

Abstract

Muscle Activity of Low Back Muscles During Isometric Back Extension Exercises

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Back extension exercises have been used for rehabilitation of the injured low back, prevention of injury, and fitness training programs. However, excessive loading on low back can exacerbate existing structural weakness. The purpose of this study was to compare muscle activity of low back muscles during back extension exercises. Twenty healthy male subjects were evaluated. Electromyographic (EMG) activities of low back muscles at L1 and L5 level were recorded during seven different back extension exercises and two reference tasks by surface EMG and saved for data analysis. Reference tasks of lifting 20% and 40% of their body weight were included for comparison. The result were as follows: 1) Single-arm extension and single-leg extension exercises on quadruped position appeared to constitute a low-risk exercise for initial extensor strengthening. 2) When arm extension was combined with contralateral leg extension on quadruped position, EMG activities of low back muscles were increased. 3) EMG activity of low back muscles was highest during the trunk extension exercises on prone position. 4) EMG activities of low back muscles during arm and leg extension exercises on quadruped position were less than those of reference task of lifting 40% of their body weight. These results have important implications for progressive back extensor muscle

strengthening exercises in patients with back pain.

Key Words : Electromyography; Extension exercise; Lumbar extensor muscle; Rehabilitation.

가 back dynamometer
 가 (Mayhew Rothstein,
 , 1985)가 ,
 24 (, 2000; ,
 1998),
 (Frymoyer Cats-Baril, 1991; Graves 가 (, 1994).
 , 1990). , .
 (Anderson , 1983; Deyo Tusi-
 Wu, 1987; Troup, 1984; Waddell, 1987). 가
 ,
 (Fordyce , 1986), Anderson , 1977; Nouwen , 1987).
 ,
 (, 1997; Cassisi , 1993;
 Hultman , 1993; Mayer , 1985; Shirado
 , 1995). (Graves , 1990).
 ,
 가 (Polatin , 1988). 1993), (Joynt ,
 ,
 가 가
 (Langrana , 1980; Mayer (Peach McGill,
 , 1985; Mayer , 1986), Pope (1985) 1998).
 가 Risch (1993)
 .
 가 , .
 가 .
 가
 가
 , (Nachemson
 , Lindh, 1969).
 ,
 가 ,

(Manniche, 1998; Mayer, 1985; Risch, 1993).

Mayer (1999) VARC (Variable Angle Roman Chair)

가
 가

Callaghan (1998)

가
 가

(surface EMG)

7가

1.

1

20

가

2.

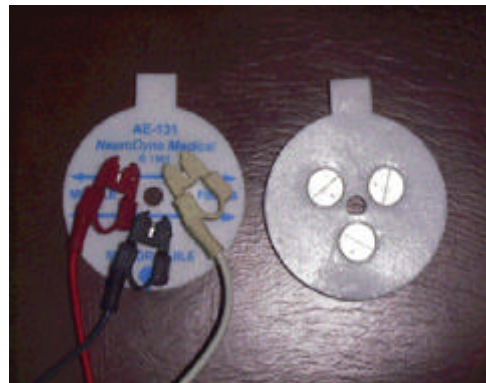
MP100SW (BIOPAC System Inc., USA)

(electrode) AE-131 circular surface EMG disposable electrode (NeuroDyne Medical Corp. MA. USA)

(1). 12 mm

3

20 mm



1. AE-131 circular surface EMG disposable electrode

3.

