Isokinetic Evaluation of Hip Muscles in Osteitis Pubis in Soccer Players

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ABSTRACT

Osteitis pubis (OP) in athletes is an old problem and its etiology is still the subject of debate. The purpose of the study was to compare the isokinetic torques for the hip flexors/extensors, and hip abductors/adductors muscle groups in OP soccer players with that of normal athlete soccer players. Isokinetic data were collected from 20 osteitis pubis (OP) soccer players and 20 healthy male soccer players (control group). Peak torque/body weight (PT/BW) was recorded from hip muscles at isokinetic concentric contraction mode with a speed of 180^{o}/sec. A multivariate analysis of variance (MANOVA) was used for each hip muscle group's PT/BW to compare between control and OP group with the initial alpha level set at 0.05 with subsequent Bonferroni adjustments. Findings revealed a significant increase in hip flexors PT/BW value (dominant limb, control group versus affected limb, OP group). Control group hip extensor PT/BW mean value was higher than that of hip flexors. Both control and OP groups hip adductor PT/BW mean value was significantly greater than that of hip abductors. Hip flexion/extension and adduction/abduction muscle imbalance might therefore be the inciting cause of OP in soccer players.

Key words: *Osteitis pubis; Isokinetic evaluation; Concentric contraction; Hip muscle imbalance.*

INTRODUCTION

Osteitis pubis (OP) is defined as a painful, inflammatory, noninfectious condition of the symphysis pubis and surrounding structures[1,2]. It may be presented as an acute abdominal, pelvic, or groin pain[3]. It is a pathological process involving the pubic bone and pubic symphysis[4] and occurring in the fibrocartilagenous disk between bodies of two pubic bones. The true pathophysiology is not understood, although a number of theories exist[5]. Magnetic resonance imaging (MRI) to pubic symphysis of OP cases revealed the presence of fracture lines, so-called tension stress fractures. These fractures may be caused by torsional stresses across the pelvis[6].

The natural history of the OP is one of the progressive deterioration with continued activity, requiring a prolonged rehabilitation period and time away from sport[7]. The most common treatment of OP is prolonged period of rest. Unfortunately, this treatment is frequently met with recurrence of pain once the activity is resumed[4,6].

Soccer playing is associated with twisting, turning and kicking. These forces lead to severe biomechanical strain on the symphysis and its associated support structures[3,8]. Subsequently, a microtear occurs at the pubic attachment of the adductor longus. This is frequently a primary event, followed by the development of osteitis presumably secondary to the induced muscular instability, laxity, and secondary impaction of surfaces at the symphysis. Why a microtear at the adductor attachment occurs so frequently in soccer players is unclear. Although overuse of the adductor longus muscle with associated increased contractility and power in the muscle belly cannot be accounted for by the small adductor attachment, it is likely that a microtear might occur as a consequence of tendon stretching and applied traction due to twisting and turning or, more likely, secondary to both[8].

Muscle imbalance between abdominal muscles and hip adductors has been suggested as an etiologic factor in OP. Muscle imbalance across the pubic symphysis occurs because of eccentric loading and overloading from abdominal muscle pull superiorly and hip flexors, adductors, and abductor muscles pulling inferiorly. When an athlete kicks, the kicking limb is hyperextended at the hip while the trunk is rotated laterally in the opposite direction1[2,3,9,10].

However the pathogenesis of osteitis pubis remains obscure, previous studies are restricted to specific issues, such as describing the physical examination (include manual muscle test and flexibility test) of OP cases, these (subjective) investigations revealed hip flexor, extensor, adductor muscles weakness which might be the result of OP[11]. On the other hand, there is a short in the literatures on isokinetic evaluation of the major hip muscle groups in osteitis pubis athletes by objective examination, which was investigated in this study. Our aim was therefore to compare the isokinetic torques of hip flexors/extensors, abductors/adductors in osteitis pubis (OP) soccer players with that of normal soccer player athletes.

MATERIAL AND METHODS

This study was conducted at the isokinetic laboratory, Faculty of Physical Therapy, Cairo University. A sample of twenty soccer male athletes suffering of osteitis pubis was selected. The sample was referred from an orthopaedic sports clinic. Their age ranged from 15 to 27 years with a mean of (19.94±3.51), their height ranged from 167.5 to 185.5 cms with a mean of (176.16±4.93), and their weight ranged from 60.5 to 86.5 kgs with a mean of (70.91±7.26). The players were examined by the team's sports medicine specialist and orthopaedic surgeon. Clinical examination demonstrated severe pubic pain and weakness with isometric adduction, both in supine and supine with 60^{o} hip flexion (Squeeze test). Pubic symphysis palpation also produced pain. The pubic symphysis stress test brought on pubic pain with abduction and extension on both sides. Symptoms of osteitis pubis include pain when kicking or advancing the leg forward during the swing phase of gait, localized pain in the symphysis pubis, and pain in the lower portion of the abdominal muscle groups. The adductor muscles were evaluated bilaterally for pain and tenderness and increased muscle guarding in the muscle belly and at the musculotendinous attachments. Another group of twenty normal healthy soccer athletes were matched with the patient group regarding sex and age. Their age ranged from 17 to 28 years with a mean of (20.78±3.35), their height ranged from 168.5 to 182 cms with a mean of (176.0±4.15), and their weight ranged from 60 to 82.5 kgs with a mean of (71.33±7.35). They had no history of lower extremity surgery or trauma or back or hip injury. 90.0% of control athletes were right leg dominant, while 95.0% of OP soccer athletes were right leg dominant. Table 1 presents the general characteristics of the participants. All data and information of each subject were recorded on a recording data sheet. Universal height/weight scales were used to measure subject height and weight respectively.

