

## Diminished skin vasodilator response to local heating in patients with long-standing subacute myelo-optico-neuropathy

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### Abstract

**Background:** Local heating of non-glabrous skin increases skin blood flow (SkBF) in two phases: the initial peak (P1) is mediated by sensory axon reflex, and the plateau phase (P2) is thought to be mediated by local production of substances including nitric oxide. We evaluated P1 and P2 responses in subacute myelo-optico-neuropathy (SMON).

**Methods:** SkBF response to local heating from 32 °C (5 min of baseline) to 42 °C (at least for 30 min) of the dorsal surface of the hand skin were measured in 7 SMON patients (67.6±10.0 years) and 7 normal control volunteers (65.0±7.4 years) participated.

**Results:** Mean values of SkBF at P1 (SkBFP1) and SkBF during P2 (SkBFP2) were significantly lower in SMON patients than in controls ( $p<0.05$ ,  $p<0.05$ ). Mean SkBFP1/SkBF at baseline (SkBFbase) and SkBFP2/SkBFbase ratios were significantly lower in SMON patients than in controls ( $p<0.01$  and  $p<0.05$ , respectively).

**Conclusions:** The SkBF response to local heating was diminished in SMON patients. This may reflect the involvement of the spinal cord, peripheral sensory nerves, and sympathetic post-ganglionic nerves in SMON.

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**Keywords:** Subacute myelo-optico-neuropathy; SMON; Skin blood flow; Skin vasodilation; Autonomic disorder; Sympathetic function; Spinal cord

### 1. Introduction

Subacute myelo-optico-neuropathy (SMON) is caused by ingestion of clioquinol (5-chloro-7-iodo-8-hydroxyquinoline), which was widely used as an antibiotic for treating diarrhea and skin infection, although Clioquinol drugs are now banned in Japan and some countries, and restricted in many other countries. The first SMON cases were reported in Japan in the 1960s. Since then, patients have been diagnosed in a number of countries, although the numbers have been far fewer than in Japan [1–5].

The pathological features of SMON are symmetrical degeneration of long tracts of the spinal cord associated with polyneuropathy, which involves the peripheral autonomic

nervous system and optic nerves [6]. It is characterized by subacute onset of dysesthesia, sensory loss, a variable degree of motor weakness mainly in the lower body, and visual loss. The sensory symptoms, which are prominent in the distal part of the lower limbs, may extend to the trunk and upper limbs [1]. Many people are still suffering the sequelae of SMON. Most long-standing SMON patients complain of coldness of the limbs [7], which may be related to skin vasomotor dysfunction: the skin vasoconstrictor response is diminished in SMON patients [8]. There has been no report on vasodilator function in SMON patients. In addition to the vasoconstrictor function, the skin vasodilator response may be involved in SMON.

To the best of our knowledge, not many methods to evaluate the skin vasodilator function have been developed. Recently, Minson et al. reported that skin vasodilatation is evoked by non-painful local heating of non-glabrous skin, which consists of two phases: the primary phase (P1) is a fast response that reaches its peak in a few minutes and is

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followed by a brief nadir, and the secondary phase (P2) reaches a plateau in about 30 min [9]. P1 is suspected to be mediated by a sensory-axon reflex and P2 is thought to be mediated by local production of substances [9–11]. These responses may be useful for evaluating skin vasodilatation function in neurological disorders [12]. We examined the skin blood flow (SkBF) during local heating to evaluate the skin vasodilator function in SMON.

## 2. Subjects and methods

### 2.1. Subjects

We studied seven SMON patients (mean age  $67.6 \pm 10.0$  years; five males and two females) and seven age-matched normal controls (mean age  $65.0 \pm 7.4$  years; three males and four females). These patients had characteristic clinical manifestations according to the diagnostic guidelines for SMON published in 1971 [1]. Table 1 shows the characteristics of the SMON patients. The mean duration of

Table 1  
Clinical features of SMON patients

Patients	1	2	3	4	5	6	7	Average $\pm$ S.D.
Sex	M	M	M	M	M	F	F	
Age (year old)	73	65	70	84	69	59	53	$67.5 \pm 10.0$
Duration of illness (years)	34	36	37	42	37	39	35	$37.1 \pm 2.7$
Grade of severity <sup>a</sup>	2	2	2	2	4	4	2	$2.6 \pm 1.0$
Visual impairment	+	-	-	-	+	+	+	
Weakness (U/E) <sup>b</sup>	-	-	-	-	-	-	-	
Weakness (L/E) <sup>b</sup>	+	+	-	+	+	+	+	
Deep tendon reflex (U/E) <sup>c</sup>	↑	↑	↓	↓	+	↑	↑	
Deep tendon reflex (L/E) <sup>c</sup>	+	+	-	↓	↑	↑	↑	
Plantar reflex	-	-	-	+	+	+	+	
Superficial sensory loss (U/E)	+	-	-	+	-	-	-	
Superficial sensory loss (L/E)	+	+	+	+	+	+	+	
Romberg sign	+	+	-	+	+	+	+	
Urinary disturbance	+	+	-	-	+	+	+	
Orthostatic symptoms	-	-	-	-	-	-	-	
Blood pressure (mm Hg)	188/ 107	152/ 82	122/ 74	187/ 104	130/ 80	154/ 87	138/ 78	

<sup>a</sup> 1, extremely mild (only sensory disturbance); 2, mild (sensory disturbance in the lower limbs); 3, moderate (gait disturbance or moderate visual impairment); 4, severe (unable to walk or severe visual impairment); 5, extremely severe (confined to bed or complete blindness).

<sup>b</sup> U/E, upper limbs; L/E, lower limbs.

<sup>c</sup> ↑, brisk; +, normal; ↓, decreased; -, areflexia.

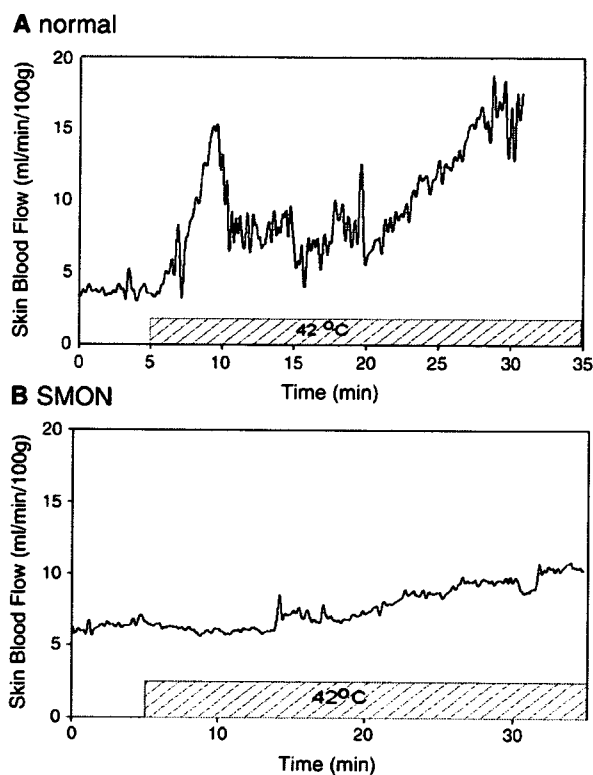


Fig. 1. Skin blood flow to local heating comprises two phases in normal subject (A), while P1 and P2 phases are diminished in SMON patient (B).

the disease was  $37.1 \pm 2.7$  years. The patients were classified in five levels according to severity: 1, extremely mild (only mild sensory disturbance); 2, mild (sensory disturbance in the lower limbs); 3, moderate (gait disturbance or moderate visual impairment); 4, severe (unable to walk or severe visual impairment); and 5, extremely severe (confined to bed or complete blindness). Of the 7 patients, 5 were classified as severe and 2 as moderate at onset. Two patients were classified as moderate and 5 as mild, when assessed for the experiment. All patients felt coldness of the lower limbs, and 2 patients complained of coldness of the upper limbs. Sensory loss of the lower limbs was seen in all patients, and that of the upper limbs in 2 patients. Four patients had hypertension, and 2 of them took antihypertensive drug (nifedipine 20 mg/day for one patient, and temocapril hydrochloride 2 mg/day for another). Three patients had glucose intolerance that well controlled only diet therapy.

The control subjects, all of whom were healthy, showed no signs or symptoms to indicate neurological disease and were not taking any medications. All participants gave their informed consent.

