Prevalence and Associated Risk Factors of Wrist Pain in Indian Gymnasts

Satnam Kaur [1], Dr. A.G.K. Sinha [2]

ABSTRACT

This study was aimed at determining the prevalence, and associated risk factors, of wrist pain in Indian gymnasts. During Sept 2008-Jan 2009, a sample of 62 gymnasts drawn from two training centers of Punjab were evaluated using schedule interview, clinical examination of wrist, and the range of motion measurement. Players complaining of wrist pain, during practice or rest, since the past 15 days were considered as afflicted with wrist pain. The prevalence of wrist pain was 79.03%. Most of the gymnasts, with wrist pain, were beginners, belonging to age group of 10-15 years. Excessive training hours, previous wrist injury, inadequate treatment, and reduced range of motion in sagittal plane, were significantly ($p<0.05$) associated with the wrist pain, though warm up and cool down practices were not associated. Majority of the gymnasts either ignored the pain and continued the practice with activity modification (N=27, 43.54%) or chose self treatment(n=16 , 25.80%). None of the gymnasts with previous wrist injury, had any access to physiotherapy treatment. The high prevalence of wrist pain, along with the information that most of the time medical advice is not sought despite presence of range of motion deficit, is alarming and depicts the poor medical and physiotherapy coverage provided to the gymnasts.

INTRODUCTION

Gymnastics, is gaining popularity in India as a competitive and recreational sport and the Indian gymnasts are working very hard to secure a place in the international rostrum. Like other sports, gymnastics also carry inherent risk of injuries. Occurrence of injury can be troublesome, both for the individual and the team, in terms of performance and non-sport aspects of life, due to loss of sports participation time and risk of long term disability, besides treatment expenses. The need for appropriate epidemiological data for

1. Sr. Physiotherapist cum officer In-charge DDRC Sangrur, Punjab.
2. Reader and Head, Department of Physiotherapy, Punjabi University Patiala.

planning, development and evaluation of measures, to prevent such injuries, is now universally recognized (Kolt & Kirkby, 1999; WHO, 1984). There has been considerable research on the epidemiology of gymnastics injuries, in the recent past (Garrick & Requa, 1980; Pettrone & Ricciardelli, 1987; McAuley et al, 1987; Caine et al, 1989; Kolt & Kirkby, 1999; Kolt & Kirkby, 1995). Similar studies on Indian gymnasts are not widely available.

The use of upper extremity, as weight bearing structure, is the unique feature of this sport. Events for men include pommel horse, rings, parallel bars, floor exercises, vault and horizontal bar; whereas, the events for women include floor exercises, vault, balance beam and uneven parallel bar. Each of these events require extreme positioning of the upper limb joints and use of upper extremity as the weight bearing structure. (Markolf et al, 1990) This often subjects the wrist to excessive physical loading, far exceeding the body weight. Subsequently, the wrist becomes a common site of injury in Gymnastics (Hetch, 2006). It is reported that about 9.8% of injuries in gymnasts occur around wrist and hand (Kolt & Kirkby, 1999). The reported prevalence of wrist pain in elite and non elite gymnasts of western countries ranges from 73% (DiFiori et al, 2002) to 79.5% (Mandelbaum et al,1989). Early age participation, training intensity per week, improper equipment , level of performance, inadequate rehabilitation etc.(DiFiori et al, 1996) have been implicated as some of the contributing factors for a variety of spectrum of wrist injuries in gymnasts ranging from simple sprain, strain , to complex stress fracture and, instability syndromes and other overuses injuries (Mandelbaum et al, 1989).

The studies on Indian gymnastic population, with regard to the epidemiology of wrist pain, are not widely available. Keeping this into consideration, the purpose of this study was to determine the prevalence of wrist pain and the associated risk factors, among Indian gymnasts.

METHODOLOGY

The sample consisted of 62 gymnasts of both sexes (M= 29 F =32) of the age group 5-25 years from two leading gymnastic centres of Punjab i.e. Polo ground gymnasium hall, Patiala, and Shri Prabodh Chander gymnastic hall, Gurdaspur. Study was conducted during the period September 2008 to January 2009.

The study consisted of three parts: schedule interview, clinical examination and passive ROM measurement of both the wrists.