Table (1): The general characteristics of the participants (mean±SD).

	Control group	OP group
Age (in year)	20.78±3.35	19.94±3.51
Height (in cm)	176.0±4.15	176.16±4.93
Weight (in kg)	71.33±7.35	70.91±7.26

Biodex 3 Multi-joint Testing and Rehabilitation System (Biodex Medical System, Shirley, NY, USA) was used to record muscle torque in each subject. It measured the internal torque produced by a group of muscles while the bony segment maintained a constant angular velocity and a preset range of motion. The isokinetic system also provided the final results in the form of test data, charts, graph records and printed results. Torque values were automatically adjusted for gravity by Biodex Advantage Software v.3.33. Calibration of the Biodex dynamometer was performed by the laboratory supervisor according to the specifications outlined in the manufacturer's service manual and was subsequently automatically conducted at the beginning of each test session. Study and control groups were familiarized with the objectives, equipment and procedures of the study.

All participants signed an informed consent form. Subjects executed a ten minute warm up bout prior to entering the laboratory and collecting hip strength measures. The warm up procedure consisted of stretching exercises for the hip flexors and extensors, hip abductors and adductors muscles. Throughout all testing with the isokinetic dynamometer, participants were verbally encouraged to perform maximal contractions through the following ranges of motion (ROM): The range of movement for hip flexion/extension was 110^o (recorded from -20^o hyperextension to 90^o of flexion); range of movement for hip abduction/adduction was 65^o (recorded from 20^o adduction to 45^o abduction). Participants were instructed to stop the test if they felt any unusual pain (intolerable pain for the OP group) or discomfort (for the control group) during the procedure using comfort stop buttons. These buttons provide the player with the ability to instantaneously terminate test by depressing either the large red button on top of the dynamometer or the hand-held remote button causing immediate cessation of dynamometer shaft rotation.

In OP patients, the non-involved side was tested first, followed by the involved one; whereas in the control group, the dominant limb was tested first. The testing limb order (in study and control groups) was done according to recommendations from the isokinetic manual (Biodex Medical System, Shirley, NY, USA). Leg dominance was demonstrated by the preferred kicking leg. Muscle group testing was conducted in a randomized order to prevent learning effects. Randomization was carried out using Latin table. A five minute rest period was given between muscle group tests. Testing was performed with the participants in the standing position as it was the most functional position, although associated with less stabilization. In order to allow performing hip movement tests from the standing position, the hip attachment was inserted into the knee adaptor and secured to the dynamometer (Fig. 1).

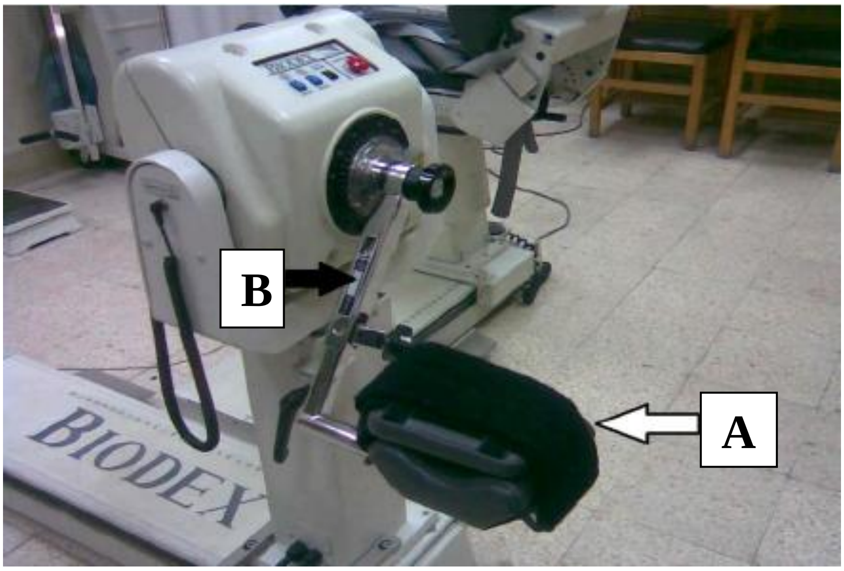

Fig. (1): The hip attachment (A) inserted into the knee adaptor (B).