### 2.2. Measurement of skin vasodilator response to local heating

During the test, each subject lay on a table, relaxed but not asleep. The room temperature was maintained at 24–26 °C.

SkBF was recorded by laser Doppler flowmetry (ALF21D; Advance, Japan) using a laser Doppler probe on the central part of the dorsal surface of the right hand, keeping away from cutaneous vein. The contact region of the local heating unit has a doughnut shape (external diameter 13 mm, internal diameter 10 mm) and was placed around the laser Doppler probe (diameter 10 mm). The temperature of the heating unit was maintained at 32 °C for 5 min to obtain baseline SkBF ( $SkBF_{base}$ ). Then, the local temperature was increased to 42 °C and maintained at this level for at least 30 min. Fig. 1A shows the vasodilator response to local heating in a normal control subject, for whom the SkBF curve shows a biphasic pattern—an initial peak (P1) followed by a brief nadir and a plateau phase (P2). We measured  $SkBF_{base}$  and SkBF at P1 ( $SkBF_{P1}$ ), and SkBF at P2 ( $SkBF_{P2}$ ). In addition, the  $SkBF_{P1}/SkBF_{base}$  and  $SkBF_{P2}/SkBF_{base}$  ratios were calculated.

### 2.3. Data analysis

Data were analyzed using the statistical software STATISTICA for Windows Release 9 (StatSoft Inc., Tulsa, OK, USA). The Mann–Whitney *U* test was used to analyze the differences between SMON patients and controls. Differences were considered statistically significant for  $p < 0.05$ .

## 3. Results

No participants reported any sensation of pain during local heating. Fig. 1A shows the response to local heating in SMON patients. Mean  $SkBF_{base}$  did not differ between the SMON patients ( $6.1 \pm 3.2$  ml/min/100 g) and controls ( $6.0 \pm 4.7$  ml/min/100 g). Mean  $SkBF_{P1}$  was lower in the SMON patients ( $10.7 \pm 6.6$  ml/min/100 g) than in the controls ( $19.7 \pm 8.2$  ml/min/100 g,  $p < 0.05$ ). Mean  $SkBF_{P2}$  was lower in the SMON patients ( $14.6 \pm 7.16$  ml/min/100 g) than in the controls ( $25.3 \pm 8.49$  ml/min/100 g,  $p < 0.05$ ) (Fig. 2). Mean  $SkBF_{P1}/SkBF_{base}$  was significantly lower in the SMON

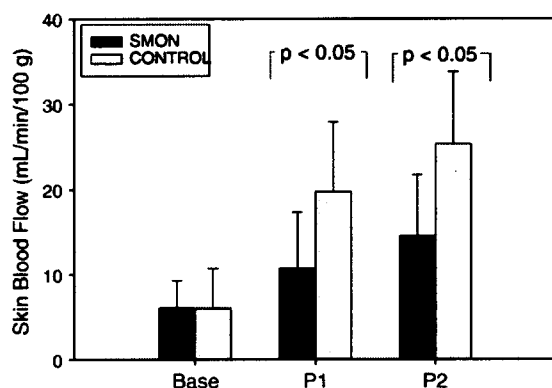


Fig. 2. Mean  $SkBF_{base}$  did not differ between SMON patients and controls. Mean  $SkBF_{P1}$  was lower in the SMON patients ( $10.7 \pm 6.57$  ml/min 100 g) than in the controls ( $19.7 \pm 8.17$  ml/min 100 g) ( $p < 0.05$ ). Mean  $SkBF_{P2}$  was lower in the SMON patients ( $14.6 \pm 7.16$  ml/min 100 g) than in the controls ( $25.3 \pm 8.49$  ml/min 100 g) ( $p < 0.05$ ).

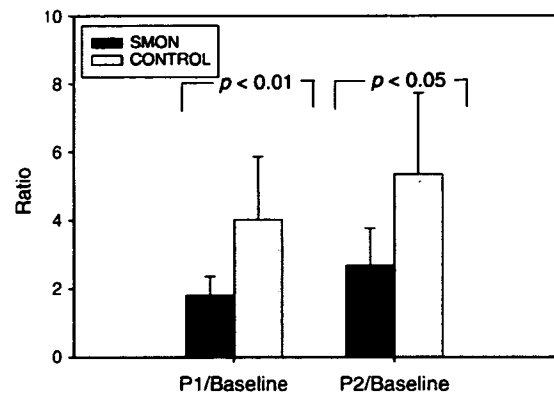


Fig. 3. Mean ratio of  $SkBF_{P1}/SkBF_{base}$  was significantly lower in the SMON patients ( $1.80 \pm 0.56$ ) than in the controls ( $4.03 \pm 1.82$ ) ( $p < 0.01$ ). Mean ratio of  $SkBF_{P2}/SkBF_{base}$  was lower in the SMON patients ( $2.68 \pm 1.08$ ) than in the controls ( $5.36 \pm 2.37$ ).

patients ( $1.80 \pm 0.56$ ) than in the controls ( $4.03 \pm 1.82$ ,  $p < 0.01$ ). Mean  $SkBF_{P2}/SkBF_{base}$  was significantly lower in the SMON patients ( $2.68 \pm 1.08$ ) than in the controls ( $5.36 \pm 2.37$ ,  $p < 0.05$ ) (Fig. 3).

## 4. Discussion

In this study, skin vasodilator responses to local heating were diminished at both P1 and P2 in SMON patients. The reduced P1 response indicates the involvement of sensory nerves in SMON, because the P1 response is thought to be mediated by sensory axon reflex [9–11]. Sensory symptoms are the predominant feature of SMON [1], and histopathological studies have shown vacuolar disruption in dorsal root ganglia neurons in the acute stage of the condition [6]. Even 32 years after the banning of clioquinol, sensory disorders persist in most patients with SMON (95.6–97.7%) [7]. Our SMON patients also showed sensory disturbance. It is possible that the diminished P1 response reflected involvement of peripheral sensory nerves in SMON. In our study, however, SkBF was measured in the hand, and five of our seven patients did not complain of sensory symptoms in the upper limbs. In a previous report [13], nerve conduction studies showed no commensurate abnormality with sensory disturbance in SMON, and degeneration of dorsal root ganglia neurons has been reported to be not severe in SMON [6]. It may therefore be difficult to demonstrate a diminished P1 phase with involvement of the peripheral sensory nerves only.

The spinal cord is one of the main sites of lesions in SMON [1]. With spinal cord injury, the skin vasodilator response to local heating is attenuated [12], and sensory axon reflex induced by histamine is diminished [14]. Although the underlying mechanism is unclear, disruption of the sympathetic spinal pathway may cause attenuation of the sensory axon reflex, which is modulated by sympathetic outflow [15]. In our study, a spinal cord lesion may be one of causes of the diminished P1 phase in SMON patients.

Degeneration of sympathetic ganglion cells has been seen in SMON [6]. Previous investigators reported that the P1 peak disappeared in patients after surgical sympathectomy [16]. They speculated that the P2 response was accelerated in sympathectomized skin, and that the amplified P2 response masked the normal P1. On the other hand, efferent activity in sympathetic neurons can regulate the release of transmitters from afferent nerve fibers and may modulate afferent nerve-mediated changes in skin microcirculation, and the activity of the sympathetic nerves influenced the sensory axon reflex [15]. Thus, the P1 peak may have been diminished in sympathectomized individuals, which may be reflected by a sympathetic post-ganglionic lesion in SMON.

The SkBF rise at P2, which is thought to be mediated by endothelial NO, was reduced in our SMON patients. The major vasodilator substances released from unmyelinated C fibers via sensory-axon reflex are calcitonin gene-related peptide (CGRP) and substance P [17,18]. These neuropeptides increase skin NO-release from skin microvascular endothelial cells [19–22]. Therefore, involvement of sensory axon-reflex may attenuate SkBF rise at P2 as well as P1. In addition to CGRP and substance P, acetylcholine also has a vasodilator effect, which increases both SkBF and NO [23]. Acetylcholine released from cholinergic nerves has been reported to contribute to skin vasodilation via NO mechanism [24]. SMON has polyneuropathy, which involves the peripheral autonomic nervous system [6]. Involvement of cholinergic peripheral nerves may have contributed to attenuation of SkBF response at P2 in our SMON patients.

