경피신경전기자극 후 상부 승모근 활성도와 EMG gap의 변화

연세대학교 대학원 재활학과
고은경
경피신경전기자극 후 상부 승모근 활성도와 EMG gap의 변화

지도 권 오 윤 교수

이 논문을 석사 학위논문으로 제출함

2002년 12월 일

연세대학교 대학원
제활학과
고 은 경
1. 15\% \text{ RMS}_{RVC}(\%); 2. 5\% \text{ RMS}_{RVC}(\%)

3. \text{ EMG gap} (\%)

4. VAS

5. \text{ EMG gap} (\%)

6. \text{ EMG gap} (\%)
EMG gap

보통의 아랫배 근력 테스트에서 바라보는 EMG gap

Visual analogue scale (VAS)를 사용하여 0에서 10까지의 점수를 매긴 이후 실시간으로 2초 동안 MAG gap을 측정하였다. RMS (root mean square)를 이용하여 EMG gap의 점수를 계산하였다.
 artikel の 事項、表現、語彙、内容等を 言語化 されます

: ±Ù¸· ÅëÁõÁõÈıº, ¾ÐÅë ¿ªÄ¡, ½Ã°¢ ÅëÁõ ôµµ(VAS), Ç¥¸é±ÙÀüµµ, EMG gap.
ÁëÁõÁõÈıº (myofascial pain syndrome: MPS) À̶õ °ñ°Ý±ÙÀ̳ª ±Ù¸·¿¡ À­¹ßÁ¡À» ¾Ð¹Ú ½Ã ÅëÁõÀÇ ¹ßÇö°ú ±× ÁöÁ¡À¸·ÎºÎÅÍ ¶³¾îÁø ƯÁ¤ ºÎÀ§¿¡ ¿¬°üÅëÀÌ ¹ß»ýÇϸç, ħ ÅëÁõÀÇ ¿øÀÎÀ¸·Î´Â ÁÁÁö ¾ÊÀº ÀÚ¼¼³ª ±ÙÀ°ÀÇ °ú´ÙÇÑ »ç¿ë, ¿µ¾ç ºÎÁ·, ´ë»ç Àå¾Ö, Á¤½ÅÀû ½ºÆ®·¹½º µî¿¡ ÀÇÇØ À¯¹ßµÉ ¼ö ÀÖÀ¸¸ç ƯÈ÷ Çö´ë »çȸ ¿¡¼­ °ú´ÙÇÑ ÄÄÇ»ÅÍ »ç¿ë, Áö¼ÓÀûÀÎ ÀÚ¼¼ À¯Áö, Á÷Àå¿¡¼­ÀÇ ¾÷¹« ½ºÆ®·¹½º µîÀÇ ºÎÀûÀýÇÑ ÀÛ¾÷ȯ°æ µî¿¡ ÀÇÇØ Á¡Â÷ Áõ°¡Çϰí ÀÖÁö¸¸, ±× µ¿¾È ±Ù¸· ÅëÁõÁõÈıº ¿¡ ´ëÇÑ ÀνÄÀÇ ºÎÁ·À¸·Î Áø´Ü°ú Ä¡·á ¹æ¹ý¿¡¼­µµ À̰ßÀÌ ÀÖ¾ú´Ù(ÁÖÁ¤È­¿Í ¿Á±¤ ÈÖ 1997).

¹Ýº¹ÀûÀ¸·Î ±ÙÀ°¿¡ ºÎÇϰ¡ °É¸®´Â Àϰú °ü·ÃÀÌ ÀÖ´Â Á÷¾÷¿¡ Á¾»çÇÏ´Â °æ¿ì ¸ñ°ú ¾î±ú ÁÖº¯ÀÇ ÅëÁõÀ¸·Î ÀÎÇØ ¸¹Àº ¹®Á¦Á¡À» ¹ß»ý½ÃŰ