Participants performed isokinetic concentric hip flexion/extension and abduction/adduction at a speed of 180^o/sec as previously recommended in the literature[12,13] and as supported by recommendations from the isokinetic manual (Biodex Medical System, Shirley, NY, USA). According to Brown and Whitehurst[14], for each of hip flexion/extension and abduction/adduction the test contained two sets, each one consisting of five repetitions, with a rest period of 60 seconds between each set. In each hip muscle test, the effect of gravity was compensated by gravity automatic correction. To correct the full influence of gravity effect torque on the data gathered, the player's limb is weighed. Test results are then automatically corrected in the software for gravity effect torque. To weigh the limb, the player's limb was placed at the angle of maximum gravity effect torque for the selected pattern. The player was instructed to relax the limb to be weighed, and then the weighed limb icon was clicked. The limb weight to be used for data correction was displayed. During hip flexion and extension, the player was positioned in the standing position lateral to the dynamometer system, the limb in neutral position, with the axis of the dynamometer aligned superior and anterior to the greater trochanter (Fig. 2).

During hip abduction and adduction, the player was positioned in the standing position facing away from the dynamometer with the axis of the dynamometer aligned with the anterior superior iliac spine (Fig.3).

Fig. (2): The player position during hip flexion /extension test.

Fig. (3): The player position during hip abduction/adduction test.

Muscle strength of the 4 major muscle groups of the hip (flexors, extensors, abductors, and adductors) was recorded. The highest value of 5 repetitions in each set was recorded; the mean value of both sets was used. The parameter evaluated was the peak torque (expressed in Nm) normalized to the participants' body weight (expressed in Nm/kg). Normalization was done in an effort to reduce intersubject variability in raw scores of quantitative muscle tests. The required data from each subject were then collected from the Biodex computer data chart, which showed the peak torque/body weight (PT/BW) of hip flexors, extensors, abductors, and adductors. Data were analyzed using a Statistical Package for Social Sciences (SPSS) version 15.0. To determine whether leg dominance affected injury status (affected limb) in osteitis pubis (OP) athletes, the Chi-Square (χ^2) test was used. To compare muscle strength of hip flexors, extensors, abductors, and adductors in normal versus OP subjects, a multivariate analysis of variance (MANOVA) was conducted. As a pre-requisite for the parametric multivariate analysis, Box's test for equality of covariance matrices was performed. This test assesses the multivariate homogeneity of covariance and the null hypothesis for the similarity of variance and covariance between groups.

The independent group factor was the study group; normal (control) group versus OP group. The within-subjects factor was the dominant leg versus nondominant (control group) and affected versus nonaffected (OP group), or which muscle group in either the control or study groups (hip flexors, extensors, abductors, and adductors versus each other). Finally, Pearson Product Moment Correlation Coefficient (r) was used to study the relationships between hip muscles in control and OP groups with alpha level set at 0.05. Level of significance for all tests was set at P <

0.05; (Kronbach's alpha level was set at 0.05; the confidence interval was 0.95). Subsequent Bonferroni adjustment and the least significant difference (LSD) test were used to locate the source of differences.

RESULTS

There was no relationship between leg dominance and injury status. Among OP group, the Chi-Square (χ^2) analysis of dominance versus affected limb was not significant (χ^2 = 0.5; P = 0.48). 60.0% of the injury occurred to the dominant leg of the OP athletes, while 40.0% occurred to the nondominant leg.

Box's test for equality of covariance matrices showed that there was no significant difference between covariance among the tested dependant variables (F=1.154, P=0.322). The results of hip flexors, extensors, adductors and abductors in the control group are presented in Table 2 and Fig. 4; those in the OP group are presented in Table 2 and Fig. 5. The results of multivariate analysis of variance (MANOVA) are presented in Table 3.

Table (2): The mean values of PT/BW (Nm/Kg) of hip muscles of control and OP groups.

Hip muscles	Groups	Group mean (±SD)	Limb	Mean	(±SD)
Flexors	Control	117.05±28.82	Dominant	113.12	23.76
			Non dominant	121.97	37.47
	OP	151.35±24.82	Affected	156.45	25.49
			Non affected	137.32	18.76
Extensors	Control	163.78±16.23	Dominant	170.33	12.47
			Non dominant	155.59	18.28
	OP	176.19±22.89	Affected	174.75	24.85
			Non affected	180.15	18.97
Adductors	Control	176.26±16.46	Dominant	179.36	18.62
			Non dominant	172.39	14.99
	OP	171.44±20.55	Affected	170.99	23.12
			Non affected	172.69	13.67
Abductors	Control	126.47±26.54	Dominant	127.74	35.13
			Non dominant	124.88	15.03
	OP	120.51±28.25	Affected	117.79	24.77
			Non affected	127.99	39.73

