with the first rest period, and recovered to the level of the first rest period during each Relax period in both groups. However, ΔO_2Hb in the pain group was lower during Relax 3 and second rest periods compared with the control group (Figure 1). ΔHHb significantly increased during isometric exercise period compared with the first rest period and the second rest period in both groups, with no significant difference between groups (Figure 2). ΔTHb in the pain group was lower during Relax 2 and Relax 3 periods at the right trapezius muscle and each Relax and second rest periods at the left trapezius muscle compared with the control group (Figure 3). The LF/HF ratio significantly increased during the first and second

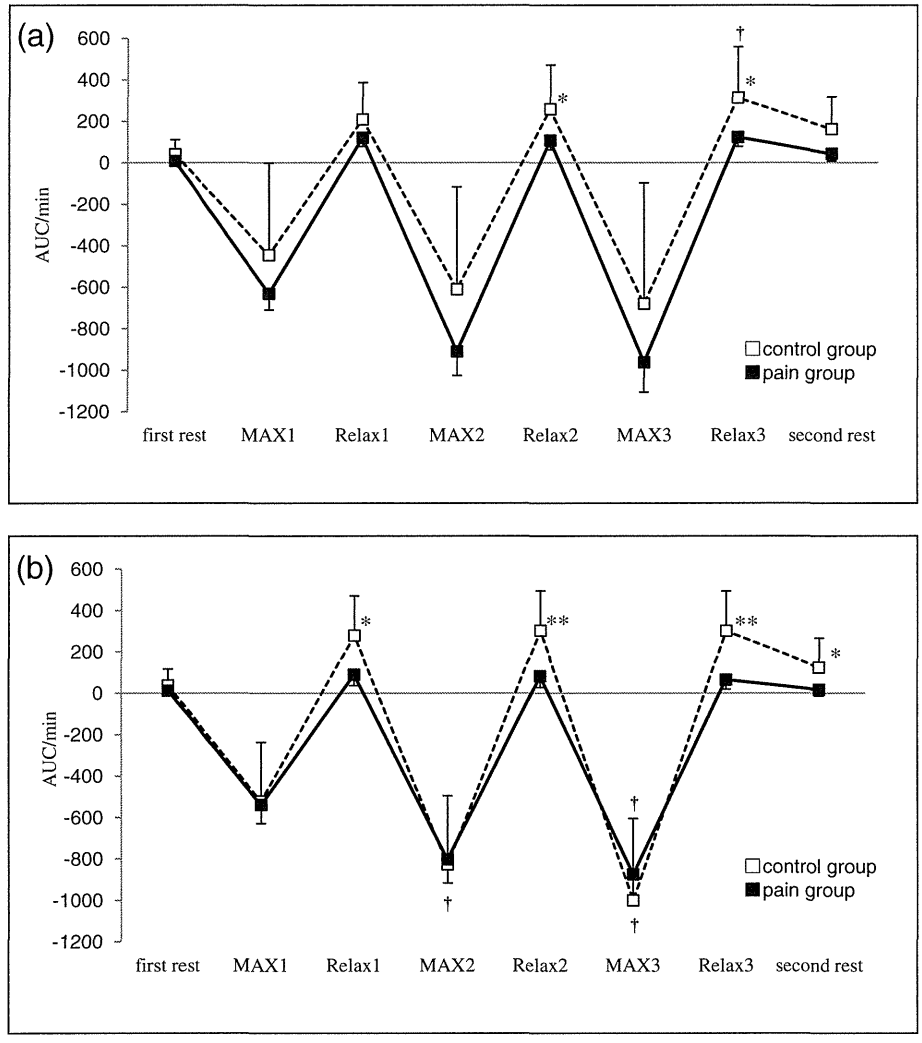

Figure 3 Change in total hemoglobin (ΔTHb) at: (a) the right and (b) the left trapezius muscle. AUC: area under the curve. MAX 1~MAX 3: the trapezius muscles contract with maximum effort for 1 min. Relax 1~Relax 3: the trapezius muscles relax for 2 min. Values are presented as mean, SE. †, different from the ΔTHb first rest ($p < 0.05$). *, **, different from the ΔTHb of the control group ($p < 0.05$, $p < 0.01$).

MAX periods compared with the first rest period in the control group. In contrast, the pain group induced no significant changes in the LF/HF ratio of HRV responding to isometric exercise. Furthermore, the LF/HF ratio in the pain group was lower during MAX and Relax period compared with the control group (Figure 4).