Sciotti et al. 2001; Simons, Travell, and Simons 1999; Sola, and Bonica 1990). ¹Ýº¹ÀûÀ¸·Î ±Ù°ñ°Ý°è À­¹ß½ÃŰ´Â °¡Àå ÈçÇÑ ¿øÀÎÀ¸·Î ¾Ë·ÁÁ® ÀÖ´Ù(Simons, Travell, and Simons 1999). ¹Ýº¹ÀûÀ¸·Î ±Ù°ñ°Ý°è ÅëÁõ¿¡¼­ ¸ñ°ú ¾î±ú ºÎÀ§ ÅëÁõÀº ¸Å¿ì ÈçÇÑ °ÍÀ¸·Î (Akesson et al. 1997; Veiersted, Westgaard, and Anderson 1990), Fricton (1985) 164¸íÀÇ ¸¸¼º °æºÎ ÅëÁõ°ú µÎÅëÀ» °¡Áö´Â ȯÀÚÀÇ 55%, Àµ 45%

Fricton (1985) 164¸íÀÇ ¸¸¼º °æºÎ ÅëÁõ°ú µÎÅëÀ» °¡Áö´Â ȯÀÚÀÇ 55%, Àµ 45%
(Hagberg, and Wegman 1987; Luopajarvi et al. 1979; Punnett et al. 1985). The trapezius muscle (trapezius muscle) has been studied extensively by various researchers (Haslegrave 1994; Ohlsson et al. 1995). Studies have shown that the activity of the trapezius muscle is influenced by a variety of factors, including posture, task characteristics, and individual differences in muscle structure and function (Haslegrave 1994; Ohlsson et al. 1995).

In 1951, Lundervold studied the trapezius muscle and its role in various tasks. The ergonomics of the trapezius muscle is a critical aspect of human movement and posture. Henneman (Hagberg, and Astrom 1997) studied the slow twitch muscle fiber (slow twitch muscle fiber) in detail, showing that the muscle fibers are responsible for different types of movement and posture. The same research was also carried out by Jonsson (1978) and Jonsson (1997; Veiersted, Westgaard, and Andersen 1990). Veiersted, Westgaard, and Andersen (Veiersted, Westgaard, and Andersen 1990).
Minor Sanford (1999) found that the deactivation of the spinal pain matrix (transcutaneous electrical nerve stimulation: TENS) decreased the pain threshold (electrical nerve stimulation) and pain (pain threshold) by 60% to 10% compared to the control group with a 20% decrease in pain intensity.

Hou et al. (2002; Kahn 1994; Woolf 1989) also observed a significant decrease in pain intensity with the use of TENS.
2.1 话

2002年7月1日至8月30日期间。

1. 表 话

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<table>
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<tr>
<td></td>
<td></td>
<td>31.5±7.8</td>
<td>26.0~43.0</td>
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<tr>
<td></td>
<td></td>
<td>168.2±6.2</td>
<td>160.0~175.0</td>
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<td></td>
<td></td>
<td>65.2±9.5</td>
<td>54.0~75.0</td>
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<td></td>
<td></td>
<td>90.0±69.2</td>
<td>0.3~160.0</td>
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<td></td>
<td></td>
<td>34.7±14.2</td>
<td>14.0~55.0</td>
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<tr>
<td></td>
<td></td>
<td>157.8±5.4</td>
<td>150.0~166.0</td>
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<td></td>
<td></td>
<td>57.3±5.2</td>
<td>50.0~64.0</td>
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<td></td>
<td></td>
<td>29.3±33.0</td>
<td>0.3~80.0</td>
</tr>
</tbody>
</table>
2.2 Methods

(visual analogue scale: VAS) and pain threshold algometer
refs were used. Methods of reference voluntary contraction: RVC), (2.5 kg)
ref. 3ºÐ °£ Àû¿ë ÈÄ 2ºÐ µ¿¾ÈÀÇ ÀÛ¾÷ ½Ã ±ÙÀüµµ º¯È­¸¦ Ãø Á¤Çϱâ À§ÇØ Ä¡·á
µ¿ÀÏÇÑ ÀÚ¼¼¿¡¼­ ½Ç½ÃÇÏ¿´´Ù.