7가

2가

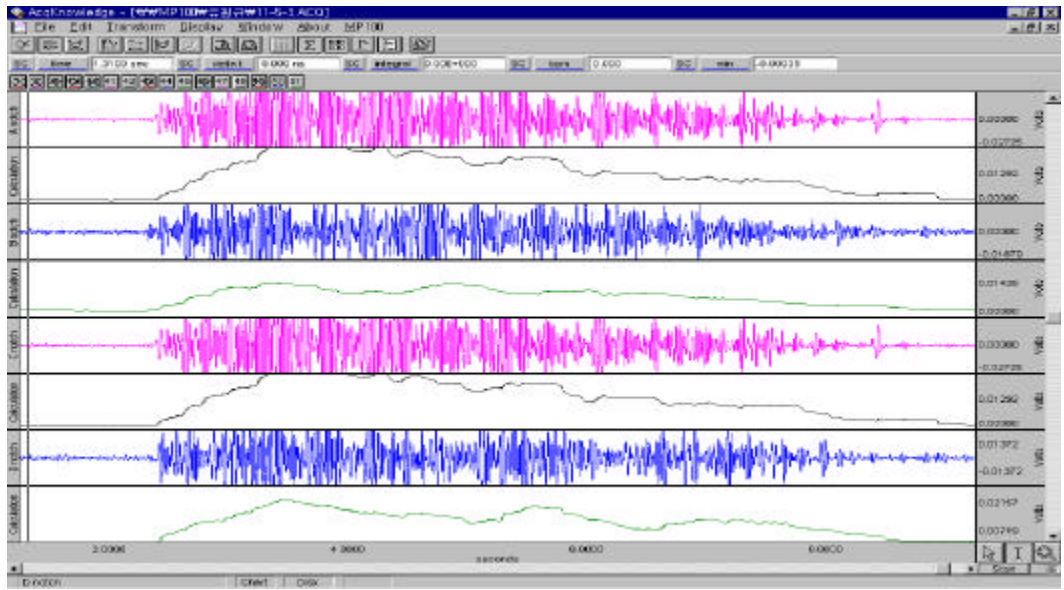
1995).

3 cm

(Roy,

5

3 cm (multifidus)



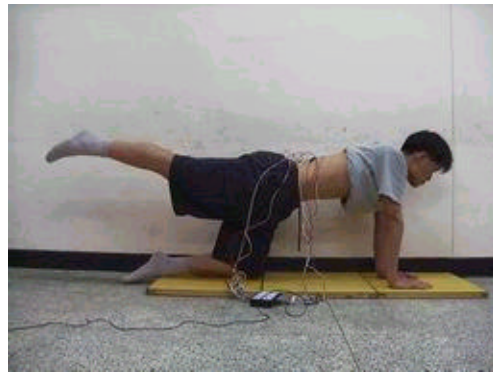
2.

6 , 1 <6>
 5 (8), <7>
 . 6
 “ ” (9).
 , <1>
 20% (10),
 3 . <2>
 3 40%
 , <1> <2>
 . 가
 . 20% 40%
 <7> 가 ,
 (maximum voluntary contraction; 100
 %MVC) . <1>, <2>, <3>, <4>
 , <5>, <6>, <7>
 . <1>
 (3), <2>
 (4), <3>
 (5), <4>
 (6),
 <5> 가
 (7),
 .

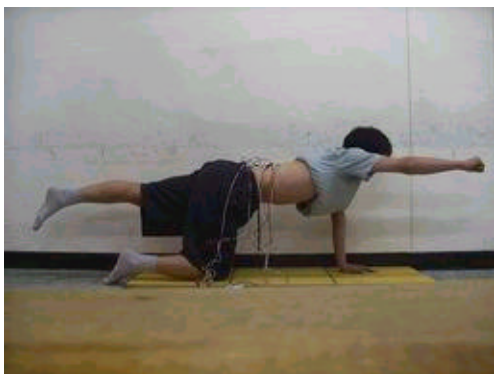
10 cm (Blackburn
 Portney, 1981). 가
 3 cm