Discussion

This study showed that ΔO_2Hb significantly decreased during each MAX period, but ΔHHb significantly increased during isometric exercise period in both groups, with no significant difference between the groups. ΔO_2Hb in the pain group was lower during Relax 3 and second rest period and ΔTHb in the pain group was lower during each Relax period compared with the control group. Although the LF/HF ratio of HRV significantly increased after isometric exercise in the control group, there were no significant changes in the pain group.

In the present study, ΔO_2Hb and ΔTHb in the pain group were lower during Relax period compared with those of the control group. Subjects with neck pain and low back pain exhibited a reduced aerobic capacity of the trapezius and erector spinate muscles [17,18]. If the aerobic capacity of the muscle is impaired, the recovery time of muscle oxygenation is prolonged [18]. We thus postulated that in the present study subjects with chronic neck and shoulder pain had reduced aerobic capacity of the trapezius muscles, thereby leading to an insufficient recovery of oxygenation of the muscles during each Relax period.

Chronic neck and shoulder pain is believed to develop in response to prolonged muscle activity causing metabolic disturbances. A previous study showed that

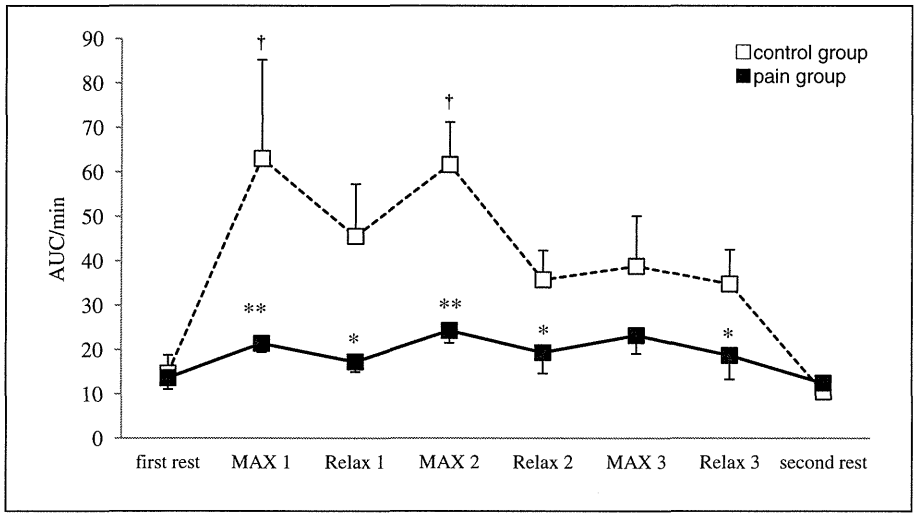

Figure 4 Change in the LF/HF ratio of heart rate variability. AUC: area under the curve. MAX 1~MAX 3: the trapezius muscles contract with maximum effort for 1 min. Relax 1~Relax 3: the trapezius muscles relax for 2 min . Values are presented as mean, SE. †, different from the LF/HF ratio first rest ($p < 0.01$). *, **, different from the LF/HF ratio of the control group ($p < 0.05$, $p < 0.01$).

chronic neck pain increased amplitude of the root mean squared electromyography (rms-EMG) of trapezius muscles during muscle contraction and rest as well, which would indicate increased basic muscle tension secondary to the impaired muscle microcirculation [19]. However, shoulder and neck pain occur commonly during work involving very low levels of muscle activity. Also the low level contraction like the work task increased the trapezius muscle blood flux [3,9]. Furthermore, subjects with neck pain did not differ from the healthy subjects in the EMG levels of the trapezius muscles during the work task [3]. Therefore, muscle activity and the relation of oxygenation are not clear with chronic neck and shoulder pain.

On the other hand, the blood flow in the exercising muscle is regulated by not only the activity of the somatic but also sympathetic nervous system [10,20]. An increase in sympathetic nerve activity exerts extrinsic control over the skeletal muscle vasculature, through the release of norepinephrine to cause vasoconstriction [10,21]. Simultaneously, increased somatomotor nerve activity causes contraction of skeletal muscle fibers, thereby relaxing vascular smooth muscle cells to increase capillary perfusion and vascular conductance [10]. In addition, the ability of arterioles to surpass sympathetic vasoconstriction is enhanced in contracting muscles with 'functional sympatholysis' promoting an increase in blood flow to active muscle fibers [10,21,22]. Moreover, sympathetic cholinergic nerve contributes to increased muscle blood flow at the onset of static exercise in cats [23]. The existence of the sympathetic cholinergic mechanism in humans has been suggested, because emotional stress increases skeletal muscle blood flow, and the increase in skeletal muscle blood flow is blocked by either atropine or sympathectomy [23]. However, several studies showed that the abnormality in the sympathetic nervous system might generate and sustain chronic pain [11,24].