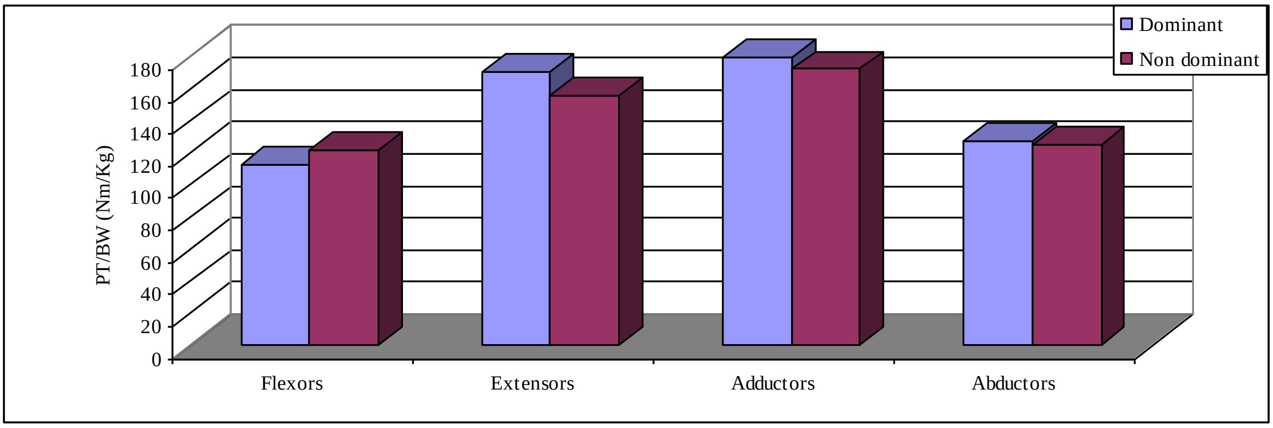

Fig. (4): The mean values of PT/BW (Nm/kg) of hip muscles of the control group.

Table (3): The Multivariate ANOVA for the hip muscles of control and OP groups.

Dependent Variable	F-value			P value
Hip Flexors	3.931			0.028*
Hip Extensors	1.137			0.381
Hip Adductors	0.313			0.891
Hip Abductors	0.098			0.887
Variables			Bonferroni	LSD
Hip Flexors	Dominant (control)	Non dominant (control)	1.000	0.624
		Affected (OP)	0.039*	0.007*
		Non affected (OP)	1.000	0.188
	Non dominant (control)	Affected (OP)	0.224	0.037*
		Non affected (OP)	1.000	0.422
	Affected (OP)	Non affected (OP)	1.000	0.230
Hip Extensors	Dominant (control)	Non dominant (control)	1.000	0.309
		Affected (OP)	1.000	0.701
		Non affected (OP)	1.000	0.495
	Non dominant (control)	Affected (OP)	0.810	0.135
		Non affected (OP)	0.689	0.115
	Affected (OP)	Non affected (OP)	1.000	0.665
Hip Adductors	Dominant (control)	Non dominant (control)	1.000	0.609
		Affected (OP)	1.000	0.446
		Non affected (OP)	1.000	0.624
	Non dominant (control)	Affected (OP)	1.000	0.905
		Non affected (OP)	1.000	0.983
	Affected (OP)	Non affected (OP)	1.000	0.885
Hip Abductors	Dominant (control)	Non dominant (control)	1.000	0.883
		Affected (OP)	1.000	0.528
		Non affected (OP)	1.000	0.990
	Non dominant (control)	Affected (OP)	1.000	0.677
		Non affected (OP)	1.000	0.880
	Affected (OP)	Non affected (OP)	1.000	0.550

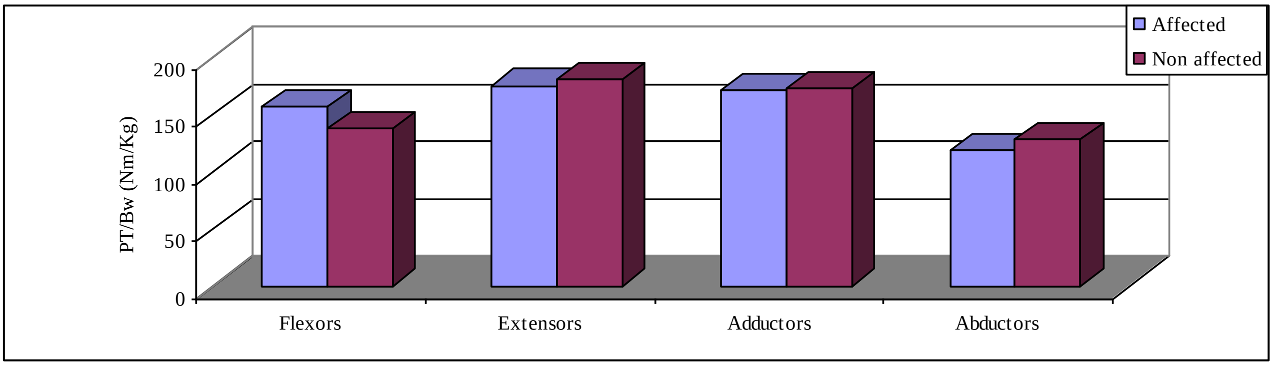

Fig. (5): The mean values of PT/BW (Nm/Kg) of hip muscles of the OP group.