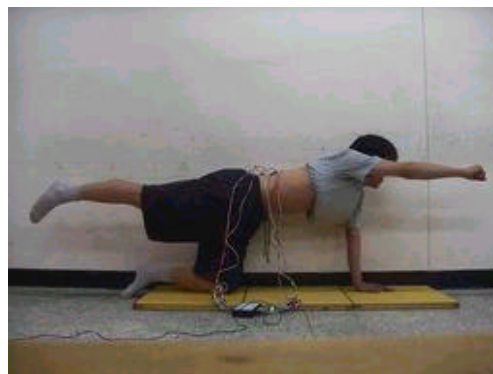
3. <1>



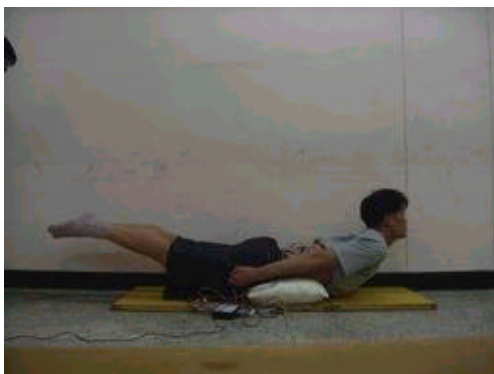
4. <2>



5. <3>



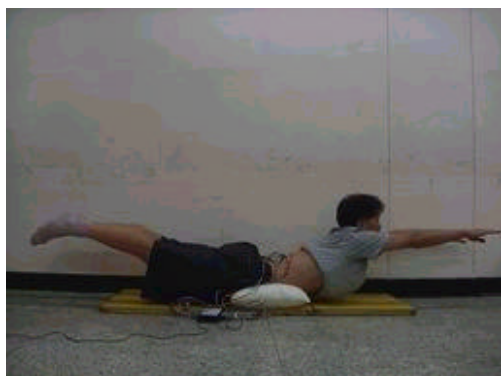
6. <4>



7. <5>



8. <6>



9. <7>



10.

4. band pass filter (low; 40 Hz, high ; 250 Hz), notch filter(60 Hz) Rectify RMS (Root Mean Square) smoothing gain 1000 , 500 sample/sec (2). Acqknowledge 3.53 (Biopac System Inc. CA. USA) 1 5

5. SPSS/Win (version 8.0) , GraphPad Prism . (single-factor repeated measure designs) (Bonferroni's correction) t- (paired t- test) . .05

1. (n=20)

	±	
()	26.60 ± 4.08*	21 32
(kg)	70.45 ± 6.77	60 82
(cm)	175.60 ± 4.08	167 183

* ±

1. 67.54% , 59.42% ,
<6> 86.00% ,
77.07% (2).
(%MVC)
(1).
가 <1> ,
26.0 ,
70.4 kg, 175.6 cm . <3> , <4> , <5> , <6>
가
2. (p<.05, p<.01), <2>
(%MVC) 가 (p
<.01),(11). 20% (p
<7>
(100 %MVC) 33.36% , 32.49% ,
<1> 40%
, 28.48% , 15.56% , <2> 77.12% ,
19.12% , 76.59% , 가 (p>.05),(3).
29.95% . <3>
40.16% , 22.64%
, <4> 54.05% ,
34.41% . <5>
2. (%MVC) (n=20)

	±	±	t
1	28.48 ± 9.04	15.56 ± 4.44	6.951**
2	19.12 ± 4.78	29.95 ± 5.86	- 10.236**
3	40.16 ± 11.87	22.64 ± 6.46	9.488**
4	54.05 ± 16.75	34.41 ± 13.60	8.264**
5	67.54 ± 11.28	59.42 ± 10.63	2.305*
6	86.00 ± 10.12	77.07 ± 14.45	2.427*
7	100.00 ± .00	100.00 ± .00	- 1.015

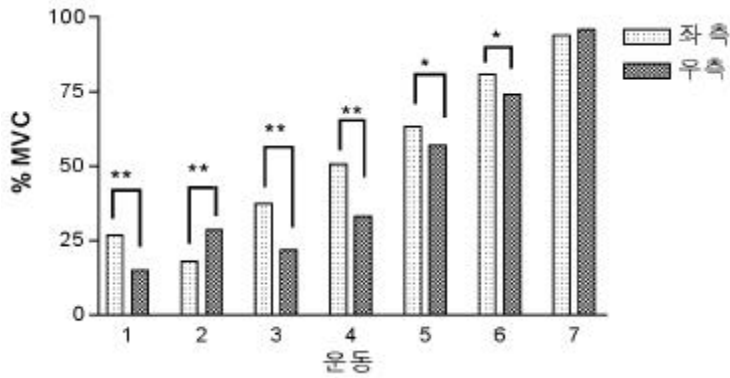
*p<.05, **p<.01

3. (n=20)

