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Abstract

## The Effect of Knee Exercises on the Onset Time of Vastus Medialis Oblique and Vastus Lateralis Muscle.

Kim Myoung-jin, M.Sc., P.T.

Dept. of Physical Therapy, Yeoungdong College

Kim Ji-won, M.Sc., P.T.

Dept. of Anatomy, Wonju College of Medicine, Yonsei University

Lee Jae-on, B.H.Sc., P.T.

Dept. of Physical Therapy, Saeroun Hospital

Park Kyoung-hee, B.H.Sc., P.T. Shin Hwa-kyoung, B.Sc., P.T.

Dept. of Rehabilitation Therapy, The Graduate School, Yonsei University

The purpose of this study was to investigate the effect of knee exercises on the onset times of vastus medialis oblique muscle (VMO) and vastus lateralis muscle (VL) and in healthy subjects. Fifteen subjects (7 men, 8 women) in a mean age of 26.4 years participated in the study.

Electromyographic (EMG) signals were recorded from the VMO and VL under four exercises. Knee exercises consisted of open kinematic terminal knee extension, straight leg raising, isometric hip adduction exercise, and closed kinematic terminal knee extension. No significant differences were found in the onset times of EMG activities of VMO and VL in the four exercises. There were also no significant differences among the exercises. These results coincided with previous studies that found no difference between onset of VMO and VL . However, it is difficult to say that there is no difference between onset of VMO and VL in healthy subjects. To confirm this results, further researches that follow same onset determination metod

and exercises are needed. Not only is the study of onset time of muscle needed, but also the studies of the amount of activation and the rate of increase of muscle activation are needed.

Key Words: Patellofemoral pain; Onset time; Knee exercise.

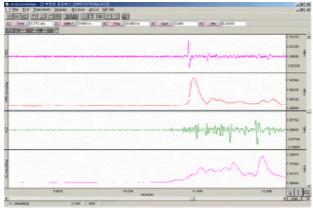
2

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가
                                                                . Gilleard
                                                                            (1998)
                        (patellofemoral pain
                                                          가
syndrome)
                        , 1999; Powers
1996),
                                                                      , 가
                                 (Callaghan
   Oldham, 1996; Powers
                            , 1996).
                                    (quad-
ricpes muscle)
                                                                                       가
가
                     (subluxation)
                                                                                가
 (vastus medialis oblique)
                                                             (Gilleard
                                                                       , 1998).
(vastus lateralis)
                  , 1983; Welsh
        (Levin
                                   Woodall,
                                                                          가
1990).
                  (onset time)
                                                                    가
           , 1998; Witvrow , 1996). 가
(Gilleard
                                                               가
    (Gilleard
              , 1998).
  Witvrouw
               (1996)
                                      (knee
                                 가
reflex)
                                                1.
   가
                                              23 31
                                                                         15
                             Willet (1995)
                    Karst
       Powers
                  (1996)
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가

가 (Quadriceps angel: Q angle) 3. 2000 7 11 9 가. 2000 11 13 12 10 가 10 cm , 6 8 cm 15° 2. MP 100WS (BIOPAC 가 4 cm , 3 cm System Inc., CA. USA) EMG amplifier 55° module EMG100B 가 (AE-B1 circular surface EMG disposable electrode patch NeuroDyne Medical Corp. MA. USA) . sampling rate 500 Hz , 60 integration Hz band stop filter, 20 250 Hz band pass (3SD: standard deviation) 30 ms filter zero off set 가 full-wave rectified

cutoff frequency 3 Hz low pass



1. full wave rectified

```
(onset time difference: OTD; 가
                                                  hip adduction exercise)
                                               60°
                                                                    30°
                                                         가
                       가
                                               4)
3
     5
                                                      (Closed kinematic terminal knee
                                     8
                                                  extension)
                                                                             30°
                                             (ischial tuberosity)
                             5
                   가
                                               4.
                                                             SAS version 6.12
                                      30
                                                                                    .05
                    . 1) 2)
                                   3 kg
                                                   (OTD)
           1), 2), 3)
                    , 4)
                                                           (two-way ANOVA)
  1)
         (Open kinematic terminal knee
     extension)
                                               1.
                                                                           26.4 ,
          30°
                                                    59.6 kg,
                                                                         166.3 cm ,
                                                                          1).
                                                                                  가
                                               2.
  2)
                 (Straight leg raising)
                                                                     가
                                                  2
                                                                              (OTD)
  3)
                                (Isometric
```