(a) Schedule Interview

After an extensive review of literature, a questionnaire was designed to interview the subjects. The questionnaire consisted of 35 questions focusing on demographic and training profile of gymnasts, warm up, cool down practices, and the wrist injury. The questions pertaining to wrist injury seek to obtain information on about current wrist pain; onset

of the pain; past wrist injury; mechanism of injury; treatment received at the time of injury, prior treatment taken for the wrist pain in the past; and the impact of injuries on performance, in terms of number of days missed per month due to pain.

(b) Clinical Examination

Clinical examination consisted of inspection of both wrists for swelling and any visible deformity around the wrist. Palpation was performed for tenderness over scaphoid, anatomical snuff box, radial styloid process, capitate, pisiform, and ulnar styloid and base of each metacarpal. The special tests battery included Finkelstein's test, for paratendinosis of Abductor Pollicis Longus and Extensor Pollicis Brevis Tendons (Magee,2002); Watson's (Scaphoid shift) test, for scapholunate instability (Magee,2002); Tinel's sign, for nerve entrapment at carpal tunnel; Phalen's test; for carpal tunnel syndrome (Magee,2002); Allen's test; for the patency of the blood vessels at wrist (Buckup,2008); thumb grinding test; for degenerative arthropathy around 1st MCP joint (Magee,2002); and resisted isometric muscle testing; for FCU, FCR, ECU, ECRL and ECRB (Kendall et al, 2005); for detection of musculotendinous lesions.

(C) Range of Motion Measurement

The passive range of motion of wrist flexion, extension, radial deviation, ulnar deviation, supination and pronation was measured in sitting position with the help of hand held universal goniometer, using standard protocol (Norkins & White, 2003).

Criteria of Considering a Gymnast as Afflicted with Wrist Pain

Those players who complaint of having suffering from wrist pain, during practice or rest, for the past 15 days, were considered as afflicted with wrist pain.

Statistical Analysis

Gymnasts afflicted with wrist pain were grouped as symptomatic group; whereas, the gymnasts not afflicted with wrist pain were put in asymptomatic group. Results are reported as absolute number and per centage. Cross tabulation with chi- square tests and 't' test were used for statistical analysis of the data.

RESULTS & DISCUSSION

Of the 62 subjects studied, a high per centage (79.03%, n= 49) were found afflicted with wrist pain. Maximum numbers of gymnasts afflicted with wrist pain (N-16, 32.65%) were beginners, followed by national level gymnasts (N-13, 26.53%) **(Table 1)**. Majority (53.06%) of the gymnasts of symptomatic group belonged to the age group of 10-15 years (Fig. 1). Among men pommel horse was the event most frequently associated with wrist pain (n=14, 63% followed by floor exercises (27.27%); whereas, in women, wrist pain (40.74%) was most frequently associated with floor exercises, followed by activities on uneven bar (25.92%).

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Table-1 : Distribution of subjects according to level of participation (N=62).

Level of participation number (%)	Symptomatic Absolute number (%)	Asymptomatic Absolute number (%)	Total Absolute
School	9(14.51%)	1(1.61%)	10(16.12%)
District	3(4.83%)	1(1.61%)	04(6.45%)
State	6(9.67%)	2(3.22%)	08(12.89)
University	1(1.61%)	–	01(1.61%)
National	13(20.96%)	1(1.61%)	14(22.58%)
International	1(1.61%)	1(1.61%)	02(3.22%)
Beginners	16(25.8%)	7(11.29%)	23(37.09%)
Total	49(79.03%)	13 (20.96%)	62 (100%)

Table-2 : Indicating the warm up patterns of symptomatic and other group.

	Symptomatic group (N=49)		Other group (N=13)	
	N	%	N	%
Always	39	79.59	07	53.84
Sometimes	10	20.40	06	46.15

Table-3 : Indicating the cool down practices of symptomatic and other group.

	Symptomatic group (N=49)		Other group (N=13)	
	N	%	N	%
Always	30	61.12	05	38.46
Sometimes	19	38.77	08	61.53

Table-4 : Association of warm up and cool down practices of Symptomatic group and other group.

	Symptomatic group (N=49)		Other group (N=13)		X^2 value
	N	%	N	%	–
Always perform warm up	39	79.59	07	53.84	2.33^{NS}
Always perform cool down	30	61.12	05	38.46	1.68^{NS}

Table-5 : Impact of wrist pain on practice of symptomatic group (N=49).