In the present study, subjects with neck and shoulder pain induced no significant changes in the LF/HF ratio of HRV responding to isometric exercise. Hence, the sympathetic nervous system of the subjects with neck and shoulder pain was an abnormality. We therefore believe that insufficient muscle blood flow and oxygenation of the trapezius muscles might derive from the lower sympathetic nerve response during isometric exercise among subjects with neck and shoulder pain compared with asymptomatic subjects.

Jinbo et al. measured the recovery time of trapezius muscle oxygenation in subjects with neck pain after performing one set of isometric exercise and they found that the recovery time was prolonged [18]. However, we did not find a prolonged recovery time in a pilot study using one set of isometric exercise. Static and high repetitive work tasks have been identified as a risk factor for work-related trapezius myalgia [25,26]. And a previous study reported increased intramuscular lactate and glutamate in the trapezius muscle responding to repetitive work [8]. Also, oxyhemoglobin of the trapezius muscle decreased during repeated work in subjects with and without trapezius myalgia, but only subjects without myalgia recovered back to the baseline level during a subsequent recovery period. In contrast, no such recovery occurred in subjects with myalgia [7]. We thus postulated that repeated isometric contraction of the trapezius muscles could easily influence muscle

oxygenation especially in subjects with chronic neck and shoulder pain, and thereby we used a muscle load task with three-time repeated isometric exercises in the present study.

There is a limitation to present study. We did not measure EMG with trapezius muscles. We need an evaluation of the relation between trapezius muscle activity and oxygenation.

Conclusion

ΔO_2Hb and ΔTHb in subjects with neck and shoulder pain were lower during each Relax period compared with those of the control group. Furthermore, the subjects with neck and shoulder pain induced no significant changes in the LF/HF ratio of HRV responding to isometric exercise.

Competing interests

The authors declare that they have no competing interests.

Authors' contribution

YS conceived of the study, participated in its study, and conducted all experiments. YPA, TM and SI conducted the acquisition of data and performed the statistical analysis. YAP and TU helped to draft the manuscript. All authors read and approved the final manuscript.

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Author details

[1]Department of Physical Therapy, Faculty of Rehabilitation Science, Nagoya Gakuin University, Seto, Japan. [2]Multidisciplinary Pain Centre, Aichi Medical University, School of Medicine, Nagakute, Japan. [3]Department of Rehabilitation, Faculty of Health Sciences, Nihon Fukushi University, Handa, Japan. [4]Department of Rehabilitation, Meitou Hosipital, Nagoya, Japan.

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エルボーバンドによる上腕骨外側上顆炎の治療成績 —アンケート調査—

西塚隆伸*，平田　仁*，中尾悦宏**，中村蓼吾**，髙橋明子**，岩月克之*

上腕骨外側上顆炎の治療は多岐に渡っているが決定的な治療は無い．今回著者らはアンケート調査により，上腕骨外側上顆炎の治療実態及びエルボーバンドの有効性を検討した．対象は2008～2010年の間に本疾患にてバンドを処方された158人中，アンケートの返信があった53人で，主なアンケート項目は，年齢，職業，性別，発症原因，施行された治療，バンドの装着様式と全装着期間，予後などである．集計後，難治化の原因を特定する為，患者を完治群と非完治群に分け，それらを従属変数，その他の項目を独立変数として，カイ二乗検定およびロジスティック回帰分析を施行した．結果，15か月後の完治率は44％と低く，難治症例は20％以上存在した．バンドは，装着コンプライアンスが不良である一方，効果を実感している患者も30％ほど存在した．統計学的検討の結果，ステロイド注射歴，発症原因，年齢，性別等は予後に影響していなかったが，一日の中でバンドを常時装着していた患者は完治率が高い傾向にあった．

【緒　言】

上腕骨外側上顆炎は近年，短橈側手根伸筋（ECRB）の上腕骨付着部における腱付着部症（enthesopathy）が病態の主体とされているが[1]，未だ不明な点も多く，治療法に関しても，NSAIDs内服投与，湿布，ステロイド局所注射，針灸，レーザー，理学療法（マッサージ，ストレッチ，筋力増強訓練），超音波，対外衝撃波，ギプス固定，エルボーバンド，手術的治療など多岐に渡るが，決定的な治療は無い[2)3)4)]．今回著者らはエルボーバンドの処方患者リストをもとに上腕骨外側上顆炎患者にアンケートを送付し，上腕骨外側上顆炎治療の実態調査を行うと共に，上腕骨外側上顆炎におけるエルボーバンドの有効性を統計学的に検討した．