We examine skin blood flow in the dorsal surface of the hand. The SkBF response should have been evaluated in the foot, because the coldness in SMON is usually more prominent in the foot. However, SkBF is low and unstable in the foot, compared with the hand, and it is not suitable for assessment even in normal controls. Our SMON patients did not have severe neurological symptoms and signs in the upper limbs (Table 1). However, their SkBF responses to local heating were diminished in the hand. Although we did not perform nerve conduction studies, our SMON patients, who had suffered from moderate to severe disabilities at the onset, may have had prominent neurological involvement in the hand. Our results indicate that recording SkBF response to local heating on the hand is useful for evaluating the skin vasodilator function, which may reflect involvement of the spinal cord, peripheral sensory nerves, and sympathetic post-ganglionic nerves in SMON.

In summary, our study showed that the skin vasodilator response to local heating was diminished in long-standing SMON patients. This reduced response may reflect involvement of the spinal cord, peripheral sensory nerves, and sympathetic post-ganglionic nerves in SMON.

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## 茨城県におけるスモン患者検診時の鍼、あんま・マッサージ施術の試み

筑波技術大学保健科学部保健学科鍼灸学専攻<sup>1)</sup> 同保健科学部附属東西医学統合医療センター<sup>2)</sup>木村友昭<sup>1)</sup> 大越教夫<sup>1)</sup> 中野智子<sup>2)</sup> 岩間かおる<sup>2)</sup> 古川聡子<sup>2)</sup>

要旨：茨城県在住のスモン患者の在宅検診時において、希望者に対する鍼、あんま・マッサージ施術を試みた。実施後のアンケート結果では、鍼施術体験者の100%（4人中4人）、あんま・マッサージ施術体験者の83%（6人中5人）が施術を受けて良かったと回答し、継続的な施術を希望していた。体験的施術の実施は、スモン患者の検診へのモチベーション維持、鍼灸、あんまマッサージの利用機会の拡大に有用であると考えられた。

キーワード：スモン、検診、鍼灸、あんま・マッサージ

## 1. はじめに

スモン（SMON, subacute myelo-optico-neuropathy）は、腹部症状（腹痛・下痢など）に続いて下肢（ことに遠位部）の感覚障害、運動障害をきたし、重症例では視力障害もみられる神経疾患である[1]。1960年代に多発し、原因となった整腸剤キノホルムの販売が中止された1970年以降は新規発症は無くなったといわれているが、その間の発病者は全国で12,000人以上と推定されている[1]。厚生労働省（厚生省）は、1960年代よりスモンに対する研究グループ（以下スモン研究班）を設置し、スモンの病態や治療法に関する研究を推進すると共に、スモン患者に対する定期検診を実施してその現状を把握している。

スモン研究班の平成17年度の報告書[2]によると、検診受診者944名の大部分が感覚障害を有しており、50%以上が独立歩行不可能で、10%弱が高度視覚障害をもつなど、深刻な後遺症が現在も続いていることが伺える。また、今後は患者の高齢化に伴う合併症等もあいまって、スモン患者へのケアは更に困難になるものと指摘されている。

スモン後遺症への対症的治療としては、ノイロトロピン等の薬剤、機能訓練に加え、鍼灸、マッサージ等の物理療法が試みられている[3]。このうち、鍼治療については、スモン研究班発足初期より有効性の検討が行われており、主として冷感や疼痛などに代表される感覚異常に対する治療法として効果が期待できることが報告された[4]。それをうけて、1978年よりスモン患者に対する鍼灸治療費の公的負担が実施されるようになった経緯がある[5]。

今回、我々は医師・鍼灸師・あんまマッサージ指圧師によるチームを編成し、スモン研究班のプロジェクトの一環として行われている茨城県在住のスモン患者の在宅検診時において、希望者に対する鍼治療およびあんまマッサージ施術を試みたのでその概要を報告する。

## 2. 実施方法

## 2.1 実施体制

実施に先立ち、筑波技術大学保健科学部保健学科の教員2名と同東西医学統合医療センター研修生3名の計5名（医師1名、鍼灸師2名、あんまマッサージ指圧師2名）でチームを編成した。

## 2.2 実施日

平成18年10月29日（日曜日）

## 2.3 実施対象

スモン研究班の定期検診に参加している茨城県在住の患者のうち、今回の鍼灸・あんまマッサージ施術体験の趣旨を理解し、希望した者計6名を対象とした。なお、鍼灸とあんまマッサージ施術の希望は別個に確認した。

## 2.4 実施場所

対象患者全員との事前打ち合わせの結果、龍ヶ崎市とひたちなか市の患者宅2箇所を決定し、実施日に集合してもらうこととした。

## 2.5 施術

検診終了後、希望者から主訴を聴取し、順次施術を行った。鍼灸治療、あんまマッサージ治療ともに20分を目安とし、施術手技もドーズ過多とならないように配慮した。

## 2.6 実施後アンケート

鍼灸・あんまマッサージ施術を受けた患者に対し、後日郵送にてアンケート用紙を配布し、回答していただいた。アンケートは、

- 1) これまで鍼灸治療を受けたことはありましたか。  
(はい・いいえ)
- 2) 今回鍼灸治療を受けてみて、どのように感じましたか。  
(よかった・どちらともいえない・よくなかった)
- 3) 今後も鍼灸治療を続けたほうが良いと思いますか。  
(続けてほしい・どちらともいえない・必要ない)
- 4) これまであんま・マッサージを受けたことはありま

したか。

(はい・いいえ)

5) 今回あんま・マッサージを受けてみて、どのように感じましたか。

(よかった・どちらともいえない・よくなかった)

6) 今後もあんま・マッサージを続けたいと思いますか。

(続けてほしい・どちらともいえない・必要ない)

7) スモン現状調査、ならびに今回行った鍼灸・あんま・マッサージについて、ご意見がありましたら自由にご記入ください。(自由回答)

の7項目を設定した。なお、2) と3) は鍼治療を受けた方のみに回答していただいた。

### 3. 実施結果

#### 3.1 対象者の概要

今回検診を受けたスモン患者6名(女性4名,男性2名)の平均年齢は75.5歳(65~88歳)であった。スモン固有の障害としては、全員が下肢に何らかの異常知覚(足底の付着感、しめつけ感、シビレ感、冷感など)を訴え、表在覚・深部覚低下が認められた。また、6名中5名(83%)に下肢の筋力低下も認められた。視力についてみると、2名(33%)は発症当時より眼前手動弁以上の高度な視覚障害を伴っていた。さらに、4名(67%)が高血圧、変形性腰椎症、変形性膝関節症、肩関節周囲炎、白内障などの合併症を併発していた。日常生活動作(ADL)の評価指標のひとつである Barthel index は平均81.7点(最低65点、最高100点)であった。

#### 3.2 鍼、あんま・マッサージ施術

スモン検診患者6名全員がマッサージ施術を、4名がマッサージ施術に加えて鍼施術を希望した。このうち、過去に鍼灸マッサージ公費負担制度を利用したことがある者は2名(33%)、現在も定期的に施術を受けている者は1名(17%)で、主にマッサージ治療を受けているとのことであった。

今回の鍼、あんま・マッサージ施術における主訴は下肢の異常知覚(しびれ、冷感、疼痛)、腰痛、膝関節痛、および肩こりなどであり、これらの改善を目的として施術を行った。なお、施術後に主訴の増悪、違和感、微小出血、皮下出血等の有害事象は発生しなかった。以下に今回の鍼、あんま・マッサージ施術の実例について紹介する。

症例1(78歳男性)

主訴: 下肢の脱力と冷感

病歴: 33歳で発症。歩行不能となり、視力低下も生じ

た(眼前手動弁)。現在でも下肢の脱力感・冷感が著明で時に締め付けられるような疼痛を伴う。視力障害も高度(視力ほぼ0)であり、自立歩行が困難な状況である。これまでに鍼灸マッサージ治療を受けた経験がある。

現症: 身長171cm 体重65kg 血圧143/77mmHg。

PTR低下 ATR消失 Babinski (-) Clonus (-)

下肢触痛覚軽度低下(末端優位性あり) 下肢筋力中等度低下(痙縮(-) 萎縮(+)) Barthel index 65。

施術: 下肢循環改善を主目的として腰部、大腿部、下腿部に対するあんま・マッサージ施術を20分間行った。その後、左右下肢の経穴(環跳、風市、梁丘、血海、足三里、三陰交)に40mm 16号ディスプレイステンレス鍼(直径0.16mm)を刺入し、鍼特有の刺激感覚(得気)が軽く得られるように鍼を操作(雀啄術)した後、抜去した。