Impact	Absolute number (%)
Missed practice for 1-2days	04 (8.16%)
Missed practice for 2-5 days	03 (6.12%)
Missed practice for 3 weeks	01 (2.04%)
Missed practice for 1 month	02 (4.08%)
Modified the practices	23 (46.93%)
No effect on performance	16 (32.65%)

Table-6 : Clinical examination findings of both groups.

Finding	Symptomatic group (N=49)		Asymptomatic group (N=13)	
	Absolute number	%	Absolute number	%
Swelling	02	4.08	–	–
Deformity	01	2.04	–	–
Tenderness On Capitate	21	42.85	03	23.07
Tenderness on Distal Forearm	07	14.28	01	7.69
Tenderness Around Scaphoid	04	08.16	–	–
Tenderness Around Ulnar Styloid Process	07	14.28	01	7.69
Tenderness Around Radial Styloid Process	07	14.28	01	7.69
Tenderness Between Radius And Ulna	11	22.44	02	15.38
Generalized Pain Around Wrist	03	06.12	–	–
Tenderness Around Anatomical Snuff Box	14	28.57	01	7.69
Tenderness at Base of Each	03	06.12	–	–
Painful Flexion	19	38.77	02	15.38
Painful Extension	32	65.30	04	30.76
Painful Radial Deviation	08	16.32	01	7.69
Painful Ulnar Deviation	05	10.20	–	–
Painful Pronation	01	2.04	–	–
Painful Supination	01	2.04	–	–
Finkelstein's test	34	69.38	03	23.07
Thumb grinding test	09	18.36	–	7.69
Phalens Test	05	10.20	01	7.69
Watsons test	–	–	–	–
Allen's test	–	–	–	–

Table-7 : Passive ROM of dominant wrist arms between symptomatic group and non-symptomatic

Movement	Side	Symptomatic (N=49) Mean)±Sd	Asymptomatic (N=13) Mean±Sd	t
Extension	D	63.48±12.08	70.53±6.05	2.02*
	ND	64.87±12.08	72.38±7.27	2.13*
Flexion	D	72.55±9.80	80.53±9.75	2.60**
	ND	74.53±8.87	81.38±7.07	2.57**
Radial deviation	D	28.61±6.76	31.92±8.68	1.47^{NS}
	ND	29.30±6.78	29.84±7.91	0.24^{NS}
Ulnar deviation	D	43.77±7.21	45.00±7.60	0.51^{NS}
	ND	44.81±7.33	46.76±9.34	0.80^{NS}
Supination	D	86.97±5.28	87.07±4.13	0.57^{NS}
	ND	84.67±7.17	86.92±6.40	1.02^{NS}
Pronation	D	85.10±7.70	88.07±5.15	1.31^{NS}
	ND	87.53±5.15	87.69±3.94	0.10^{NS}

$P_{t\,(60,0.05)} \leq 1.671$* $P_{t(60,0.01)} \leq 2.390$** $P_{t(60,0.001)} \leq 2.660$*** NS-Non significant

D= dominant, ND = non dominant

Table-8: Comparison of Previous injury, recurrence and Treatment of symptomatic and a symptomatic group

	Symptomatic Group (N=49)	%	Other Group (N=13)	%
History of previous wrist pain	46		6	
Recurrence	46	100%	5	83,33%
Medical treatment	07	15.21%	02	33.34
Physiotherapy treatment	00	–	–00	–
Surgical treatment	-00	–	00–	–
Self treatment	14	30.43	02	33.34%
Ignored pain	25	56.52	02	33.34

Table-9 : Association of past history of wrist pain and treatment taken among symptomatic group and other group.

	Gymnasts with wrist pain (N=49)		Other group (N=13)		χ^2 value
	N	%	N	%	
Past history of wrist pain	46	93.87	06	46.15	13. 95***
Medical treatment taken	07	15.21	02	33.34	3.5507*

$P_{c^2(60,\ 0.05)} \leq 2.71$* $P_{c^2(1,\ 0.01)} \leq 5.41$** $P_{c^2(1,\ 0.001)} \leq 10.83$*** NS no significant

Table-10 : Comparison of monthly training hours between symptomatic group and other group.