【対象と方法】

対象は2008～2010年の間に我々の病院を受診し「上腕骨外側上顆炎」にてエルボーバンド（アルケア社，テニスエルボーサポーター）を処方された158人中，アンケートの返信があった53人で，年齢は32～78平均58.3歳，平均経過観察期間は15.3か月であった．この間エルボーバンドは，「治療法の説明を聞いた後に，患者が処方を希望された場合」にのみ処方された．主なアンケート項目は，年齢，職業，性別に加え，発症原因，エルボーバンドに併用された治療，一日の中でエルボーバンドを装着していた時間帯と全装着期間，そして最終治療成績などである．アンケート集計後，難治化の原因を特定するため，患者を完治群と非完治群に分け，それらを従属変数，また，性別，重労働，発症原因の負荷強度，一日の中でエルボーバンドを装着していた時間帯，全装着期間，対側肢の症状の有無，腱鞘炎の有無，肩こりの有無，ステロイド注射歴，ストレッチ歴などを独立変数としてカイ二乗検定などの単変量解析を行い，傾向があったものを，ロジスティック回帰分析で解析した．P値が0.05未満を有意な差とした．

【結　果】

発症原因としては，ゴルフや草むしりが多かったが，パソコンなどの弱負荷作業が40％存在した．また発症原因の負荷強度と完治率の間に関連はなく，家事などの弱負荷でも完治率は良くない結果となった（図1）．エルボーバンドに併用された各治療法の人数は，湿布治療が最多で，以下はストレッチ，ステロイド局所注射，NSAIDS内服，理学療法

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*名古屋大学　手外科　〒466-8550　愛知県名古屋市昭和区鶴舞町65
**中日病院名古屋手の外科センター　整形外科