直後効果: あんま・鍼施術直後より、足が軽くなって動かし易いとの印象の報告を受けた。

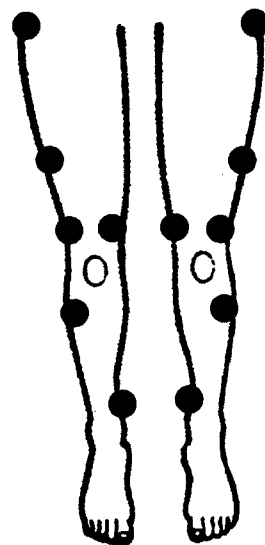


図1 症例1における鍼施術部位

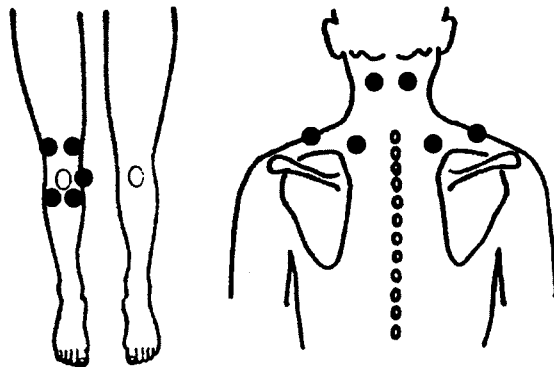


図2 症例2における鍼施術部位

## 症例 2 (87 歳女性)

主 訴：#1 右膝関節痛 #2 肩こり

病 歴：48 歳の時にスモン発症。臍部以下の感覚異常（ジンジンとしたシビレ感）と軽度の視力障害が現在まで持続している。歩行には一本杖を使用している。

上記症状に加え、10 年ほど前より #1 右膝関節痛を自覚するようになった。特に歩行時に強く感じ、その強さは現在までに徐々に増悪傾向にある。また、かねてより #2 肩こりを自覚することがあったが、スモン発症後は特に強く感じるようになっていた。今回は #1 と #2 の改善を期待して鍼・あんまマッサージ施術を希望した。これまでに鍼・マッサージ施術の経験はない。

現 症：身長 144cm 体重 55kg 血圧 130/70mmHg（高血圧にて内服治療中）。

PTR 正常 ATR 正常 Babinski (-) Clonus (-)

下肢触痛覚高度低下（末端優位性あり）下肢筋力中等度低下（痙縮 (+) 萎縮 (+)）Barthel index 80。右膝関節屈曲拘縮 (+) 同内反変形 (+) 同関節水腫 (±) 同熱感 (-) 触診にて僧帽筋上部線維を中心に筋緊張 (+)。

施 術：右膝関節痛の緩和を目的として膝関節周囲の経穴（内膝眼、外膝眼、梁丘、血海）および内側関節裂隙部に、また、僧帽筋上部線維を含む上肢帯筋群の過緊張緩和と循環改善を目的として頸肩部の経穴（天柱、肩外兪、肩井）にそれぞれ 40mm 16 号ディスプレイステンレス鍼を刺入し、15 分間留置した後に抜去した（置鍼術）。その後、後頸部・肩上部・肩甲間部に対してあんま・マッサージ施術を 15 分間実施した。

直後効果：施術直後より、肩こりが著しく軽減したとの報告を受けた。膝関節痛に関しては、直後に改善は認められ

なかった。

## 3.3 アンケート結果

後日に回収したアンケートの集計結果を表 1 に示す。鍼灸については 6 名中 4 名 (67%)、あんま・マッサージでは 3 名 (50%) が過去に経験があると回答した。今回の鍼施術体験者 4 名中 4 名 (100%)、あんま・マッサージ施術体験者の 6 名中 5 名 (83%) が施術を受けて良かったと回答し、継続的な施術を希望していた。

アンケート 7 項目の自由記述の欄には、

- ・ 鍼の方はしているうちに大変心地よくなり、3,4 日は体も楽だった。近くによいところがあれば通院してみたい。
  - ・ 肩こりがひどいのですが、今回の治療で少し軽くなった。
  - ・ 回復したのが元に戻ってしまうのが欠点。持続する治療があればよい。
- などの意見が回答されていた。

## 4. 考察

茨城県在住のスモン患者の障害度を総じてみると、先に述べた全国集計の結果 [2] とほぼ同様であり、異常知覚の改善が最大の目標となることが確認できた。また、変形性関節症による疼痛などの合併症も認められたが、スモン患者の高齢化に伴うこれら合併症に対するケアは、ADL の維持のために今後ますます重要なテーマになると考えられた。

これらの症状に対する鍼、あんまマッサージ施術を試みた結果、症状の一部に直後からの改善傾向が報告された。今回は茨城県において初の試みであることや訪問施術で

表 1 アンケートの結果

設 問	回 答	回答者数 (%)
1) これまで鍼灸治療を受けたことはありましたか	はい	4名 (67%)
	いいえ	2名 (33%)
2) 今回鍼治療を受けてみて、どのように感じましたか	よかった	4名 (100%)
	どちらともいえない	0名 (0%)
	よくなかった	0名 (0%)
3) 今後も鍼治療を続けたほうが良いと思いますか	続けてほしい	4名 (100%)
	どちらともいえない	0名 (0%)
	必要ない	0名 (0%)
4) これまであんま・マッサージを受けたことはありましたか	はい	3名 (50%)
	いいえ	3名 (50%)
5) 今回あんま・マッサージを受けてみて、どのように感じましたか	よかった	5名 (83%)
	どちらともいえない	1名 (17%)
	よくなかった	0名 (0%)
6) 今後もあんま・マッサージを続けたいと思いますか	続けてほしい	5名 (83%)
	どちらともいえない	1名 (17%)
	必要ない	0名 (0%)



あることなどいくつかの制約があり、効果の客観的指標による判定は行えなかったが、後日回答して頂いた自由回答箇所も含むアンケートの結果もふまえると、今回の鍼、あんまマッサージ施術が症状の緩和にある程度貢献できたと考えている。また、このような直後効果をもつ施術は、検診参加へのモチベーションの維持のために有効であると思われる。

一方、鍼灸の効果はある程度の継続的な治療によって累積するように大きくなる現象があることが知られており、スモンの異常知覚に対する鍼の研究結果からも同様の傾向がみとれる [4]。したがって、今後の継続的な施術によって、より大きな症状改善が期待されるが、今回のような体験的施術は継続的な施術への契機ともなり、鍼灸、あんまマッサージ利用機会の拡大につながると思われる。北海道地区においては、1985年よりスモン患者の検診時において鍼灸・マッサージの体験的治療を行い、継続的な治療を希望した患者に対しては地域の鍼灸マッサージ師を紹介するなど、スモン患者に対するケアの方法のひとつとして鍼灸マッサージを積極的に導入しているという [6]。このような好例を参考にしつつ、今後はスモンのみにとどまらず、地域ケアシステムの一環としての鍼灸・あんまマッサージ指圧の可能性について検討を進めるべきだと考えている。

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**A new approach to provide acupuncture and medical massage to patients with SMON (subacute myelo-optico neuropathy) during annual health checkup in Ibaraki prefecture.**

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**Abstract:** We attempted to provide acupuncture and medical massage to patients with SMON (subacute myelo-optico neuropathy) in Ibaraki prefecture during an annual health checkup. We practiced acupuncture to 4 patients and gave medical massage to 6 patients. A questionnaire survey after the services showed that 100% of patients receiving acupuncture and 83% of those receiving medical massage were satisfied with the services. Eighty-three percent of the patients also hoped to receive the acupuncture and medical massage service at the next checkup. These services provided on a trial basis appear to be useful in maintaining the patients' motivation to participate in the annual checkup and increasing the opportunities to receive acupuncture, moxibustion, and medical massage.

**Keywords:** SMON (subacute myelo-optico neuropathy), annual health checkup, acupuncture, medical massage

RESEARCH PAPER

## Factors associated with life satisfaction in Japanese stroke outpatients

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### Abstract

**Purpose.** To measure life satisfaction in Japanese stroke outpatients and randomly-sampled community residents and to investigate variables influencing their life satisfaction.

**Method.** Data on the demographic and clinical profiles, Satisfaction in Daily Life (SDL), other measurements, were obtained from 869 stroke outpatients (552 males, 317 females) and 748 community-dwelling elderly (360 males, 388 females), aged 55 years and older. Differences in categorical variables and continuous variables were tested by chi-square test and ANCOVA with age as the covariate, respectively.