	±	±	t
1	33.36 ± 10.07	32.49 ± 9.17	- .046
2	77.12 ± 18.58	76.59 ± 18.93	- 1.157

4.	(%MVC)	(n=20)
106778.9	6	17796.4
117657.1	6	19612.5

**p<.01



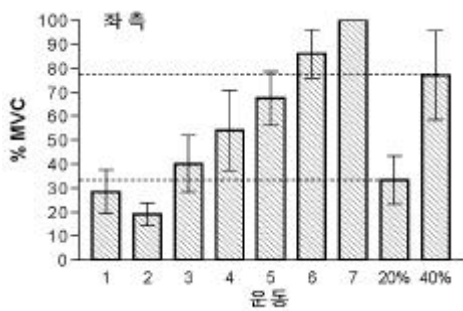
* p< .05, ** p< .01

11 . (%MVC)

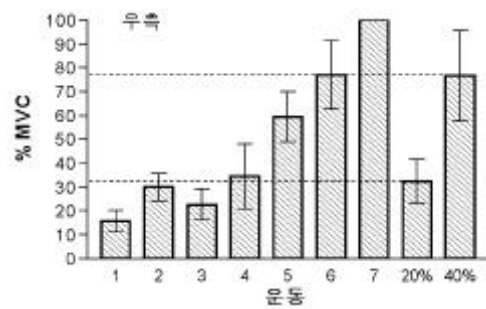
3.
 (%MVC)
 가

4.
 (%MVC)
 7가
 20%, 40%

(p<.01), 20%
 (4). 가 <2> , <1>, <2> ,



12. (%MVC)



13. (%MVC)

<3> 가 <3>, <4>, <5>, <6>, <7>
40% 가
<6> <7> , Callaghan (1998)
<7>
, <6> 가
(
,
12),(13). 가
. Arokoski (1999)

VI.

, 가
가
,
(Handa , 2000). <1>, <2>, <3>,
가 <4> . <1>,
<3>, <4>
(Carpenter Nelson, 1999; Parkkola , 가 , <2>
1992; Taimela Harkapaa, 1996). 가
Callaghan (1998)
가
(Nachemson , 1969). , 가
7가 , 가
가
20% 40% <2>
가 ,
<3> 가
가 가 <1>
<3>, <2>, <4>, <5>, 가 <4>
<6>, <7> 가
가 가
<2> 가 <1>, <2>, <3>, <4>
, <1>, <5>.

<6>, <7>

<1>, <2>, <3>, <4>

<5>, <6>

가

가

가

가

Mayer (1999) VARC (variable angle
Roman chair)
(torque)

가

가

가

. Nouwen

가 가

, (1987)

가

가

Andersson (1977) 3

가 가

가 가

가

Callaghan (1998)

1 5

3 cm

10 kg

60°

40%

20%,

가

(Floyd Silver,
1995; Nouwen, 1987; Valencia Munro,
1985; Wolf, 1979).

, <1>, 1 5

<2>

<1>, <2>, <3>

20%

가

<1>, <2>, <3>, <4>, <5>

(Moritani Muro,
가

40%

가

가

(Floyd Silver, 1995; Sihvonen
, 1988). Rozendal Meijer(1982)

7 가

V. . 1997;15:304-309.

20 가. . 2000;
18:181-190.

(%MVC)
7가 . 1998;22(1):68-76.

가 가. . 1994;18:248-255.

가 가 . 1998;16:411-417.

20% Anderson GBJ, Jonsson B, Ortengnen R, et al. Quantitative electromyographic studies of back muscle activity related to posture and loading. *Orthop Clin North Am.* 1977;8:85-96.

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40% 가 Arokoski JPA, Kankaanpaa M, Valta T, et al. Back and hip extensor muscle function during therapeutic exercises. *Arch Phys Med Rehabil.* 1999;80:842-850.

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가 Callaghan JP, Gunning JL, McGill SM. The relationship between lumbar spine load and muscle activity during extensor exercises. *Phys Ther.* 1998;78:8-18.

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