Gymnasts with wrist pain (N=49)			Other Group (N=13)			
Mean	SD	SE	Mean	SD	SE	t
154.8367	38.41	4.96	124.38	37.74	4.87	2.55**

$P_{t\ (60,\ 0.05)} \leq 1.671$* $P_{t\ (60,\ 0.01)} \leq 2.390$** $P_{t\ (60,\ 0.001)} \leq 2.660$*** NS-non significant

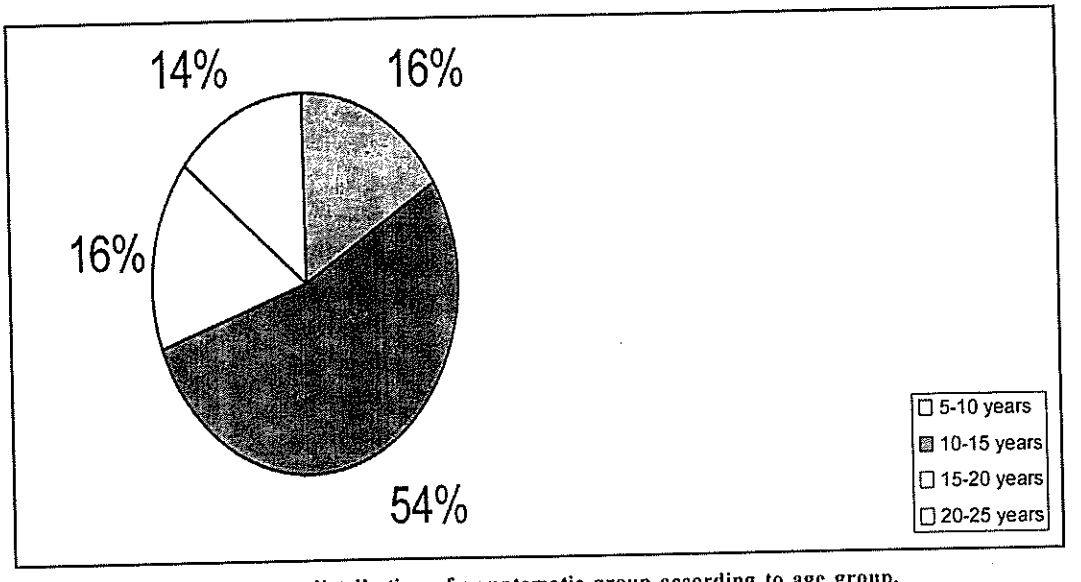

Figure-1 : distribution of symptomatic group according to age group.

Training factors

The symptomatic group had significantly ($p<0.05$) more hours of training as compared to other group. The mean monthly training hours of symptomatic group (154.83 ± 38.41) were 30.45 hours more than the asymptomatic group (124.38 ± 37.74), which culminated into 365.43 excessive hours, on the yearly basis. Both groups showed larger standard deviations, which means that the training hours were not uniform for all gymnasts (Table 10). No association was observed between warm up and cool down practices and occurrence of wrist pain (Table 2, Table 3, Table 4).

Impact of wrist pain on practice

While the occurrence of complete absence from training due to wrist pain was low, a majority of the participants continued training by avoiding the skills, producing the pain (Table 5).

Clinical evaluation finding

Table 6 summarizes the findings of clinical evaluation of both groups. Tenderness on some bony prominence such as capitate, between radius and ulna; and tenderness around anatomical snuff box, along with painful extension and positive Finkelstein's Test were the most frequent clinical signs elicited during the clinical examination of symptomatic groups. Some athletes of non-symptomatic group also demonstrated these positive signs.

Range of motion

Table 7 presents the passive ROM data of both the groups. The symptomatic group had significantly ($p<.05$) reduced range of motion for flexion and extension in dominant as well as non-dominant wrist, as compared to the other group. However, significant differences were not observed in the range of motion of radial deviation, ulnar deviation, supination and pronation in dominant as well as non dominant side, as compared to other group.

Previous injury, recurrence and Treatment

Significant association was observed between the recurrence of wrist pain with the history of previous wrist pain (?2-13.95, p?0.01) All the gymnasts with past history of wrist pain had experienced recurrence of wrist pain. Even though 83.87 % (N=52) of gymnasts suffered the wrist pain only 14.51 % (N=09) had sought the medical care. Majority of the gymnasts either ignored the pain or continued the practice with some activity modification (N=27, 43.54%) or chosen self treatment (n=16, 25.80%). None of the gymnasts with previous wrist injury had any access to physiotherapy treatment (Table 8 and Table 9).