**Results.** The 11 SDL items were subjected to a factor analysis, which extracted two factors. Factor 1 (F1), labeled as 'satisfaction with one's own abilities', included satisfaction with housework, self-care, gait, physical health, hobby and leisure, social intercourse and mental health. Factor 2 (F2), 'satisfaction with external factors', included satisfaction with partner/family relationship, economic state and social security, and house facilities. Both F1 and F2 scores were significantly lower for stroke outpatients ( $M=19.7$  and  $10.9$ , respectively) than for community-dwelling elderly ( $M=28.2$  and  $12.0$ , respectively) ( $p < 0.001$ ). Living conditions were significantly associated with F2, but not with F1. Males living alone scored lowest on F2 than the others for both groups. Among stroke outpatients, both F1 and F2 scores differed significantly by the type of hemiparesis and the severity of aphasia.

**Conclusions.** SDL of stroke outpatients, which was lower than community-dwelling elderly, differed by the type of hemiparesis, the severity of aphasia, and living conditions. The effects of living conditions might vary with gender.

**Keywords:** Stroke, life satisfaction, satisfaction in daily life, principal component analysis

### Introduction

Although medical treatments for stroke have been progressing, stroke is still one of the major causes of death in most industrialized countries [1–3] and impairments and disabilities after stroke persist in many cases. After acute medical and/or neurosurgical treatments for stroke, rehabilitative treatments play a major role at the subacute and chronic stages, including improvement in hemiplegia, independence in activities of daily living (ADL), encouragement to participate in social activities, and improvement in quality of life (QOL). Activity limitations and participation restrictions, as well as life satisfaction, which constitute a subjective perception of the individual and is a subjective domain of QOL, are very important in community rehabilitation programs and home-care and home-help services.

Previous studies have revealed that life satisfaction of post-stroke patients was influenced by race [4,5], gender [6,7], marital status [1,7], living conditions [8], aphasia [4,9,10], social support [3,11,12], and returning to work [14]. However, the influence of these factors on patients' satisfaction remains controversial due to inconsistent findings.

As to the effect of aphasia, for example, Christensen and Anderson [9] reported that patients with aphasia showed lower satisfaction than those without aphasia in the central region of the USA, whereas Ross and Wertz [10] showed that life satisfaction might be independent of aphasia in the southwestern region of the USA. As to gender, marital status, and living arrangements, Jaracz [6] observed that life satisfaction of stroke patients was not significantly correlated with their gender, marital status, or living arrangements in Poland, whereas

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Kauhanen [7] found that various aspects of QOL, including life satisfaction, were associated with marital status in Finland. Thus, it seems reasonable to hypothesize that the association of these factors with life satisfaction may differ across nationality and race/ethnicity or culture.

On the other hand, the sample sizes of the previous studies were relatively small, i.e., mostly less than 100 patients. Because life satisfaction is a subjective perception of the individual, it may fluctuate easily. Thus, a larger number of subjects are needed to obtain a stable result concerning life satisfaction. As far as we know, however, only one previous report has demonstrated the life satisfaction and its related factors among post-stroke outpatients with more than 800 subjects. Wyller et al. [12] reported that the subjective well-being (SWB) of 1,417 post-stroke patients in Norway, which may be regarded as interchangeable with life satisfaction mentioned here, was considerably lower than that of the counter-age community residents. They also described its relationship with female gender, older age, good general and mental health, and a firm social network. A body of large-scale investigations is necessary to obtain a consensus about life satisfaction of patients living at home with disabilities, such as stroke, subacute myelo-optico-neuropathy [13] and others.

The aims of the present study are to measure the life satisfaction of a large number of stroke patients living at home and community-dwelling elderly in Japan, and to disclose the features and influencing factors of their life satisfaction. We paid particular attention to the influence of living condition, which might play a supportive role for the outpatients after stroke, and to the influence of the time duration after onset of stroke as well. In the future, we intend to investigate the SDL of patients with subacute myelo-optico-neuropathy.

## Methods

### *Stroke outpatients*

All of Japan was divided into 10 regions, and one to three hospitals were selected from each region based on the following criteria: (i) the hospital has first-grade rehabilitative facilities in the legal medical insurance system, (ii) a board-certified doctor of rehabilitation medicine organizes the department of rehabilitation medicine, and (iii) the hospital serves the region. Finally, 16 hospitals were chosen from all over the country, and were asked to join the collaborative study. The board-certified doctor in each hospital was asked to select a maximum of 80 consecutive stroke outpatients according to our common inclusion criteria: patients (i) are 55 years of age or older, (ii) have a history of stroke confirmed

with computed tomography or magnetic resonance image, (iii) have already received stroke rehabilitation in the hospital, (iv) have no dementia or extremely severe aphasia, or who could not understand the questionnaire, (v) are able to respond to a self-rating questionnaire, and (vi) agree to join this study.

The SDL and other questionnaires were administered to stroke outpatients by these doctors. The doctors evaluated the severity of aphasia into 4 degrees: no aphasia, mild aphasia, moderate aphasia and severe aphasia. Stroke outpatients with aphasia were interviewed by trained speech therapists who were allowed to be proxy for patients with aphasia who were unable to complete the questionnaires by themselves, while the other outpatients and community residents responded to each item by themselves.

Although the doctors sent us anonymous data on 1,070 stroke outpatients from 16 hospitals nationwide, only 869 participated in the study (Table I), as the remaining 201 patients were in long-term hospital or nursing home care, or had missing values. Of the 869 patients, 59.0% had cerebral infarction, 35.1% had cerebral hemorrhage, 4.3% subarachnoid hemorrhage (SAH), 0.9% others, and 0.7% unknown; and the duration from onset was  $5.3 \pm 4.8$  years (mean  $\pm$  standard deviation).

### *Community-dwelling elderly*

One thousand community-dwelling elderly were randomly selected from the register of electors of Yahatanishi Ward, Kitakyushu City, Japan. Kitakyushu City, a large city located in a rural province of Japan, was designated by the national government as a model city for treating the elderly. Yahatanishi Ward is a residential area of the city, and its elderly residents were regarded as representative of aged persons in Japan. First, we sent a letter of request and questionnaires to 1,000 elderly people, asking them to participate in the survey; 780 agreed to take part in it. One hundred forty-nine did not respond, 46 refused to join the survey, and 25 had died or moved. Members of our survey team then called at the subjects' homes, and collected 748 questionnaires (Table I), as 32 of the 780 were excluded because they were in a hospital or nursing home, or less than 55 years old. Details regarding the data collection have been described elsewhere [15]. Of the 748 community-dwelling elderly, 451 (205 males, 246 females) received some medical treatments and rehabilitation services.

### *Instruments*

The questionnaires consisted of a subject's profile sheet, the Satisfaction in Daily Life (SDL) [16],

Table I. Characteristics of stroke outpatients and community-dwelling elderly.

	Stroke outpatients (n = 869)				Community-dwelling elderly (n = 748)			
	Male		Female		Male		Female	
	n	(%)	n	(%)	n	(%)	n	(%)
Subjects	552	(63.5)	317	(36.5)	360	(48.1)	388	(51.9)
Age (years old)								
mean (SD)	67.3	(7.5)	69.2	(8.6)	66.5	(7.6)	67.7	(7.8)
range	55–91		55–96		55–89		55–90	
Living conditions								
Alone	23	(4.2)	27	(8.5)	16	(4.4)	69	(17.8)
With spouse	261	(47.3)	103	(32.5)	213	(59.2)	148	(38.1)
Spouse and/or other family members	266	(48.2)	185	(58.4)	131	(36.4)	170	(43.8)
Type of hemiparesis								
Without hemiparesis	57	(10.3)	42	(13.2)				
Right hemiparesis	222	(40.2)	129	(40.7)				
Left hemiparesis	248	(44.9)	135	(42.6)				
Bilateral hemiparesis	25	(4.5)	11	(3.4)				
Severity of aphasia								
Without aphasia	252	(45.7)	194	(61.2)				
Mild aphasia	199	(36.1)	89	(28.1)				
Moderate-severe aphasia	100	(18.1)	34	(10.7)				

other measurements, such as the Short Form-36 (SF-36) [21,22], the Self-Rating Barthel Index [15], and the Self-Rating Frenchay Activity Index [23]. Details regarding these measurements without SDL have been described elsewhere [15].