2.3 VAS

10.0 cm VAS ref. 10ºÐ °£ Àû¿ë ÈÄ 2ºÐ µ¿¾ÈÀÇ ÀÛ¾÷ ½Ã ±ÙÀüµµ ÀÌ¿ëÇÏ¿© ¼±ÀÇ ¹Ù´ÚºÎÅÍ È¯ÀÚ°¡ ÅëÁõÀÇ Å©±â¸¦ Ç¥½ÃÇÑ °÷±îÁö À§ÇØ ÀÇ Çϵµ·Ï ÇÏ¿´´Ù. ref. Fischer(1986) ref. 10ºÐ°£Àû¿ë Å©±â¸¦ Ç¥½ÃÇÑ
°¡Àå ¹Î°¨ÇÑ ¾ÐÅë Á¡ ºÎÀ§¸¦ º¼ÆæÀ¸·Î Ç¥½ÃÇÑ ÈÄ, ±× ÁöÁ¡¿¡ ¾ÐÅë ¿ªÄ¡ "Fischer(1986)" ref. 10ºÐ°£Àû¿ë À§ÇØ ÀÇ Çϵµ·Ï ÇÏ¿´´Ù. ref. Fischer(1986) ref.
2.4 °æÇǽŰæÀü±âÀCheckpoint

±â·ÏµÇ¾ú¼±å×(HAT-2000)²¸¬ ±â·ÏµÇ¾ú¼±å×. ±â·ÏµÇ¾ú¼±å× 3~20 ¼±±¥Ì±â·ÏµÇ¾ú¼±å× Àû¿ëÇÏ¿´´Ù. À̶§ ¾çÂÊ ½Â¸ð±Ù¿¡ 3~20 §ÔÀÇ Á֯ļö°¡ ÀÚµ¿ÀûÀ¸·Î À̶§ Ä¡·á°­µµ´Â °¡½Ã¼öÃàÀ» ÀÏÀ¸Å°Áö ¾Ê´Â ¡üÀ§¿¡¼­ ȯÀÚ°¡ °¡Àå Æí¾ÈÇÏ´Ù°í ÆÇ´ÜµÇ´Â À§ÇØ Àü±âÀ», À§ ÇÏ¿´´Ù. À̶§ ±ÙÀüµµÀÇ Àü±ØÀ» ºÎÂøÇÑ »óÅ¿¡¼­ ÃÑ 10ºÐ µ¿¾È Àû¿ëÇÏ¿´´Ù.
2.5.2 250 Hz to 500 Hz

Bagnoli DE3-1 EMG, 2 ¹®Áú·¯               MP100 ¹®Áú·¯

ºÎÂøÇÏ¿´´Ù. PC¿¡¼­ Acqknowledge 3.71 512 ¹®Áú·¯, 20~250 ¹®Áú·¯ (band pass filter) 60 ¹®Áú·¯ (notch filter)

²©±â¿¡¼­ ¾òÀº Ç¥¸é±ÙÀüµµ ½ÅÈ£Áß¿¡¼­ ¾çÆÈÀ» ¿ÜÀüÇϰí ÁÖ°üÀýÀÌ ¿ÏÀüÈ÷ ½ÅÀüµÇµµ·Ï ÇÏ¿´°í, °ß°©°ñÀÇ ¿¬Àå¼±°ú ÁÖ°üÀýÀÌ °ð°Ô À¯ÁöµÇµµ·Ï ÇÑ ÈÄ, ¼ÕµîÀÌ À§¸¦ ÇâÇÏ°Ô ÇÏ´Â µ¿¾È »óºÎ ½Â¸ð±Ù¿¡¼­ ±ÙÀüµµ ½ÅÈ£¸¦ 4ȸ ¹Ýº¹ Çµ±ØÇÏ¿´°í, 4ȸ ÂøÁ¤ÇÑ 100% RMSRVC ·Î »ç¿ëÇÏ¿´´Ù. ²©±â¿¡¼­ 3 DelSys Inc., Boston. MA. USA

4 Biopack System Inc., Santa Barbara, CA. USA

5 Biopack System Inc., Santa Barbara, CA. USA
2.5.4 RMS\(_w\) (RMS\(_{work}\))

\[ \text{RMS}_{work} = n\% \text{ RMS}_{RVC} \]  \hspace{1cm} (1)

\(^6\) Math Works Inc., MA. USA
1. \(15\%\) RMS_{RVC}(\%) ; 2. \(15\%\) RMS_{work}(\%).