1.					(n=20)
		7		±	
	( )			26.4 ± 2	4 23 31
	(kg)			59.6 ± 9	8 45.0 78.0
	(cm)			166.3 ± 7.	5 158.0 178.0
1), 2), 3)		4)		·	(Fulkerson
	,	4)			Shea, 1990; Holmes Clancy, 1998; Insall, 1982). Lieb Perry(1968)
3.	(OT D)				가
					,
		,		.6467	
		가		( 2).	가
2.					·
		,		F	
	3	2.87	.96	.56	,
	14	.01	.00	.00	(squatting), (kneeling)
		•			(Brukner Khan, 1993), (weakness), (Henry Crosland, 1979).
3.					
					(sec)
	1				.0277 ± .0514
	2				$.0258 \pm .1206$
	3				$.0089 \pm .0853$
	4				0008 ± .1426

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Clancy, 1998; Fulkerson
        (Holmes
                                                                               가
  Shea, 1990),
                      (Outbridge, 1964),
                                                                  가
               (Levin, 1979).
                                       가
                                                                  , 3
                                 (tracking)
                                             (
                                                     15
                                                            4
                              (Fulkerson
Shea, 1990).
                                             (Callaghan
                가
                             가
                                                          Oldham, 1996).
                              (Insall, 1982;
                                                     (adductor magnus)
Voight
       Weider, 1991).
                                       가
                                                    (Hanten
                                                               Schulthies, 1990; Levin
                                               , 1983).
                                             30
                                                              가
가
                              가
                                       가
                                                         15
                                                                   30
                                                                       (Francis
                                                                                  Scott,
                                             1974).
                     가
                 가
                                 (Grabiner
 , 1994).
                            가
                                                    가
                       (Grabiner
                                   , 1994;
        Willet, 1995; Morrish
                                 Woledge,
Karst
1997; Power , 1996; Sheehy
                                                 가
                                   , 1998;
                                                          가
Voight
         Weider, 1991).
                                                      가
        가
                                                                   Willet, 1995; Powers
                                                           (Karst
                                               , 1996).
                                               Voight
                                                          Weider (1991), Witvrouw
                                             (1996)
(DiFabio, 1987; Powers , 1996; Voight
                                                    가
Weider, 1991).
                                                                , Karst
                                                                          Willet (1995)
                                             가
                                                                               가
                                                      , Powers
                                                                 (1996)
                                                                                     가
               (Scuderi
                          , 1992).
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30 ms

가 (2001)가 . Cowan (p > .05). 가 가 가 가 가 가 (2001)15 Cowan 20 ms 가 가 . 1999;23(6):1229-1235. Brukner P, Khan K. Clinical medicine. Sydney. McGraw-Hill, 1993:376. 가 Callaghan MJ, Oldham JA. The role of 가 quadriceps exercise in the treatment of patellofemoral pain syndrome. Sports Med. 1996;21:384-391. 가 Cowan SM, GrandDip, Bennell KL et al. 가 Delayed on set of electromyographic 가 activity of vastus medialis obliquus relative to vastus lateralis in subjects with patellofemoral pain syndrome. Arch Phys Med Rehabil. 2001;82:183-189. Cram JR, Kasman GS. Electrode placement. In: Introduction to Surface Electromy ography. Aspen Publishers, Inc., Gaithersburg, Mayland. 1998:363-366. 가 Di Fabio RP. Reliability of computerized surface electromyography for determining 15 the onset of muscle activity. Phys Ther. 1987;67:43-48. Francis RS, Scott DE. Hypertrophy of the vastus medialis in knee extension. Phys Ther. 1974;54:1066-1070. 3 Fulkerson JP, Shea KP. Current concepts

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