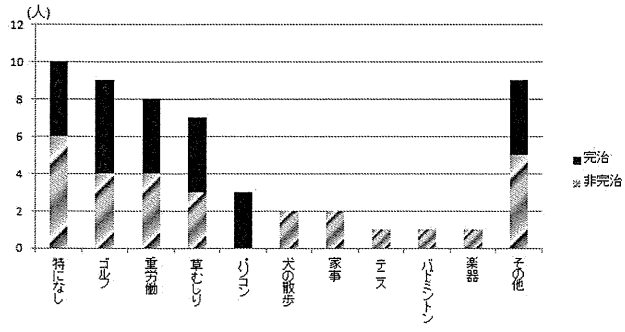

図 1　上腕骨外側上顆炎の発症原因

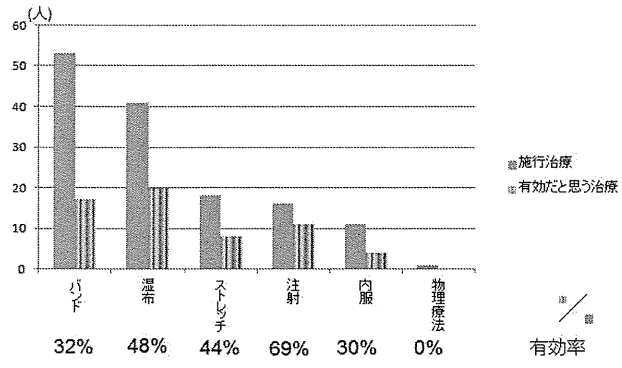

図 2　実施された治療および有効だと患者が思う治療（複数回答可）

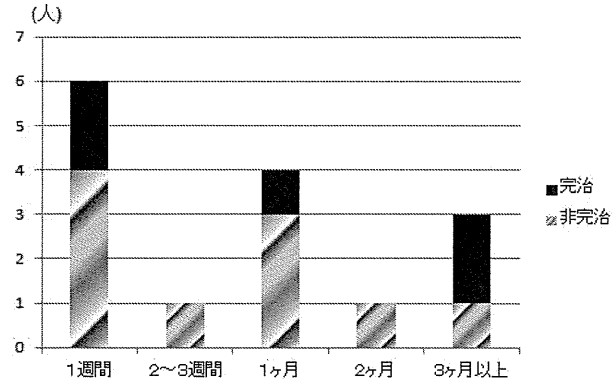

図 3　一回のステロイド注射の効果持続期間

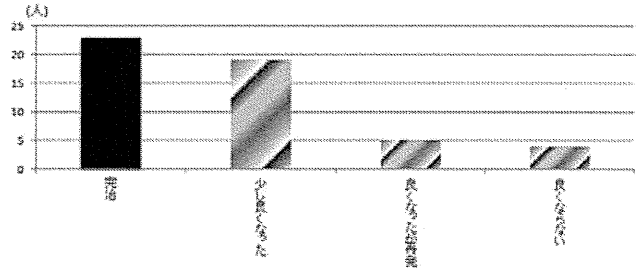

図 4　最終治療成績

の順であったが，その中で，有効であると患者が感じた割合は，ステロイド局所注射（ベタメタゾン 2mg と 1%リドカイン 2ml）が 69%と最高で，その他の治療法はエルボーバンドを含め，どれも 30～40%台であった（図 2）．注射療法は「効いている」という実感は強いものの，実際には全体の 40%の患者が 1 週間で，さらには全体の 70%が 1 か月で効果が切れており，過去の報告[5]と同様の結果となった（図 3）．次に，対側肢の同症状の有無であるが，これは 12 人（22%）に認められた．同じ上肢で痛かった部位は，頚部や肩が 7 人（14%），手指や手関節が 11 人（22%）と多く，その中で腱鞘炎患者が 6 人存在した．平均 15 か月後の最終経過観察時には，完治した患者は 44%であった．「再発した」や「良くならない」など，難治性といえる患者が合計 22%存在した（図 4）．エルボーバンドの装着状況であるが，80%の患者は「仕事やスポーツの時のみ時間限定で装着している」という状況であり，常時装着していた患者は 20%に留まった（図 5）．バンドの全装着期間つまりコンプライアンスであるが，26%が直ちに，60%が 2 か月までに辞めており，直ちに辞めている患者の 86%は，完治していないにも関わらず「痛い，面倒，効かない」などの理由で辞めてしまっていた（図 6）．統計解析の結果であるが，カイ二乗検定では性別，対側肢の症状の有無，肩こりの有無，注射歴などは完治率に影響していなかったものの，重労働者は完治率が低い傾向にあり（P 値 0.09），バンド常時装着者は完治率が高い傾向にあった（P 値 0.06）（表 1）．また，続いて施行したロジステッィク回帰分析では，バンド常時装着者の完治率が高い傾向があるのみであった（P 値 0.07）．

【考　察】

今回，対側肢の症状を全体の 22%の患者に，また，首から肩にかけての痛みを全体の 14%の患者に，手指や手関節の痛みを全体の 22%の患者に認めた．この事に関して，Fernandez ら[6]は「上腕骨外側上顆炎患者のうち，幾らかには central sensitization が起こり筋肉の痛みが発生しやすい状態にある」と

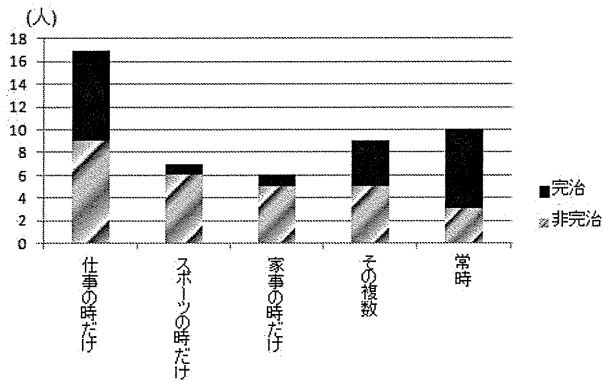

図5 エルボーバンドの装着様式

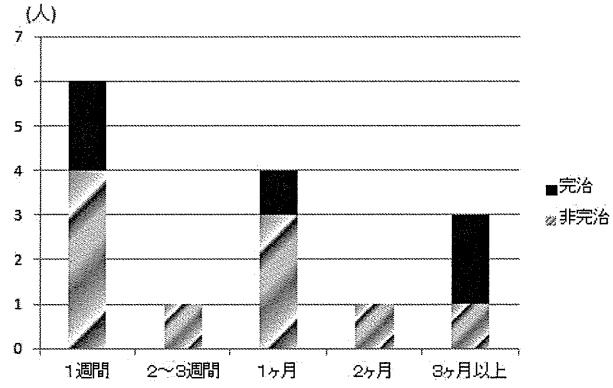

図6 エルボーバンドの装着期間

表1 カイ二乗検定及びロジスティック回帰分析の結果

	カイ二乗検定		
	オッズ比	95%信頼区間	P値
性別(女、男)	1.329	0.43-4.03	0.61
仕事(重労働、非重労働)	0.182	0.20-1.63	0.09
発症負荷(強負荷、弱負荷)	1.19	0.39-3.59	0.75
バンド装着(常時、非常時)	3.846	0.97-15.20	0.06
バンド装着期間(二か月以下、以上)	0.6	0.19-1.86	0.37
対側肢の症状(有、無)	0.35	0.08-1.48	0.14
手指腱鞘炎症状(有、無)	0.313	0.05-1.67	0.16
肩こり(有、無)	0.6	0.13-2.71	0.5
ステロイド注射歴(有、無)	0.706	0.21-2.34	0.56
ストレッチ治療歴(有、無)	1.19	0.39-3.59	0.75
	ロジスティック回帰分析		
			P値
仕事(重労働)			0.283
バンド装着(常時)			0.075