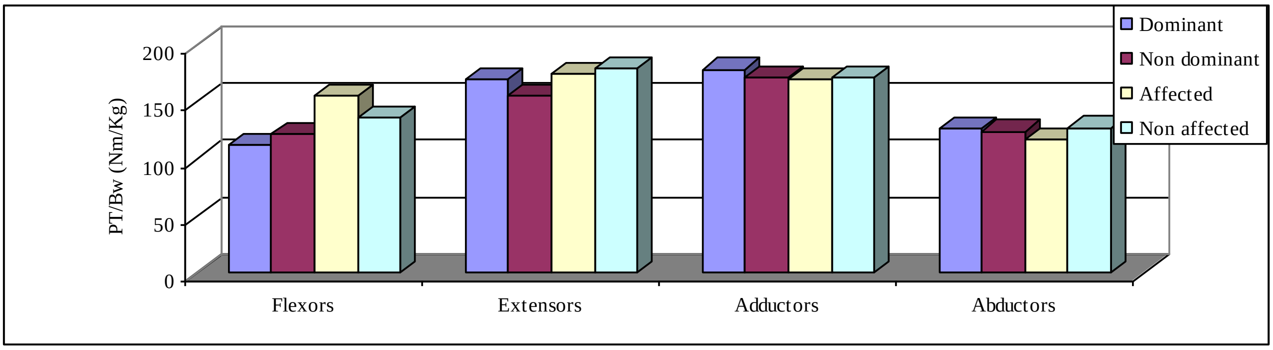

Fig. (6): The mean values of PT/BW of all hip muscles groups of the control group and OP groups.

There was no significant difference in covariance among the tested dependent variables (hip flexors, extensors, adductors and abductors) in the study group versus control group (F=1.154, P=0.322). However, the Bonferroni multiple comparison test revealed a significant increase in hip flexor PT/BW value between the dominant limb of the control group and the affected limb of the OP group (P<0.05). The LSD test, on the other hand, revealed a significant increase between the nondominant limb of the control group and the affected limb of OP group. These results are presented in Table 3 and Fig. 6. Neither the Bonferroni multiple comparison test nor the LSD test revealed any significant difference (P>0.05) in hip extensor, adductor or abductor PT/BW values between the control and OP groups of athletes. However, PT/BW values of hip extensors tended to be higher in the OP group than in the control group (Table 2, Fig. 6). Similarly, neither the Bonferroni multiple comparison test nor the LSD test revealed any significant difference (P>0.05) in the mean PT/BW values between the dominant and nondominant limbs in the control group. Nor did they reveal any significant difference (P>0.05) in the mean PT/BW values between the affected and nonaffected limbs of the OP group (Table 3, Fig. 6). In the control group, and according to the Bonferroni multiple comparison test and the LSD test, hip extensor PT/BW mean value was higher than that of hip flexors; in both control and OP groups. Hip adductor PT/BW mean value was significantly greater than that of hip abductors.

According to Pearson Product Moment Correlation Coefficient (r), there was a non-significant weak positive correlation between the hip flexors and adductors muscles in the OP group (r = 0.159, P = 0.515) with a regression equation of (hip adductors = 156.09+0.09* hip flexors) (Fig. 7). In the control group, on the other hand there was a non-significant weak negative correlation between the hip flexors and adductors muscles (r = 0.354, P = 0.195) with a regression equation of (hip adductors = 195.39 - 0.20*hip flexors) (Fig. 8).

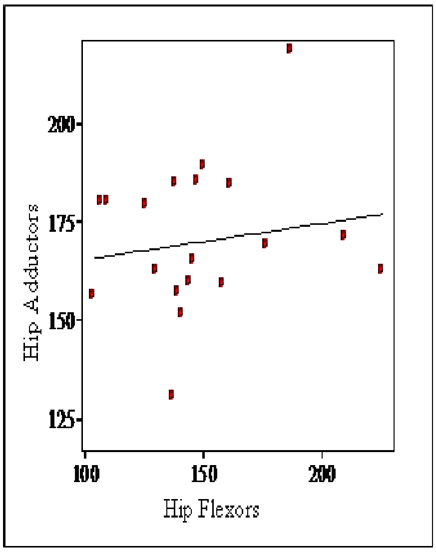

Fig. 7. The scatter plot for the bivariate correlation between the hip flexors and adductors muscles in OP group.

