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ORIGINAL ARTICLE

Effect of Low Intensity Modified Hölmich Protocol on Long-Standing Adductor Longus Related Groin Pain

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ABSTRACT

Aim: To evaluate the effect of low intensity Modified Hölmich Protocol (MHP) for long-standing groin pain on pain, and return to sport.

Place and duration: Tehran University of Medical Sciences and Lebanese football club clinic from March 2021 till September 2021.

Methods: Ten male soccer (age= 24±4.8 yrs.) with adductor longus related groin pain underwent 10-weeks of Low intensity MHP.

Results: All outcome measures, except SEBT, improved significantly($p<0.05$) in all participants at week 10 as in pain, BKFO, and return-to-sport, muscle strength.

Conclusions: Ten-week of low intensity Modified Hölmich Protocol were sufficient to induce significant improvements in all clinical measures with all participants in our study.

Keywords: Modified Hölmich Protocol, Long-standing Groin pain, Low Intensity.

INTRODUCTION

Groin Pain (GP) is one of the existing problems among professional and amateur athletes, representing around 5-18% of sports injuries(1) with Adductor Longus related Groin Pain (ALrGP) representing 58% of all forms of sport(2). The treatment of GP represents a real challenge in sports medicine especially when we deal with a long-standing pain that requires a long period to fully return to sport (RTS) after rehabilitation(3). In the literature, studies show that Exercise Therapy (ET) fits as the first choice to treat long-standing pain and achieves significant outcomes(4).

Hölmich et al. in their randomized control trial recommended sport physiotherapists to use their protocol as an effective intervention in treating ALrGP(5). This recommendation was supported by Shadmehr et al. in 2018 where they developed a modified version of the Hölmich protocol called Modified Hölmich Protocol (MHP) by adding stretching, elastic bands strengthening, core strengthening, running program, Copenhagen Adduction (CA) and avoiding hip abduction/adduction sliding to the original one. Accordingly, Shadmehr et al. reported the superiority of MHP in terms of safety and effectiveness compared to the Hölmich et al. ET protocol(6).

In ET, the parameters of the exercise must be well identified (optimal dose) including repetitions, sets, intensities, durations, frequencies, number of total exercises, and progression of each exercise have not been carefully recorded in clinical trials(7).

The aim of this study is to evaluate the effect of low intensity of exercise treatment based on MHP on long-standing ALrGP.

MATERIALS AND METHODS

The Ethics Committee of Tehran University of Medical Sciences approved the study and it was conducted in accordance with the Declaration of Helsinki (1964). Ten male soccer players (18-35 years age) with long-standing ALrGP and clear from any other trauma preventing him to follow the exercise training, underwent 10-weeks of MHP after signing an informed consent form.

Treatment: The treatment consisted of MHP suggested by Yousefzadeh et al. 2018(6) under the supervision of a trained sport physiotherapist (Figure 1). Note that, the participant will continue his normal pain-free training with the team and he rest if pain is felt at any time during team training.

The minimum duration of treatment was 10 weeks. Intensity identification session was held one week before the protocol treatment starts to exclude any effect of muscle fatigue(8) and low exercise intensity was well defined.

Figure 1: One of the exercises that the participants performed during the second phase of modified Hölmich et al. protocol. (Copenhagen)

Figure 1: Testing the movement intensity by placing a sphygmomanometer calf in a way that it is stressed and the mercury level changes accordingly

For isometric hip adduction: we identified the 100%MVC (peak torque) of adduction using Biodex Dynamometer (BIODEX MULTI-JOINT SYSTEM – PRO, New York) and then we adjusted low- intensity 10% MVC(9). For the application of 10% MVC (peak torque) during the treatment, we used a sphygmomanometer (MERCURIAL SPHYGMOMANOMETER KAWAMOTO CORPORATION OSAKA, JAPAN) which is a reliable tool. For

each movement intensity test, we placed the sphygmomanometer calf around the knee in a way that it will be stressed under the arm of the Biodex dynamometer and the mercury label move till a certain level (peak torque) (Figure2). For applying low resistance in dynamic exercises, we identified the 1RM for each exercise in the pre-treatment session and we applied low intensity exercises at 40% of 1RM(10). The intensity can be changed to the targeted percentage of 1RM by using weights or elastic bands with different resistances as needed. Note that, 1RM will be assessed every two weeks as a progression of exercise intensity.

For balance exercising, in addition to warm-up and stretching exercises, the intensity was not changed because it is considered as functional and overall exercising.

In addition to Copenhagen Adduction exercises, where the intensity was identified based on previous studies.(11)

A single-blinded therapist evaluated the athlete one week before starting the treatment to avoid any fatigue when we start training(8) and at week 10. Pain was assessed and recorded based on the visual analogue scale (VAS) against resistance "squeeze test" and during functional tests. Biodex dynamometer (BIODEX MULTI-JOINT SYSTEM – PRO, New York) was used to assess maximal isometric hip adduction (IHAD), maximal isometric hip abduction (IHAB), maximal eccentric hip adduction (EHAD), maximal eccentric hip abduction (EHAB) and maximal IHAD/IHAB and maximal EHAD/EHAB ratios. The Bent Knee Fall Out Test was used to measure total hip range of motion in a crook lying position. Star excursion balance test (SEBT) was used to assess the effect of our intervention from the functional point of view. We counted the time needed for the player to RTS in weeks and days; medical clearance of an athlete for full participation in sport without restriction(12).