述べている．肘が痛い為，肩や手指の動きで代償し，その結果，それらの部位にも疼痛が発生しているということも考えられる．今後さらに検討していきたいと考えている．

治療の有効性に関する過去の論文では，短期的にはステロイド注射が有効であるものの，6か月以上の長期では，経過観察のみ群と大きく変わる治療法はなく，ストレッチや筋力トレーニングがわずかに優れているだけという報告がある[7]．今回の著者らの調査でも注射は大半が2か月以内の効果に留まっており，長期にわたり有効な治療というのはその他の中でも存在しなかった．

今回のアンケートでは，バンドは「痛い，面倒，効かない」などの理由から装着コンプライアンスが良くない事が分かったが，一方で，32%の患者には「効いている」という実感があり，「一日中，常時装着すると完治率が高い」という傾向が統計学的にも認められた．2007年の月村ら[8]の報告でも，手関節装具ではあるが「一日の中で6時間以上装着していた群が6時間以下の群に比べ最終時の痛みのVAS値が有意に低かったとしている．バンドがどのような患者に対し有効であるかについては，Walther[9]らは「エルボーバンドは外上顆への加速振幅と加速度の積分値を減少させるので，テニス，ゴルフなどには有効であるが，弱負荷作業には適していない」と述べており，月村ら[10]は「弱負荷発症の外上顆炎にはエルボーバンドよりも中指伸展制限付き手関節装具の方が効果ある」と報告している．今回の研究では，発症原因の負荷強度による完治率の差は認められなかったが，今後はエルボーバンド使用群と対照群を比較するrondomized controlled trialを行い，バンドの有効性をより詳細に検討すると共に，どのような患者に対しバンドが有効であるのかも検討していきたい．

【まとめ】

・エルボーバンド処方患者にて，上腕骨外側上顆炎の治療の実態を調査した．

・短期的には注射治療が効果的であったが，長期的には完治率が有意に高い治療は認められなかった．上腕骨外側上顆炎の15か月後の完治率は44%と低く，難治症例は20%以上存在した．

・エルボーバンドは，装着コンプライアンスが不良である一方，効果を実感している患者も30%ほど存在し，一日の中で常時装着している患者は完治率が高い傾向にあった．

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心身相関医学の最新知識

Psychosomatic Medicine

久保木富房・久保千春・野村 忍
不安・抑うつ臨床研究会 編

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慢性の痛み愁訴における失感情症の役割

――罹患リスクと心身医学的治療対象の観点から――

細井昌子
Masako Hosoi／九州大学病院心療内科

柴田舞欧
Mao Shibata／九州大学病院心療内科

安野広三
Kozo Anno／九州大学大学院医学研究院心身医学

牧野聖子
Seiko Makino／九州大学病院心療内科

二宮利治
Toshiharu Ninomiya／九州大学大学院医学研究院環境医学

有村達之
Tatsuyuki Arimura／九州ルーテル学院大学

河田 浩
Hiroshi Kawada／九州大学病院心療内科

清原 裕
Yutaka Kiyohara／九州大学大学院医学研究院環境医学教授

久保千春
Chiharu Kubo／九州大学病院病院長

須藤信行
Nobuyuki Sudo／九州大学病院心療内科教授

心身症の中核概念である失感情症は、自らの気持ちを言葉で表現しにくい心理特性であり、多彩な痛み関連疾患における痛み関連アウトカムと相関していることが国際的研究で知られている。しかし、失感情症が一般住民における痛み愁訴に対して与える影響については、これまで注目されてこなかった。

本稿では、福岡県久山町における40歳以上の住民を対象にした定期健診のなかで実施したストレス健診で、一般住民に対する慢性疼痛の疫学研究を行った結果を報告する。失感情症や生活満足度に注目して分析した結果、失感情症は慢性の痛み愁訴の罹患リスクを約2倍から3倍に増大し、慢性疼痛および失感情症の合併で一般住民の生活満足度が低下していた。さらに、心身医学および心療内科の専門医に対するアンケート結果、および九州大学病院心療内科外来および入院治療における慢性疼痛の実態から、慢性の痛み愁訴においては、失感情症が心身医学的治療対象として重要となっている状況を報告する。そして、実際の心身医療において慢性疼痛患者が言葉にならない思いとして抱いている否定的感情や愛着障害の様相について、臨床経験からの考察を提示し、慢性疼痛領域における心身相関医学の重要性を喚起する。