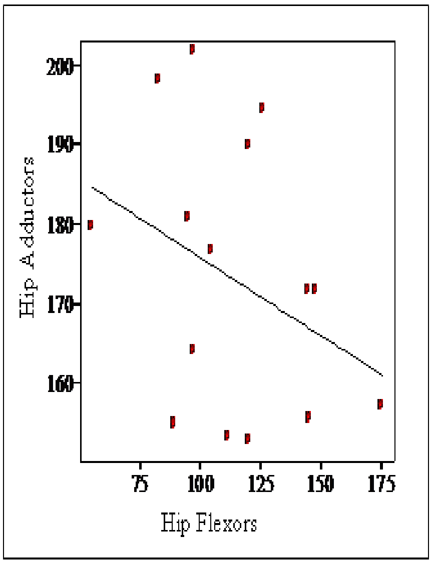

Fig. 8. The scatter plot for the bivariate correlation between the hip flexors and adductors muscles in control group.

DISCUSSION

The aim of this study was to compare the isokinetic torques of hip flexors/extensors, abductors/adductors in osteitis pubis (OP) soccer players with that of normal soccer player athletes. The results revealed the following. 1. There was no relationship between leg dominance and injury status. 2. There was no significant difference in covariance among the tested dependent variables (hip flexors, extensors, adductors and abductors in the study group versus the control group. 3. The Bonferroni multiple comparison test, on the other hand, revealed a significant increase in hip flexor PT/BW value between the dominant limb of the control group and the affected limb of the OP group. The LSD test, on the other hand, revealed a significant increase between the nondominant limb of the control group and the affected limb of OP group. 4. Neither the Bonferroni multiple comparison test nor the LSD test revealed any significant difference in hip extensor, adductor or abductor PT/BW values between the control and OP groups of athletes.

However, PT/BW values of hip extensors, adductors, and abductors tended to be higher in the OP group than in the control group. 5 Similarly, neither the Bonferroni multiple comparison test nor the LSD test revealed any significant difference in the mean PT/BW values between the dominant and nondominant limbs in the control group. Nor did they reveal any significant difference in the mean PT/BW values between the affected and nonaffected limbs of the OP group. 6. In the control group, and according to the Bonferroni multiple comparison test and the LSD test, hip extensor PT/BW mean value was higher than that of hip flexors. 7. In both control and OP groups hip adductor PT/BW mean value was significantly greater than that of hip abductors. 8. According to Pearson Product Moment Correlation Coefficient (r), there was a non-significant weak positive correlation between the hip flexors and adductors muscles in the OP group. 9. In the control group, on the other hand there was a non-significant weak negative correlation between the hip flexors and adductor muscles.

As the results demonstrated the absence of any significant effect of leg dominance on the injury status, it is concluded that the site of affection in the OP group (left or right) was not influenced by leg dominance. This may be due to symmetry in training program for both lower limbs. This result is similar to that found by O'Connor[15] who stated that the site of the adductor strain (left, right or bilateral) was not influenced by leg dominance among groups with and without a groin injury of professional rugby league players. The peak torque/bodyweight (PT/BW) values of hip muscles for OP soccer players are unique to this study. No other study was found to measure peak torque values for hip flexion, extension, adduction, and abduction. However, several studies reported peak torque of hip muscles in normal athletes[13,16], or the effect of specific training program on the symptoms of OP[1,8,17,18,19].

There was no significant difference in covariance among the tested dependent variables (hip flexors, extensors, adductors and abductors) in the study group versus control group. However, the Bonferroni multiple comparison test revealed a significant increase in hip flexor PT/BW value between the dominant limb of the control group and the affected limb of the OP group ($P<0.05$). The LSD test, on the other hand, revealed a significant increase between the nondominant limb of the control group and the affected limb of OP group. In the control group and according to the Bonferroni multiple comparison test and the LSD test, hip extensor PT/BW mean value was higher than that of hip flexors. Interpreting these results, we conclude that muscle imbalance between hip flexors and extensors might be an injury risk factor. The posterior muscle group of the thigh is at maximum strain during kicking activity (extreme hip joint flexion at a simultaneous finite extension of the knee joint). When the hip flexors are excessively active or tight; they cause exaggerated pelvic anterior tilt and the lumbar spine becomes excessively arched. Tight hip flexors cause the primary hip extensors (the gluteal group) to become lengthened and weak because of their agonist-antagonist action. When the primary hip extensors become extremely weak relative to the hip flexors, insufficient hip extension occurs during kicking consequently leading to OP. This hypothesis is supported by the observation that strength asymmetry of lower extremities may overload the pubic area[20]. So, weakness of hip extensors is associated with hyperactivity of hip flexors; the resulting imbalance leads to anterior pelvic tilt, which in turn increases the stresses on the symphysis pubis and the sacroiliac joint. The latter stresses lead to the development of OP, and excessive motion through the pubic symphysis. Our hypothesis is also supported by the following observations. A significant relationship was measured in female athletes correlating hip extensor weakness to sustaining an injury[21]. The flexibility of adductors, rectus femoris, and hip flexors were noted to be risk factors for injuries in elite European football players[9]. Also, significant weakness of all hip muscles (flexors, extensors, adductors, abductors) was found in soccer players suffering from groin pain[20]. This may be due to short number of cases of previous study (ten cases), in addition to different groups of sportsmen were examined.