RESULTS

The dependent variables had normal distribution (Kolmogorov-Smirnov test), a paired-sample t-test was used for comparison between before and after MHP to see the significance of mean difference. We maintained the statistician's blindness to the treatment protocol and outcomes until the analysis was completed. We used a double data entry process and SPSS Statistics (Version 26), for the data analysis. We established the alpha level at .05 for all statistical analyses.

Table 1: Basic characteristics of the participants

	Mean ± SD
Age (years)	24±4.8
Height (cm)	172.6±3.5
Weight (kg)	70.9±5.1
Duration of Injury (weeks)	6.8±3.9
Location of Injury	6 Right, 4 Left

Table 2: mean, standard deviation of variables difference before and after MHP and Paired Sample t-test

		Low Intensity MHP		
		Mean ± SD		Sig. (2-tailed)
		Pre	Post	
Pain (VAS)	Squeeze	4.7±0.6	1.8±0.9	0.000
	Functional	3.7±1	0.9±0.7	0.000
BKFO (cm)	Right	13.9±2.5	14±2.5	0.037
	Left	13.8±2.6	14.1±2.4	0.022
SEBT (sec)	21±2.5	18.8±3.4	0.105	
Muscle Strength (N-M)	IHAD	115.5±11.4	126±13.1	0.000
	IHAB	24.2±3.1	35.3±4	0.000
	EHAD	120.4±2.7	132±3.7	0.000
	EHAB	21.3±1.4	33.6±2.4	0.000
	IHAD/IHAB	4.8±0.5	3.5±0.3	0.000
	EHAD/EHAB	1.7	0.3	0.000
RTS (weeks)	17.3±1.3			

Ten athletic male footballers with ALrGP (mean age= 24±4.8 years) were tested in this study. The basic characteristics of the participants are shown in table 1. The mean, standard deviation of variables difference before and after MHP, in addition to paired t-test are shown in table2.

A re-evaluation follow-up was done at the end of week 10 showed that all participants returned to full sports activity without any GP symptoms (mean=17.3±1.3 weeks). Pain decreased significantly after low intensity MHP ($p<0.05$). The ROM of both hips, in addition to muscle strength of hip abductors and adductors increased significantly (isometric and eccentric) after intervention ($p<0.05$) and muscle strength ratios improved significantly. SEBT difference mean decreased after treatment but it was not significant pre-post treatment after low intensity.

DISCUSSION

The aim of this study was to identify the effects of low intensity MHP applied on ten athletes with long standing ALrGP on pain and return-to-sport as well as other outcome measures.

Return to Sport: The rehabilitation of tendon injuries should promote tissue healing taking into consideration the loading environment and the anatomic location of tendons that are essential factors in accelerating the RTS (13). After accomplishing the full treatment protocol, all participants (n=10) have returned to fully participating in training and competitions without any GP related symptoms with a mean time span of 17.3±1.3 weeks from the baseline assessment. This result is in line with previous study conducted by Shadmehr et al. in 2018 who reported that MHP lead to a RTS of 86.6% of participants after 12.06 weeks of training (Shadmehr et. al 2018).

Pain: Generally, a previous systematic review performed by Daniel et al. in 2020 was found reporting that ET had greater effect on pain locally and remotely as well as on pain sensitivity and pressure pain threshold than other treatment intervention protocols(14). Our results were supported by Shadmehr et. al in 2018 who compared Hölmich protocol to MHP on Long Standing ALrGP by a decrease of pain during leg adduction against resistance from 5.07 to 0.27 and during functional tests from 5.20 to 0.75. Stefano Balducci et al. suggested that the analgesic effects of exercise are intensity-dependent(15,16), thus, we suggest future studies might compare the effect of low intensity training to different intensities.

Hip muscle strength (abductor/adductor): Pre-post mean differences of the maximum peak torque of the relevant muscles' strength changed significantly ($p<0.05$). These results were confirmed by the findings of Shadmehr et al. in 2018. The improvement seen with low intensity exercises might be due to the absence of "Delayed-Onset Muscular Soreness" and "exercise-induced muscle damage" as stated by Stéphanie Hody 2019(17).

Total Hip range of motion (ROM): The total hip ROM increased significantly after treatment with low MHP ($p<0.05$). We hypothesize that this is due to the effect of stretching. The results of Taizan et al. support this hypothesis by showing that the ROM increased significantly after stretching in low-intensity intervention(18). Other hypothesis might explain this result; suggested that training both agonist and antagonist muscles in the same protocol or performing exercises at full analytic range of motion might affect the overall total range of motion(19–21).

Functional ability: It's worth mentioning that the use of SEBT has not been reported in any other study on the effect of ET in GP rehabilitation. Despite the improvement of SEBT with after 10 weeks of intervention using low intensity MHP compared to baseline assessment, the paired sample t-test show no significant difference pre-post treatment. The lack of significant differences pre-post treatment in SEBT might be due to the consideration that bidirectional and multiple directional tests have not been affected by the intensity of exercises applied. This statement was partially explained by King et al. in 2016 who suggested that independently from exercise intensity, linear running program may increase patients' load tolerance and exposure to avoid injury(22) while change of direction drills is more effective at improving change of

direction performance than strength training or sprint training alone(22).

CONCLUSION

Ten-week of low intensity MHP were sufficient to induce significant improvements in all clinical measures with all participants in our study, except SEBT. Future studies might compare different intensities of MHP other than low intensity trying to figure out better results with more number of participants.

Data Availability: The data that support the findings of this study are available from the corresponding author, upon reasonable request.

Conflict of interest: All authors declare that there is no conflict of interest in this paper.

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