はじめに

慢性疼痛に影響を与えているとされる心理特性として、1973年にSifneosが提唱した失感情症（Alexithymia）という概念がある（Taylor, Bagby, Parker（1997）；安野、細井、柴田、船越、有村、久保、須藤（2010））。自らの感情についての気づきが乏しい傾向であり、感情がないのではなく、感情を表す言葉を発せないという意味で、失感情言語症という日本語の方が適切であるともいえる概念であ

る。この失感情症は、いわゆる慢性疼痛、疼痛性障害、頭痛、顎関節症、舌痛症、癌、全身性エリテマトーデス、線維筋痛症、腰背部痛、関節リウマチ、脊柱管狭窄症、神経筋疾患など、多彩な痛みや痛み関連アウトカムとの関連が国際的に知られている（Hosoi, Molton, Jensen, Ehde, Amtmann, O'Brien, Arimura, Kubo (2010)）ものの、日本における慢性疼痛医療のなかでは注目されてこなかった現状がある。

一方、失感情症が心身症一般と関連があることは古くより経験的に知られてきた（Taylor, et al (1997)）。痛覚との関連について、近年急速に発達した脳画像研究からのエビデンスをあらためて見直してみると、人で侵害刺激により活性化されている脳部位のなかで、痛覚の情動成分と関連するといわれている前部帯状回、島皮質、扁桃体や痛覚認知に関与している前頭前野（Lieberman & Eisenberger (2009)）に、複数の研究で失感情症傾向が強い人における異常が報告されている（守口 (2011)）。図1に痛覚伝導の上行路（痛みの識別を行う感覚系と痛みの不快感を伝える感情系）と下行性疼痛抑制系および失感情症で異常が報告されている脳部位を重ねて示した。このエビデンスをかんがみると、いわゆる心因性疼痛に失感情症が関係しているというよりも、侵害刺激を伴う身体疾患の痛み一般にもあまねく失感情症が影響を与えていると考えられる。したがって、古くより知られてきた失感情症という概念の疼痛領域における重要性が、近年の脳画像研究の進歩に伴い、論理性を持って理解される事態になってきているといえる。

以上の知見より、心身症患者においてのみ失感情症傾向が慢性疼痛に影響を与えているのではなく、一般住民においても同様の傾向がある可能性が出てくる。しかし、一般住民を対象にして、失感情症傾向が慢性疼痛の罹患リスクへ与える影響を調べた研究について、過去の報告は見当たらない。

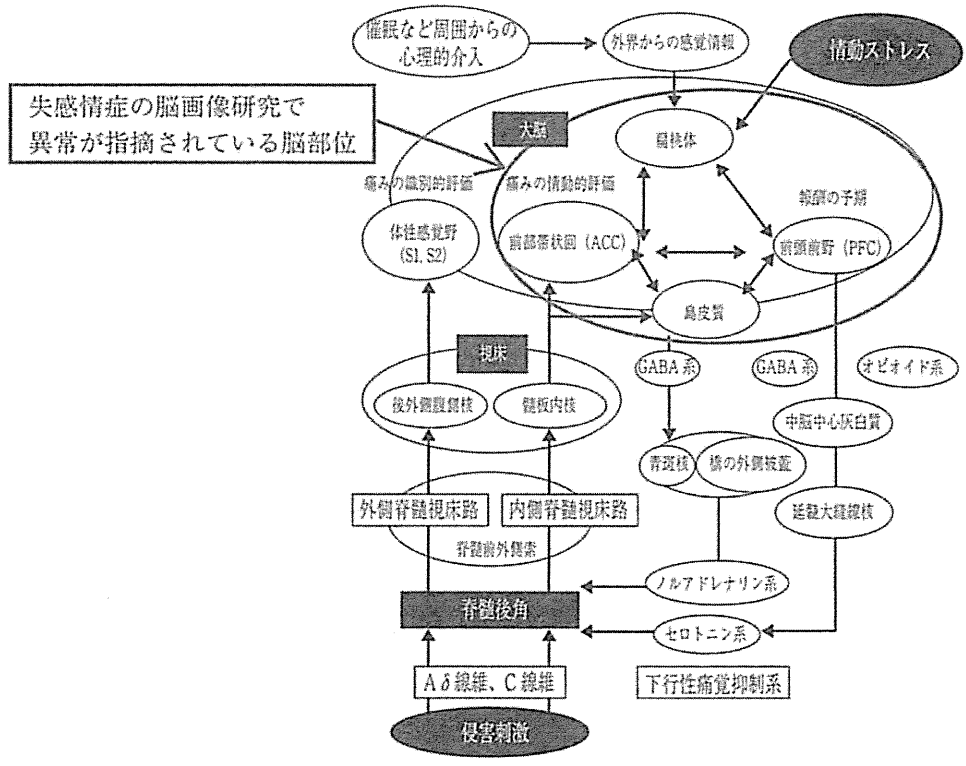

図１　痛覚伝導路、下行性痛覚抑制系と失感情症で異常が報告されている脳部位

そこで、われわれは、1961年より約半世紀の疫学研究の歴史がある福岡県久山町疫学フィールドにおいて、①一般住民において、失感情症傾向が慢性疼痛の罹患リスクを増大するかという仮説を検討した。さらに、もし罹患リスクが増大するならば、②失感情症や慢性疼痛は、一般住民の生活の質（QOL）に影響を与えているかについて、さらに解析を行ったため、その結果を報告する。