This study supports the notion that wrist pain is a common occurrence in Gymnastics (Hecht, 2006). The prevalence of wrist pain, in the present study, was 79.03%. Similar findings have been reported in other studies done on the western gymnasts. (DiFiori et al, 2002; DiFiori et al, 1996 ; Mandelbaum et al,1989, Lowry & Leveau,1982) Excessive training hours, previous wrist injury and inadequate treatment, and reduced range of motion in sagital plane, were found associated with the wrist pain, in this study; though, no association was observed

between warm up and cool down practices and occurrence of wrist pain.

Use of upper extremity, as weight bearing structure, is the unique feature of Gymnastics that often subjects the wrist to excessive physical loading, far exceeding the body weight (Koh et al, 1992). The wrist of a gymnast is frequently exposed to various combinations of compression, tortional, and tensile stresses with wrist in extreme of extension, pronation and supination (Hecht, 2006). Subsequently, wrist becomes a common site of injury in Gymnastics. Mandelbaum et al (1989) surveyed the 38 collegiate gymnasts and reported the occurrence of wrist pain in 75% of the males and 33 % of the females. 73% of the 52 non-elite gymnasts, in the study of DiFiori et al (2002), were afflicted with chronic wrist pain. In another study, wrist pain was present in 79.5% of the young gymnasts (DiFiori et al, 2002b).

In the present study, majority (53.06%) of the gymnasts who had wrist pain were in the age group of 10-15 years and majority of them were beginners. The repeated weight bearing on the skeletally immature wrist is considered as a major causative factor for the occurrence of the wrist plain in gymnasts (Dobyns & Gable, 1990). The repeated and undue loading of the wrist results in micro trauma, in skeletally immature gymnasts, giving rise to periostitis, stress reactions and micro fractures within the bone (Cervoni et al,1997). The tenderness found on the bony prominences, in some asymptomatic group gymnast might indicate the onset of micro trauma to the bone which may culminate, in the course of time, as frank wrist pain. Further longitudinal studies are required to explore this issue.

In the present study, among men, pommel horse was the event most frequently associated with wrist pain (n=14, 63% followed by floor exercises (27.27%). In women, floor exercises were most frequently associated with wrist pain (40.74%) followed by activities on uneven bar (25.92%). All these events produce loading to the wrist and require wrist to be positioned in extreme of dorsiflexion (Markolf et al, 1990); and adequate flexibility of wrist is a must for painless execution of these activities. Practice on pommel horse — the event that is performed on a rigid structure — has been reported to place repetitive high intensity wrist impact with sustained period of body weight support (Markolf et al, 1990). We have observed that most of the gymnasts with wrist pain demonstrated limitation of wrist range motion in sagital plane, which could be a cause of wrist pain during participation, due to compression of bone and stretching of soft tissues. Dorsiflexion of the wrist is the most frequently encountered movement in the Gymnastics. This movement stretches radiolunotriquetral ligament and the radiocapitate ligament (Kapandji, 1998). Repetitive and unaccustomed demands placed on the wrist may also cause the irritation and inflammation of the long tendons around the wrist, giving rise to pain and reduction of ROM of the wrist. Presence of positive Finkelstein's test: in a majority of gymnasts of both the groups, appears to support this notion. This test is designed to detect

paratendinoses of extensor tendon of thumb by putting them into stretched position. However, it is not clear whether wrist pain was the consequence of the decreased ROM or it is the cause of decreased range of motion. Further longitudinal studies are required to explore this issue.

In the present study, a significant association has been found between the past history of the wrist pain and occurrence of wrist pain ($X2=13.95, p<=.001$). 93.87% of symptomatic group had a past history of wrist pain out of which 100% had recurrence. 46.15% of the other group gymnasts had past history of pain out of which 83.33% had recurrence. The findings of this study are in accordance with the previous studies (Caine et al, 1989; Harringe et al, 2004; Lysens et al, 1984; Powell et al, 1986) and suggest that wrist pain in gymnasts do not run a self-limiting course.