2.5.5 EMG gap \\
---

EMG gap \(\text{Veiersted} \ (1990, \ 1993)\) \(\text{Hansson} \ (2000)\) “\(\text{Veiersted} \ (1990, \ 1993)\) \(\text{Hansson} \ (2000)\) “

\(0.2\%\) RMS

\(1.5\%\) RMS_{RVC} \(\approx 47\%\) RMS_{RVC}
EMG gap の値

<table>
<thead>
<tr>
<th>%RMSRVC</th>
<th>±RMSRVC</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>1~25%</td>
<td></td>
<td>13.79±11.21</td>
</tr>
<tr>
<td>2~25%</td>
<td></td>
<td>8.87±8.51</td>
</tr>
</tbody>
</table>
2. 5% RMS\(_{RVC}\) EMG gap.

3. EMG gap.
2.6 问题

2.6.1 常规(normalization)

常规处理通常包括归一化处理(Ann et al. 2001; Clancy, Bouchard, and Rancourt 2001)。常规处理包括 RMS (均方根)，

%RMSRVC。常规处理通常包括误差分析。例如，EMG gap

(Hansson et al. 2000)。常规处理包括 EMG gap。

2.6.2 问题

常规处理通常包括 VAS (视觉模拟量表)。常规处理包括 EMG gap。

常规处理通常包括 Wilcoxon Signed-Ranks test(Wilcoxon Signed-Ranks test)

α = 0.05。常规处理通常包括 SPSS 10.0 (Statistical Package for the Social

Sciences)。常规处理通常包括 SPSS.
3.1 VAS의 변화

(3) (p<0.05), (p>0.05)

<table>
<thead>
<tr>
<th>VAS (cm)</th>
<th>(¶/¶)</th>
</tr>
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<tbody>
<tr>
<td>5.8</td>
<td>2.2</td>
</tr>
<tr>
<td>4.5</td>
<td>2.1</td>
</tr>
</tbody>
</table>
4. *p<0.05.

5. *p<0.05.
3.2 EMG gap

- 20.6 ± 14.9°
- 14.6 ± 13.5°

3.3 EMG gap

- 9.1°
- 15.9°

* p<0.05; "a" ±

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<th>Z-</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>20.6 ± 14.9°</td>
<td>14.6 ± 13.5°</td>
<td>- 3.3°</td>
</tr>
<tr>
<td></td>
<td>16.8 ± 19.4°</td>
<td>13.5 ± 17.1°</td>
<td>- 3.3°</td>
</tr>
</tbody>
</table>
5. 表现了EMG间隙的数据。

<table>
<thead>
<tr>
<th>Z-</th>
<th>EMG gap(°)</th>
<th>2°</th>
<th>EMG gap(°)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>8.1±17.9°</td>
<td>35.6±24.9°</td>
<td>-3.2°</td>
</tr>
<tr>
<td></td>
<td>9.1±18.4°</td>
<td>36.9±26.5°</td>
<td>-2.6°</td>
</tr>
</tbody>
</table>

*p<0.05; 双侧检验。
*a表示±值。

* p<0.05.

6. 说明了EMG间隙的数据。
40% of the EMG activity is detected and the amplitude probability distribution function (APDF) is calculated (Cram, Kasman, and Holtz 1998). RMS values decrease significantly in the absence of EMG activity and the amplitude probability distribution function (APDF) is calculated (Cram, Kasman, and Holtz 1998). ABRAC (basic rest activity cycle) is defined as the percentage of EMG gap (Shannahoff-Khalasa 1991).

- 17 -
EMG gap 1.5\% 1.5\% 0.2\% 5\%
 gaps \% 0.5\% MVC (maximal voluntary contraction: MVC) 0.2\% (amplitude) 0.2\% EMG gap (Veiersted and Westgaard, and Anderson 1990; 1993). RVC 5\% RVC (amplitude) 0.2\% EMG gap (Hansson et al. 2000).