In an attempt to find a possible cause for that imbalance between hip flexors and extensors, Fricker et al.[11] hypothesized that the nerve supply to the muscles and associated pelvic structures might be involved in OP cases. Pelvic pain induced either by pelvic vascular impairment or inflammation may cause reflex muscle spasm of hip rotators, flexors and adductors in particular. Symphysial pain and tenderness ensue aggravating the condition and causing symphysial instability.

There was no significant difference in covariance in adductor or abductor PT/BW values in the study group versus control group. Neither the Bonferroni multiple comparison test nor the LSD test revealed any significant difference in hip adductor nor abductor PT/BW values between the control and OP groups of athletes. This result may due to similarity in training mode, loads, body physique or same strengthening of muscle groups, the participants playing the same game and most of them in youth teams.

Neither the Bonferroni multiple comparison test nor the LSD test revealed any significant difference (P>0.05) in the mean PT/BW values between the dominant and nondominant limbs in the control group. This suggests that although all players favored one foot in kicking and receiving the ball, this had no effect on the strength of the limb. A possible explanation is that isokinetic movements cannot replicate the way muscles and joints work during actual soccer kick conditions; another explanation is the symmetry in training of both lower extremities. This observation is supported by the literature. In one study, no difference was found in musculature (in terms of muscle cross-sectional area and strength) between the dominant and non-dominant legs among well-trained soccer players, even[12]. Biomechanical analyses of instep soccer kick have failed to demonstrate any significant difference in isokinetic strength between dominant and nondominant legs of soccer players[22]. On the contrary, in another study, isokinetic data demonstrated significant asymmetry between dominant and nondominant limbs in male subjects[23]. The sample selection and the variation among the isokinetic testing devices may be the cause of the difference. Similarly, in this study, the Bonferroni multiple comparison test and the LSD test did not reveal any significant difference (P>0.05) in the mean PT/BW values between the affected and nonaffected limbs of the OP group. Possible explanations include bilateral affection of hip muscles or symmetry in strength training program.

In the control group, and according to the Bonferroni multiple comparison test and the LSD test, our results showed that the mean value of PT/BW of hip extensors was higher than that of hip flexors. This emphasizes the fact that the peak torque and power of hip extensors are the most informative parameters for estimating the efficiency of a training process in athletic sports. The observation itself might be accounted for like this: the hip extensors are one of the supporting muscles required during different supporting activities like landing, jogging, and during sprinting[24]. Besides, the hip extensor muscle group have the largest cross-sectional area of all the muscles in the body[13]. Similar conclusions were made by other authors[13,25,26]. Peak torque of hip extensors was found to be greater than that of hip flexors in Greek soccer players[25]. The hip muscles performance of normal subjects produced a higher peak torque in hip extensors at low and high speeds[26], and during kicking (dominant leg) or supporting (nondominant leg) at different skill levels among soccer players[13].

In the control group, hip adductor PT/BW mean value was found to be significantly greater than that of hip abductors. This could be explained as follows. As the adductors contract at toe off and continue through the early swing phase, they are more active with sprinting, and during kicking[13,27].

The same phenomenon was observed in professional rugby league players at each of the three test speeds for both the injured (groin injuries) and noninjured groups[15]. It was also observed among Greek soccer players at 180^o/sec[25]. A non-invasive method (MRI) used in identifying the thigh muscles involved in kicking in Australian Rules football players reported that the adductor muscles and the gracilis in the kicking leg displayed the highest levels of activity[28]. Similarly, in the OP group, and according to the Bonferroni multiple comparison test and the LSD test; hip adductor PT/BW mean value was significantly greater than that of hip abductors. This may be due to an overuse syndrome in running and kicking athletes leading to repeated mechanical shear strain on the symphysis associated with forceful adductor-muscle pull. Hip abductor and external rotator muscle weakness and hip abduction range of motion deficit have been implicated as a risk factor for groin injury in rugby league players[15,27].

Other authors[1,7,17] supported these results, they emphasized on adductor and gluteal muscles strength in the rehabilitation program. Some programs progressed from isometric to concentric adductor exercise[17]. Prevention, flexibility exercise, conditioning exercises, and correction of biomechanical problems (e.g., agonistantagonist muscle imbalances) were deemed of importance in rehabilitation[1,7]. Leetun et al.[29] noted that athletes who sustained an injury in their study displayed significantly less hip abduction and external rotation strength than uninjured athletes. Many authors[30,31,32,33] supported this. An extreme stretch, e.g. when a player makes a tackle, would force external rotation of the hip to its end range. Because of insufficient hip abduction, the abduction force would reach the pelvis and the weakest point, the pubic symphysis, would come under load[19]. This study demonstrated that, there was no significant difference between the control and OP groups of athlete neither for hip adductors nor for hip abductors. This may refer to similarity in training mode, loads, body physic, strengthening for the same muscle groups as the participants play the same game and most of them in youth team.

According to Pearson Product Moment Correlation Coefficient (r), there was a nonsignificant weak positive correlation between the hip flexors and adductors muscles in the OP group.