According to Lysens et al (1984) re-injury is the result of underestimation of the severity of the primary injury, inadequate rehabilitation, or premature return to the sports. The present study supports this notion. Statistically significant association was observed between the occurrence of the wrist pain and inadequate treatment($X2=2.8119$, $p<=0.05$) It is matter of concern that none of the subjects in the symptomatic group, had any access to physiotherapy which might have contributed to reduced ROM persisting, long after the resolution of inflammation and acute pain. 32.65% of the gymnasts ignored the pain and continued training with some alteration in the training schedule. This finding is alarming and depicts the poor medical care provided to the training gymnasts.

The treatment of any musculoskeletal injury involves three distinct phases, i.e., maximal protection phase, consisting of PRICE and NSAID; healing phase, where the various physical modalities are utilized to accelerate the rate of healing and minimize the negative impact of healing; and the performance restoration phase, where the deficits in the range, strength, balance, agility are corrected and the emphasis is placed on painless restoration of sporting skills (Prossor & Connolly, 2003 ; Renstrom, 1994)). It was clear that none of the players had undergone the complete treatment of the wrist pain nor there was any schedule of regular screening, to detect the loss of wrist range of motion, before or during the training. The loading of wrist having reduced flexibility,during various gymnastics activities, could produce re-injury. This may account for the observation that all the gymnasts with, past history of wrist pain (100%), had experienced recurrence of wrist pain. We have observed that the players, and many a time coaches, were grossly ignorant of the methods of the treatment to the wrist injuries. In this situation, it is imperative that an awareness programme should be launched to educate the players and coaches about the process of injury management in order to enable them to seek timely help. The need to provide comprehensive medical coverage, with the provision for specialized physiotherapy

services, to all the injured gymnasts cannot be overemphasized.

Injury prevention is a combination of several factors. Mere emphasis on one or two factors would not be sufficient, to prevent the injury. In this study, no significant association was found between warm up and cool down practices and occurrence of wrist pain in the gymnasts; but, the training hours were significantly associated with the wrist pain. The symptomatic group trained for longer hours without paying much attention to the wrist pain. According to Renstrom (1994) the per centage of injuries is directly proportional to the amount of time spent time spent in training, due to increased exposure to the risk factors of injury. Combination of high volume repetition, with upper extremity in weight bearing positions, has often been implicated as a prime causative factors for variety of wrist problems observed in gymnasts (Hecht,2006). It is reported that often gymnasts do not report the pain to coach and medical attention is not sought until very late in the course of some conditions (Dobyns & Gabel,1990). Several previous studies suggest that many gymnasts continue to train with modified schedule, regardless of pain and injury (Kolt & Kirkby ,1995; Kerr , 1991; Kolt & Kirkby ,1996) plausibly due to coach / peer group pressure or behaviour carried out to divert focus from physical injuries ((Kolt & Kirkby ,1999). This information has important implications for coaches and the sports medicine providers in establishing protocol for rehabilitation, and return to sports from injury (Kolt & Kirkby, 1999). Further periodic musculoskeletal screening of gymnasts may assist in identification of the injuries that could be aggravated by further training and allow appropriate rehabilitation protocol to be commenced.

CONCLUSION

An alarming proportion of the gymnasts, in this study, were found afflicted with wrist pain. Lack of adequate treatment of previous wrist pain, and subsequent loss of flexibility in the extension and flexion range of wrist, have emerged as the main associated risk factors for the occurrence of injury, along with the excessive training hours. This highlights the lack of appropriate medical support provided to the players during training. Reduction of range of motion is a common squeal of any musculoskeletal injury which, if neglected, could incite re-injury and progression. The reduced range of motion of wrist can be corrected by proper physiotherapy; and, it is extremely important that after any injury to the wrist the players should have a contact with physiotherapist, for early detection and correction of limitation of range of motion.

The limitations of the study include a relatively small sample size belonging to only two centers of Punjab. The information was obtained by one time examination of the subjects. It is imperative to cross-validate the findings on a larger sample. In order to detect the occurrence of wrist injuries, and its impact longitudinal studies involving the components of injury surveillance programme, is the need of the hour. Amelioration of several risk factors

such inadequate wrist flexibility, and improper treatment, requires the active involvement of physiotherapists, with the team. Therefore, steps should be made to include the physiotherapists in the pre-participation examination and incorporation of recommendation into the training programme of the gymnasts.

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