The SDL, a simple measurement of subjective QOL referring to the Life Satisfaction Measure by Viitanen et al. [16], was used to assess the life satisfaction of stroke outpatients. The SDL was initially developed to evaluate the life satisfaction of sub-acute myelo-optico-neuropathy [17], and has been widely applied to stroke patients [18] and hemophiliacs [19]. The SDL consisted of 11 items, i.e., physical health, mental health, self-care, gait, housework, house facilities, partner and family relationships, hobby and leisure activities, social intercourse, economic state and social security, and having a job [20]. Each item was rated along a 5-point rating scale from 'dissatisfied' (rated as 1) through to 'satisfied' (rated as 5); thus, giving a possible range of SDL scores from 11 (the lowest state of satisfaction) to 55 (the highest state of satisfaction).

Living conditions were asked by a single item with 5 response alternatives: 'living alone', 'living with spouse', 'living with spouse and other family member(s)', 'living with child (daughter or son), their spouses, and grandchild(ren) etc.', and 'others'.

#### Data analysis

A principal component analysis was performed to: (i) clarify the dimensionality of the SDL which might cover various aspects of the life satisfaction, and (ii)

construct some summary variables rather than individual items. The latter might prevent increased possibilities of type I error due to repeat comparisons using 11 items. After the promax rotation, items showing loadings exceeding 0.50 were regarded as salient on a component. Differences in categorical variables and continuous variables were tested by a chi-square test and ANCOVA with age as the covariate. Statistical analyses were conducted using the SPSS 11.0 J.

## Results

### Dimensionality of the SDL scale

A total of 1,617 data responses on individual SDL items were factor analyzed. According to an initial unrotated solution, the eigenvalues of the first two factors exceeded 1.0. These factors were then subjected to the promax rotation. Table II shows the factor loadings of individual SDL items.

The SDL consisted of two factors, and one item was quite independent to other items. Factor 1 (F1) included satisfaction with housework, self-care, gait, physical health, hobby and leisure, social intercourse, and mental health. These seven items seemed to represent several aspects of 'one's own abilities'. Factor 2 (F2) included satisfaction with partner/family relationship, economic state and social security, and house facilities. These three items were related to the satisfaction with 'external factors' of the respondents. One item, satisfaction with having a job, showed extremely lower communality estimate (0.16) as compared to any other items' counterpart

Table II. Promax rotated factor loadings of 11 items of satisfaction in daily life.

Items of satisfaction	Factor 1: Satisfaction with One's Own Abilities	Factor 2: Satisfaction with External Factors
Housework	<b>0.97</b>	-0.16
Self-care	<b>0.95</b>	-0.12
Gait	<b>0.89</b>	-0.07
Physical health	<b>0.70</b>	0.13
Hobby/leisure	<b>0.67</b>	0.15
Social intercourse	<b>0.62</b>	0.18
Mental health	<b>0.57</b>	0.30
Partner/family relationship	-0.14	<b>0.85</b>
Economic state and social security	-0.05	<b>0.75</b>
House facilities	0.20	<b>0.65</b>
Having a job	0.16	0.28
Interfactor correlation	.55	

Bold-faced values: factor loadings  $\geq 0.50$ .

(>0.53), and had no salient loadings on either factor. Two scale scores were calculated based on the factor structure, excluding that item. Cronbach's  $\alpha$ 's were 0.91 and 0.66 for F1 and F2, respectively.

#### *Differences in life satisfaction according to the history of stroke and gender*

Total SDL scores were significantly lower for stroke outpatients (entire 33.3; males 32.7, females 34.2) than for community-dwelling elderly (entire 43.3; males 43.7, females 42.9) ( $p < 0.01$ ). However, the SDL involved two components (Table II), and one relatively independent item as mentioned above. Therefore, we decided to use these two factors separately in the subsequent analyses rather than the total SDL score.

Figure 1a depicts the mean scores of F1, 'satisfaction with one's own abilities' by gender and subject characteristics (stroke outpatients vs community-dwelling elderly). F1 scores were significantly lower for the stroke outpatients ( $M = 19.7$ ,  $SE = 0.23$ ) than for the community-dwelling elderly ( $M = 28.2$ ,  $SE = 0.24$ ) ( $F = 644.7$ ,  $p < 0.001$ ). Also, a significant interaction with gender was observed ( $F = 6.7$ ,  $p < 0.01$ ). Among the stroke outpatients, males ( $M = 19.1$ ,  $SE = 0.28$ ) showed lower scores than females ( $M = 20.2$ ,  $SE = 0.37$ ), but among the community-dwelling elderly, females ( $M = 27.9$ ,  $SE = 0.33$ ) showed lower scores than males ( $M = 28.4$ ,  $SE = 0.35$ ).

As displayed in Figure 1b, the mean scores of F2, 'satisfaction with external factors', were also significantly lower for the stroke outpatients ( $M = 10.9$ ,  $SE = 0.09$ ) than for the community-dwelling elderly ( $M = 12.0$ ,  $SE = 0.14$ ) ( $F = 66.6$ ,  $p < 0.001$ ), while

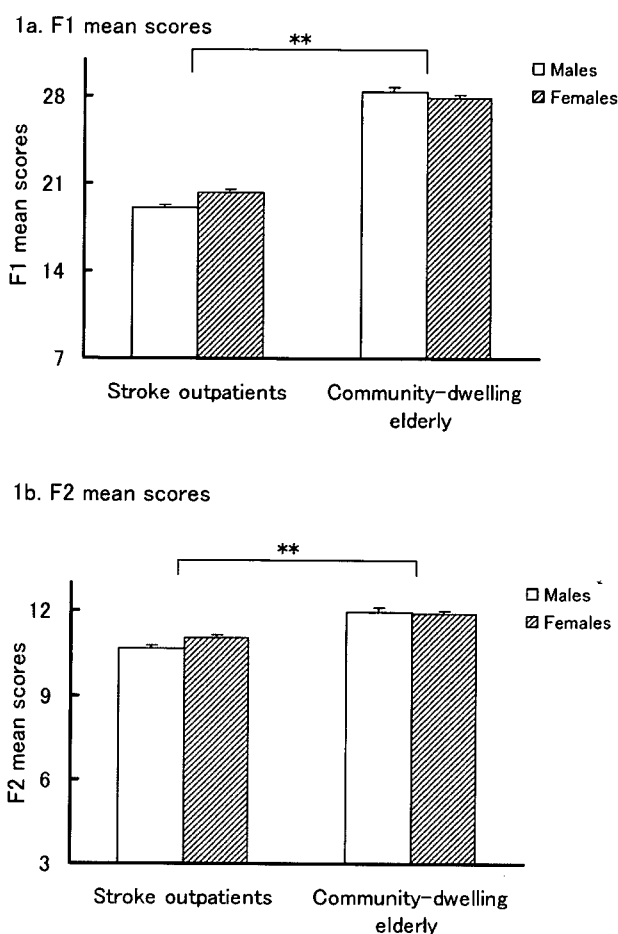


Figure 1. Comparison of F1 and F2 mean scores with stroke outpatients and community-dwelling elderly. Both scores (Figure 1a and 1b) were significantly lower for stroke outpatients than for community-dwelling elderly ( $F = 644.7$  for F1,  $F = 66.6$  for F2, both  $p < 0.001$ ). \*\* $p < 0.01$ , by ANCOVA.

the interaction with gender was marginal ( $F = 2.9$ ,  $p < 0.09$ ). Gender difference was not observed in F1 and F2 scores.

#### *Differences in life satisfaction of stroke outpatients and community-dwelling elderly according to living conditions*

Of the 5 categories of living condition, the category of 'living with my children (daughters or sons), their spouses, and grandchild(ren) etc.' was combined with another category of 'living with spouse and other family members' because of the fewer number of stroke outpatients in the former category. In addition, 5 subjects who responded to 'others' in their living conditions were omitted in the subsequent analyses. Then the differences in life satisfaction according to living conditions were examined by ANCOVA, with gender and their interaction, controlling for the effect of age. The analysis was conducted separately for stroke outpatients and community-dwelling elderly.

Among the stroke outpatients, although the main effect of living conditions and its interaction with gender were not significant on F1 scores, a significant main effect of living conditions ( $F = 3.6$ ,  $p < 0.05$ ) on F2 scores was observed. As displayed in Figure 2a, F2 scores were comparable between genders living with a spouse, and the scores of females did not differ between those who were living with a spouse and those who were living alone. Thus, the significant difference according to living conditions observed here might be attributable to the lower F2 scores for males who were living alone.