Nordander (2000) EMG gap 1.5\% 0.2\% EMG gap 1.5\% 0.2\% EMG gap.


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(Nordander et al. 2000). Veiersted (1990) reported EMG gap values of 0.4–10% MVC. Veiersted (1990) noted that the EMG gap values were 0.1–0.5% MVC for 0.2–1.5% MVC. Hagg and Astrom (1997) observed EMG gap values of 1.9–20°, whereas Veiersted (1993) reported EMG gap values of 0.8–7.7°. Hagg and Astrom (1997) also noted that EMG gap values were 1.9–20° for 8% MVC, 14.2° for 17.3% MVC, 17.3° for 8% MVC, 8.0° for 3.9° MVC, 7.4° for 8% MVC, and 6° for 17.3% MVC. Veiersted (1993) observed EMG gap values of 8% MVC, 14.2° for 17.3% MVC, 17.3° for 8% MVC, 8.0° for 3.9° MVC, 7.4° for 8% MVC, and 6° for 17.3% MVC.
データを取り入れ、分析し、結果を説明することにより、

・データの正しさおよび分析の妥当性を確認
・説明の簡潔さと明確さを追求

1999年、Finsenと1986年、Harms-RingdahlとEkholm(1986)の

・データを基に分析を行った。
Hsueh et al. (1997) found that applying counter irritation (counter irritation) to the skin before applying heat or cold reduces the pain sensation.

Lee, Lin, and Hong (1997) also demonstrated that applying counter irritation before applying heat or cold significantly reduces pain (p<0.05).

EMG gap results showed that counter irritation before applying heat or cold further reduces pain compared to applying heat or cold alone.

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図 5

VAS を用いて %RMSrvc と EMG gap の関係を観察した。VAS の評価において、VAS が低くなるほど %RMSrvc の値が小さくなり、EMG gap の値が大きくなる傾向が見られた。

また、VAS の評価において %RMSrvc の値が小さくなるほど EMG gap の値が大きくなる傾向が見られた。


Hou CR, Tsai LC, Cheng KF, Chung KC, and Hong CZ. 2002. "Immediate effects of various physical therapeutic modalities on cervical myofascial


Westgaard RH, Jansen T, and Jensen C. 1996. "EMG of the neck and

Changes of Upper Trapezius Muscle Activity and EMG gap After Transcutaneous Electrical Nerve Stimulation in Subjects With Myofascial Pain Syndrome

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Dept. of Rehabilitation Therapy
(Physical Therapy Major)
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Yonsei University

The purpose of this study was to compare visual analogue scale (VAS), pain threshold (PT), %RMS$_{RVC}$, and EMG gaps before and after applying transcutaneous electrical nerve stimulation (TENS) on the upper trapezius muscle at the patients with myofascial pain syndrome (MPS). The subjects were 4 men and 10 women composed of both the inpatients and outpatients who were diagnosed as MPS at Wonju Medical Center. VAS and PT measurements were performed to assess the subjective pain level. The reference voluntary contraction (RVC) test was performed for 15 seconds for normalization on the bilateral trapezius muscle using surface electromyography (sEMG). After 3-minute resting time, the EMG signal was recorded while performing a typing activity for 2 minutes and then
TENS was applied with a comfortable intensity for 10 minutes. The EMG activity of the upper trapezius muscle was recorded during typing for 2 minutes. The results of study were as follows: 1) VAS score was significantly decreased on the more painful side after treatment, however, it was not significantly different on the less painful side. 2) PT was increased after treatment on both sides, however, it was not significantly different between before and after the TENS application. 3) The EMG activity during typing was significantly decreased after treatment, and 4) The EMG gaps were significantly increased after TENS treatment compared to before it. Consequently, the study showed that TENS was effective in decreasing VAS, %RMS_{RVC}, and in increasing EMG gaps. The EMG gap analysis could be a useful method to measure pain in patients with MPS in the upper trapezius.

Key words: EMG gap, Myofascial pain syndrome (MPS), Pain threshold (PT), Surface Electromyography (sEMG), Transcutaneous electrical nerve stimulation (TENS), Visual analogue scale (VAS).