それに加えて、痛みの臨床で遷延化し難治化した症例が、整形外科、内科、神経内科、および麻酔科ペインクリニックなどを経て、最終的に心療内科に紹介されて心身医学専門家あるいは心療内科医が診療している状況を、日本心身医学会および日本心療内科学会の専門医に対して行ったアンケート結果を通して解析した。

本稿では、一般住民に対する慢性疼痛の疫学研究、専門医に対する

アンケート結果、および九州大学病院心療内科外来および入院治療における慢性疼痛の実態から、慢性の痛み愁訴における失感情症の役割について考察する。そして、実際の心身医療において慢性疼痛患者が言葉にならない思いとして抱いている否定的感情や愛着障害について、臨床経験からの考察を提示する。

一般住民における慢性疼痛の疫学

●久山町疫学研究における慢性疼痛と失感情症研究

2010年6月から8月の福岡県久山町の定期健診の際に、九州大学病院心療内科および九州大学大学院医学研究院心身医学の担当するストレス健診を希望した40歳以上の一般住民1020名のうち、タッチパネル式コンピューターでの質問を途中でやめた32名およびデータの欠損がある72名を除外した916名を解析対象とした。

この研究のために独自で開発したタッチパネル式コンピューターソフトを使用し、以下の項目について回答を得た。

①年齢、性別、婚姻状況、教育年数、主観的経済状況
②痛みの有無および6カ月以上続く慢性疼痛の有無
③最も強い痛みの部位
④痛みの強さ（Visual Analogue Scale；VAS, mm）
⑤日常生活障害（VAS, mm）
⑥生活満足度（VAS, mm）
⑦失感情症 TAS-20（20-item Toronto Alexithymia Scale）→61点以上を失感情症ありと評価。
⑧抑うつ・不安（Symptom Checklist-90-Revised；SCL-90-R）

（倫理面への配慮）

わが国の疫学研究に関する倫理指針および臨床研究に関する倫理指

表1　ストレス健診参加者の特徴

	痛みなし群 $n=310$	急性疼痛群 $n=166$	慢性疼痛群 $n=440$
平均年齢（歳）	61	60	62
性別（女性）	58.4%	75.3%**	65.9%*
婚姻状況（同棲・既婚）	80.3%	82.5%	82.5%
教育年数（9年以下）	15.2%	16.9%	17.1%
経済状況（やや厳しい～とても厳しい）	17.7%	22.9%	20.5%
失感情症総点（範囲0～100点）	45.8	49.6**	48.8**
失感情症（有り）	4.5%	9.6%*	12.7%**
抑うつ（範囲0～4点）	0.54	0.69**	0.85**
不安（範囲0～4点）	0.30	0.40**	0.50**
痛みの強さ（範囲0～100点）	0	28**	42**
日常生活障害（範囲0～100点）	0	5**	10**

*$p<0.05$、**$p<0.01$ vs. 痛みなし群
年齢、失感情症総点は平均値を、抑うつ、不安、痛みの強さ、生活障害は中央値を表示

針に沿って、九州大学倫理委員会の許諾を受け、研究を施行し、倫理面への配慮を行った。

●久山町疫学研究結果

(1) ストレス検診参加者の疼痛の有無と持続期間による分類

916人（男性320人、女性596人）の結果が得られた。健診当日に、痛みがない群（痛みなし群）、6カ月以内の痛みがある群（急性疼痛群）、6カ月以上の痛みがある群（慢性疼痛群）の3群に分類し、表1に参加者の特徴について示した。

各群のストレス検診を受けた全体の割合は、痛みなし群で全体の33.9%、急性疼痛群18.1%で、慢性疼痛群48.0%となっていた。

ストレス検診を受けた3群についての比較では、急性疼痛群と慢性疼痛群では女性の割合がそれぞれ75.3%、65.9%となっており、痛みなし群の58.4%よりも有意に多かった。TAS-20で測定した失感情症の総点も、痛みなし群と比較して、急性疼痛群と慢性疼痛群で有