Among the community-dwelling elderly, similar to the stroke outpatients, although living conditions had no significant effects on F1 scores, its main effect on F2 scores was significant ( $F = 13.7$ ,  $p < 0.001$ ) and its interaction with gender was marginal ( $F = 2.9$ ,

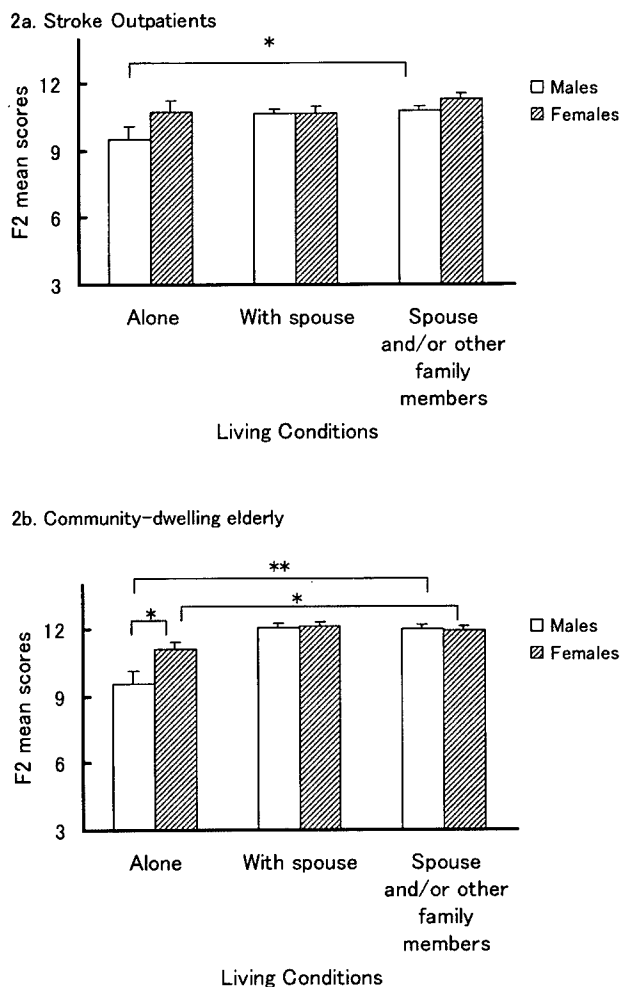


Figure 2. F2 mean scores by living conditions. For stroke outpatients (Figure 2a), living conditions showed a significant main effect on F2 scores ( $F = 3.6$ ,  $p < 0.05$ ). For community-dwelling elderly (Figure 2b), living conditions showed a significant main effect ( $F = 13.7$ ,  $p < 0.001$ ) and a marginal interaction effect with gender ( $F = 2.9$ ,  $p < 0.06$ ) on F2 scores. \* $p < 0.05$ , by ANCOVA.

$p < 0.06$ ): i.e., as displayed in Figure 2b, F2 scores were comparable for both genders who were living with a spouse or living with a spouse and other family members, but the scores were lower for those who were living alone, particularly for males.

#### Differences in life satisfaction of stroke outpatients according to clinical features

F1 scores varied significantly by the type of hemiparesis ( $F = 9.4$ ,  $p < 0.001$ ) and the severity of aphasia ( $F = 6.1$ ,  $p < 0.01$ ), while gender and any other possible interactions were not significant (Figure 3). Further inspection by Bonferroni post-hoc test indicated that F1 scores were significantly higher for the stroke outpatients without hemiparesis ( $M = 23.6$ ,  $SE = 0.97$ ) than for those who had right hemiparesis ( $M = 19.1$ ,  $SE = 0.42$ ), left hemiparesis ( $M = 17.4$ ,  $SE = 0.64$ ), and bilateral hemiparesis ( $M = 18.4$ ,  $SE = 1.57$ ). Also, F1 scores significantly differed between those without aphasia ( $M = 21.6$ ,  $SE = 0.58$ ) and those with moderate-severe aphasia ( $M = 17.8$ ,  $SE = 0.94$ ), while F1 scores of those with mild aphasia ( $M = 19.5$ ,  $SE = 1.01$ ) did not differ among any of these groups.

The similar analysis on F2 scores yielded significant main effects of the types of hemiparesis ( $F = 2.95$ ,  $p < 0.05$ ), the severity of aphasia ( $F = 7.5$ ,  $p < 0.01$ ), and significant gender X aphasia interaction ( $F = 3.2$ ,  $p < .05$ ). Bonferroni post-hoc test indicated that F2 scores differed significantly between those without hemiparesis ( $M = 11.4$ ,  $SE = 0.38$ ) and those with left hemiparesis ( $M = 10.1$ ,  $SE = 0.25$ ), while other comparisons, including those with right hemiparesis ( $M = 10.7$ ,  $SE = 0.17$ ) and bilateral hemiparesis ( $M = 10.5$ ,  $SE = 0.62$ ), was not significant. The significant gender X aphasia interaction indicated that the effect of aphasia on F2 scores differed by gender.

As displayed in Figure 4a and 4b, F2 scores of males seemed comparable across the three levels of aphasia (no, mild, and moderate-severe), while F2 scores of females were slightly higher than those of males at no aphasia and mild aphasia conditions, but considerably lower than males at the moderate-severe aphasia condition. Further analysis by gender provided supportive results that no significant main effect was observed for males, but both types of hemiparesis ( $F = 2.8$ ,  $p < 0.05$ ) and the severity of aphasia ( $F = 8.3$ ,  $p < 0.001$ ) showed significant main effects for females. In particular, the effect of aphasia was crucial for the female outpatients, if they suffered from hemiparesis.

The time after onset of stroke, which might have some influence on life satisfaction for the stroke outpatients, showed no association with either F1 or F2 scores.

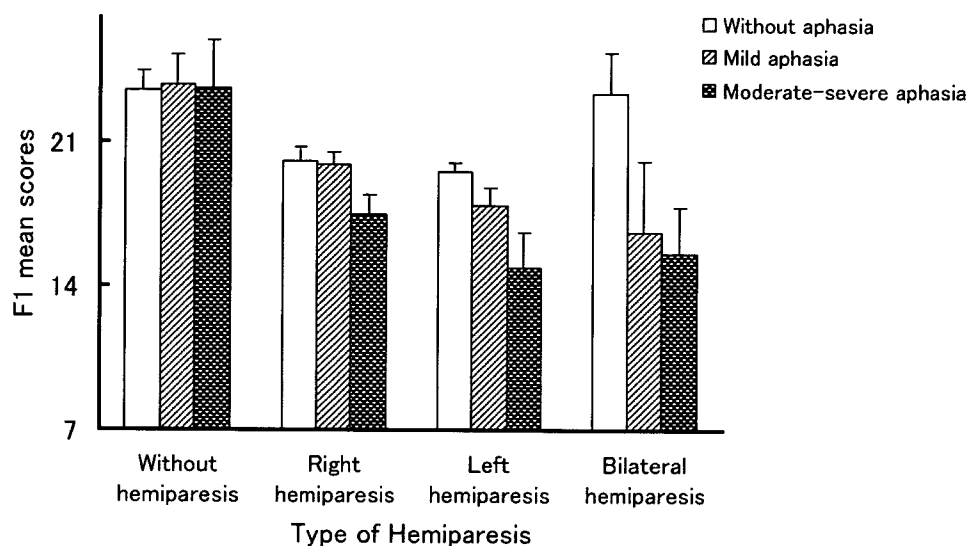


Figure 3. F1 mean scores by type of hemiparesis and severity of aphasia for stroke outpatients. F1 mean scores of types of hemiparesis are shown in without aphasia, mild aphasia and moderate-severe aphasia. F1 mean scores varied significantly by the type of hemiparesis ( $F = 9.4$ ,  $p < 0.001$ ) and the severity of aphasia ( $F = 6.1$ ,  $p < 0.01$ ), while gender and any other possible interactions were not significant.

## Discussion

In a sample of 869 post-stroke outpatients living at home and 748 community-dwelling elderly randomly sampled in Yahatanishi Ward, Kitakyushu City, Japan, we found that: (i) life satisfaction could be assessed by two different but correlated constructs, (ii) life satisfaction differed significantly between stroke outpatients and community-dwelling elderly, and (iii) life satisfaction among stroke outpatients varied according to their living conditions in general. As far as we know, no previous research, except for one study in Norway [12], has investigated the life satisfaction and/or QOL of hundreds of stroke patients living at home, with simultaneous reference to their clinical diagnoses and assessments.