In the control group, on the other hand there was a non-significant weak negative correlation between the hip flexors and adductor muscles. The presence of that positive correlation between hip flexors and adductors in the OP group, even if not significant, may incriminate combined hip flexor/adductor hyperactivity as a factor increasing stress on the symphysis pubis and eventually leading to OP. This finding was supported by Fricker et al.[11] who stated that repetitive adductor muscle pull during kicking produced shear forces at their origin on the inferior pubic rami, which led to instability of the symphysis pubis and therefore contribute to the development of OP.

Conclusion

The aim of this study was to compare the isokinetic torques of hip flexors/extensors, abductors/adductors in osteitis pubis (OP) soccer players with that of normal soccer player athletes. The most important results include a significant increase in hip flexor PT/BW value between the dominant limb of the control group versus the affected limb of the OP group. In the control group, hip extensor PT/BW mean value was higher than that of hip flexors. In both control and OP groups hip adductor PT/BW mean value was significantly greater than that of hip abductors. There was a non-significant weak positive correlation between the hip flexors and adductors muscles in the OP group. Hip flexion/extension and adduction/abduction muscle imbalance might therefore be the inciting cause of OP in soccer players. Restoring the correct relationship between hip agonists and antagonists might therefore be a very important preventative measure that should be of primary concern in training and rehabilitation programs. This should be preceded by isokinetic muscular evaluation of soccer players so that we may obtain normative data specific to soccer player activity. Evaluation of these may help us prevent possible imbalance, consequent instability of the pelvic region and subsequent risk of injury. In addition, the results obtained in this study can be used for elaborating special training programs to strengthen the weak muscle groups at a particular angular velocity and contraction mode. According to our results, there was also a lack of significant difference in PT/BW values between dominant and nondominant limbs in the control group; this finding may be not only of value in preseason evaluation of soccer players but may serve as a reference point in the rehabilitation process of injured soccer athletes. Lastly, according to our results there was a lack of significant difference in PT/BW values between the affected and nonaffected limbs in the OP group. This finding may indicate that OP soccer players are prone to bilateral affection and underlines the need for devising a bilateral rehabilitation program.

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الملخص العربي

التقييم الايزوكينيتيكى لعضلات الفخذ في حالة التهاب عظم العانة بين لاعبي كرة القدم

يعد التهاب عظم العانة في الرياضيين مشكلة قديمة وسببها مازال محل للجدل. ولذا فقد عنيت هذه الدراسة بمقارنة العزوم الايزوكينيتيكيه لمجموعة عضلات مفصل الفخذ الباسطة والعاطفة، والمُبْعِدة والضامة بين لاعبي كرة القدم المصابين ب التهاب عظم العانة و لاعبي الكرة الأصحاء. أجريت هذه الدراسة على عينة مكونه من 20 لاعبا لكرة القدم مصابون ب التهاب عظم العانة بلغ متوسط أعمارهم 19.94± (3.51) سنة ومتوسط أطوالهم 176.16± (4.93) سم ومتوسط أوزانهم 70.91± (7.26) كجم، في مقابل 20 لاعب لكرة القدم من الأصحاء بلغ متوسط أعمارهم 20,78± (3,35) سنة ومتوسط أطوالهم 176± (4,15) سم و متوسط أوزانهم 71.33± (7.35) كجم . تم تسجيل عزوم اللّي البالغ الذروة / وزن الجسم من عضلات الفخذ أثناء الانقباض الايزوكينيتيكي بسرعة زاوية قدرها 180°/ثانية ثم معالجة البيانات إحصائيا باستخدام تحليل التباين متعدد الاتجاهات بين المجموعتين لعزوم اللّي البالغ الذروة / وزن الجسم لعضلات الفخذ العاطفة / الباسطة والمُبْعِدة / الضامة عند مستوى معنوي (0.05) مبدئياً مع الضبط التتبعي التلاحقي على طريقة بونفروني. وقد أوضحت النتائج وجود زيادة ذات دلالة إحصائية في عزم اللّي البالغ الذروة / وزن الجسم للعضلات العاطفة لمفصل الفخذ للمجموعة المصابة مقارنة بمجموعة الأصحاء .كما سجلت نفس الزيادة في العضلات الباسطة لمفصل الفخذ مقارنة بالعضلات العاطفة لنفس المفصل في مجموعة الأصحاء . وسجلت أيضا زيادة ذات دلالة إحصائية في المجموعتين فيما يخص عضلات الفخذ الضامة لعزم اللّي البالغ الذروة / وزن الجسم مقارنة بالعضلات المبعدة. لذلك هذه الدراسة قَدْ تَدْعمُ أن مجموعة من العوامل قد تُوضّحُ نشوء التهاب عظم العانه في لاعبي كرةِ القدم مثل اختلال التوازن العضلي بين عضلات مفصل الفخذ.

الكلمات الدالة: التهاب عظم العانه ، التقييم الايزوكينيتيكي ، إنقباض مركزي ، عضلات الفخذ و الجذع .