Exploratory factor analysis revealed that the SDL consisted of two factors (Table II). Factor 1 reflected 'satisfaction with several aspects of one's own abilities'. Factor 2 was related to 'satisfaction with external factors'. These two components regarding life satisfaction were significantly lower for the stroke outpatients than for the community-dwelling elderly (Figures 1a, 1b). In comparison between the stroke outpatients and the community-dwelling elderly, both similarity and dissimilarity were observed in living conditions related to higher or lower 'satisfaction with external factors' (Factor 2) (Figures 2a, 2b), although their 'satisfaction with own ability' (Factor 1) was not associated with living conditions.

The similarity was found for males: (a) males who were 'living alone' showed the lowest 'satisfaction with external factors'; (b) the satisfaction levels were comparable between males who were 'living with

spouse' and males who were living with spouse and/or other family'. On the contrary, females showed a different feature between the two groups: although 'satisfaction with external factors' was independent of living conditions among female stroke outpatients, 'living with spouse and/or other family' might appear the most satisfying condition and 'living alone' was the least satisfying condition (post-hoc test,  $p < 0.05$ ) among female community-dwelling elderly. A Post-hoc test further revealed that male community-dwelling elderly who were 'living alone' showed significantly lower F2 scores than their female counterparts ( $p < 0.05$ ). That is, 'satisfaction with external factors' could be influenced by living conditions for males, but not particularly so for females.

It might be suggested that males who were 'living alone' tended to have less communication with others and thus to be more isolated than males who were living with others. Social support may, therefore, be needed particularly for male post-stroke patients who are living alone. There have been several researches on the effects of social support on post-stroke patients and their caregivers. Wyller et al. [12] found that a firm social network was related to higher life satisfaction in 1,417 stroke patients in Norway. Some other studies, although the sample sizes were not necessarily sufficient, have also demonstrated that social support is an important determinant for life satisfaction of stroke outpatients living in the community [3,11,26–29]. Gottlieb et al. [11] reported the direct effect of social support on QOL in Israel, and Åström et al. [29] found that social disintegration was associated with reduction in life satisfaction in stroke patients in Sweden.



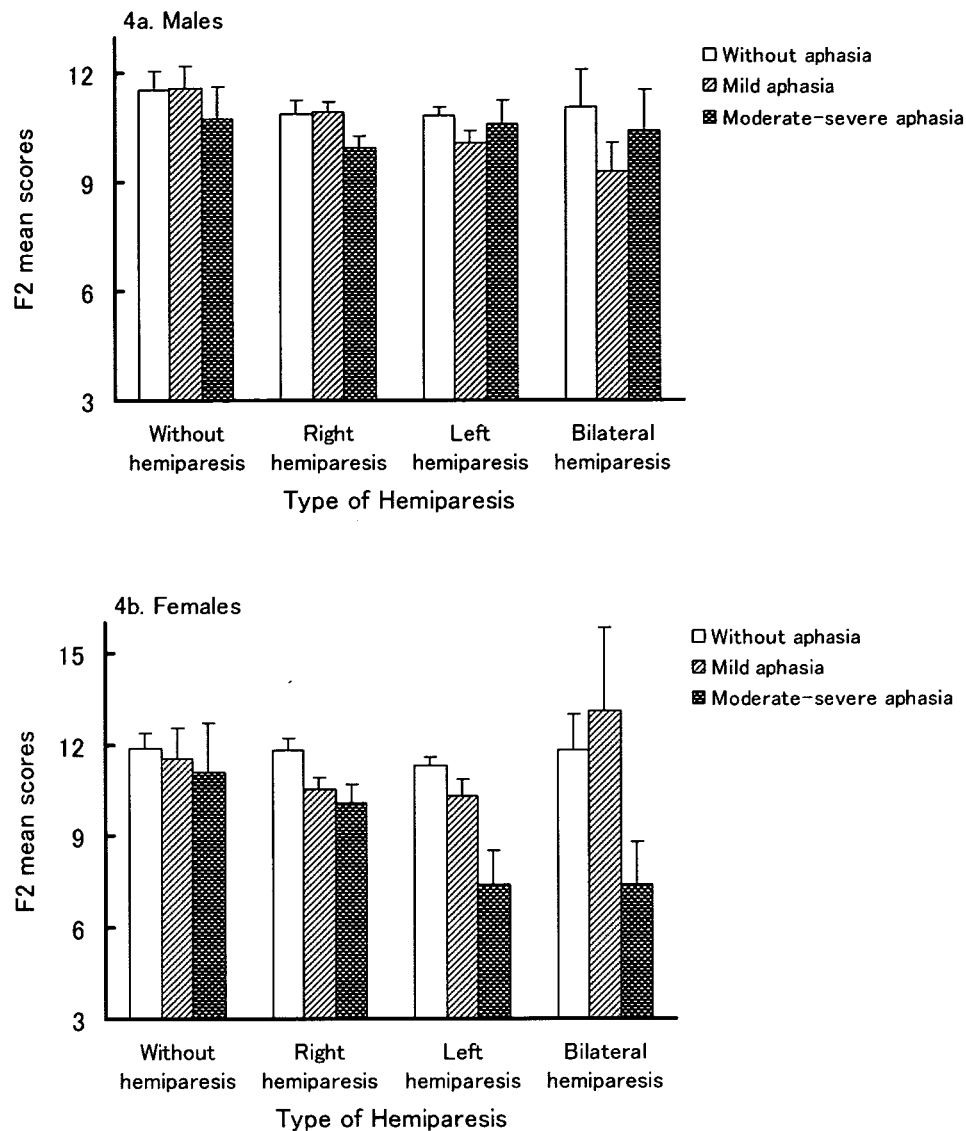


Figure 4. F2 mean scores by type of hemiparesis and severity of aphasia for stroke outpatients. F2 mean scores of males seemed comparable across the three levels of aphasia (no, mild, and moderate-severe) in figure 4a, while F2 scores of females were slightly higher than those of males at no aphasia and mild aphasia conditions in figure 4b, but considerably lower than males at the moderate-severe aphasia condition ( $F = 8.3, p < 0.001$ ).

On the other hand, Clarke et al. [27] noted that social support might act as a moderator of the effects of disability on well-being in Canada. Kauhanen [7], in Finland, found that married patients coped less well in terms of mental health than unmarried patients, because of overprotective and over-caring spouses and noted that the support for caregivers was important for the success of stroke rehabilitation. In the present study, although the direct and indirect effects of social support could not be tested, lower 'satisfaction with external factors' scores for male stroke outpatients who were 'living alone' might suggest the importance of social support for them.

One of the clinical phenomena for post-stroke patients is depression. Post-stroke depression

occurs in about 40% of patients [24], and clinical severity in stroke is related to severe post-stroke depression [25]. Because of such psychological impairment, many patients might be likely to show reduced enthusiasm for continuing rehabilitation treatment. If their spouses and/or family members do not notice this common phenomenon, such patients may be regarded as lazy, and then feel isolated due to the lack of sympathy from family members. Glass et al. [26] and Glass and Maddox [28] demonstrated that a high level of social support was associated with faster and more extensive recovery of functional status after stroke, based on a longitudinal observation of ADL among stroke patients. Social support may have such a desirable influence.

There is no doubt that both types of hemiparesis and the severity of aphasia have a larger impact on 'satisfaction with own ability' (Factor 1) of stroke outpatients (Figure 3). Following the significant gender X aphasia interaction on 'satisfaction with external factors' (Factor 2), detail analyses conducted separately by gender indicated that significant findings on these clinical features were peculiar for females (Figure 4b), but not for males (Figure 4a). Lack of communication might make post-stroke patients feel alone and depressed [9], suggesting that the adverse impact of aphasia might be stronger for females. Although communication is an important factor for males and females, a component of communication influencing life satisfaction might be different between genders. Females may be more likely to seek verbal communication, but males may be more likely to seek any care/help for their daily life.

In conclusion, life satisfaction of Japanese stroke outpatients was influenced not only by clinical features (hemiparesis and aphasia), but also by their living conditions. We discussed several reasons, such as family factors and social support, explaining why 'living alone' was the least satisfactory condition, particularly among male stroke outpatients. We did not, however, research the reason why living conditions influence life satisfaction of stroke outpatients in this study. More details about daily activities, living conditions and the needs of stroke outpatients should be investigated in a future study.

There exist several strategies in rehabilitation medicine for enhancing the life satisfaction of stroke outpatients. It seems desirable that rehabilitation staff should provide general education for family members of stroke patients so that they might understand the physical and mental problems after stroke, and facilitate manifold social support with adequate timing and/or sufficient quantity [28].

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