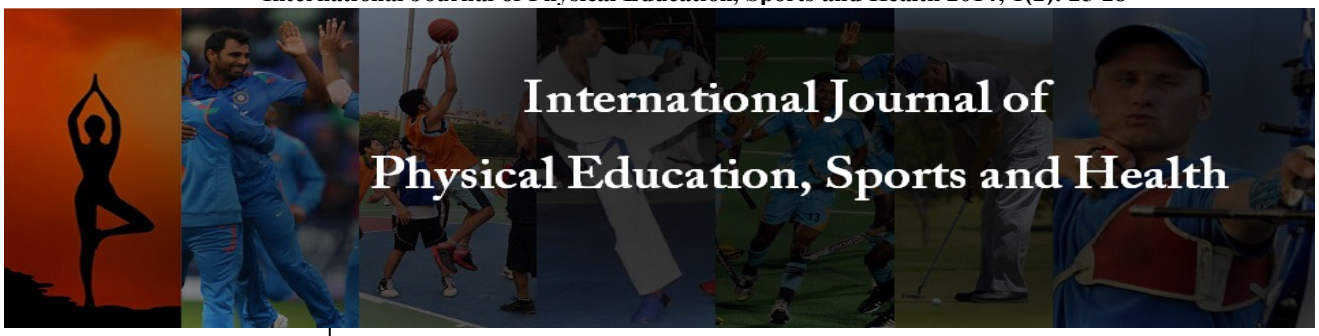

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Mal-Alignment as a Risk Factor for Lower Extremity Overuse Injuries in Young Adults in Unorganised Sports Activities.

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Abstract
Overuse injuries in young adults present a unique challenge to the treating clinician. In this study, we studied the association of male-alignment as a risk factor for overuse injuries of the lower extremity in young adults. This prospective cohort study examined all the adult patients presented with various lower extremity overuses injuries. Only those engaged in unorganised sports activity were studied. After making a clinical impression, all patients were subjected to relevant X-rays to diagnose the mal-alignment, if present or not. A total of 252 cases with overuse injuries was included, in which seventy-three per cent were male patients. The sprain ankle was the commonest overuse injury to both genders. In our study, the mal-alignment was seen in 64.3% of the total overuse cases, of which the commonest mal-alignment in both genders was internal tibial torsion. In conclusions overuse injuries in young adults are frequently associated with mal-alignments. Better understanding of these mal-alignments are better for the management of these injuries.

Keywords: Overuse Injury, Mal-alignment, Unorganized Activity, Risk factors of overuse injuries.

1. Introduction
There are various characteristics that can clue towards over training or overuse as the possible underlying cause of injury. Mild discomfort after physical activity is common. If the pain appears and exists during sports activity and persists even after the activity, then it denotes that the amount of sports activity (whether single shot or after multiple episodes of these activities) is perhaps "too much," "too fast," or "too soon" and may cause overuse injury [1]. The unorganized exercises and physical activities include any sports or related exercises / physical activities being performed without any qualified supervision and / or protocol. These may include playing at local / university / college / office level, performing during an annual day of university / office / company or college, in a gym, at summer camps, during or before an interview / selection, during a training period etc. Overuse injuries in the young adults vary from person to person, both anatomically and physiologically. It is difficult to estimate the actual impact of this problem. It has been observed that amongst all patients, approximately 5% of mature athletes seek their treatment for sports-related overuse injuries [2]. Even the incidence of overuse injuries also appears higher in young athletes (about 8% to 10%) [3]. Because of limited studies, the contribution of alignment abnormalities as a risk factor for overuse injuries is unclear. The rehabilitated players may also suffer re injury, if risk factors are not addressed properly. Most of the unorganized exercise and physical activities are being carried out for a common reason i.e. fun [4]. But unfortunately these injuries not only take away the concerned person from fun, but also restrict most of them to perform similar activities in their future. Regrettably, due to fear of being removed from these activities or disappointing their parents, teachers and bosses, many young unprofessional players forcefully continue to perform, bearing pain. Though, all resources are being directed to the athletes who are trained in a controlled environment (sports college / stadium) while the real burden remains with unorganized sports and exercise activities. The study of these risk factors will open a new scope in the management of these injuries and by identifying these problems at an early stage, overuse injuries can be avoided by explaining the type of activities to be done and not to be done. In this proposed study, the investigator tries to bridge this information gap by analyzing the association of mal-alignment with overuse injuries in wide variety of unorganized sports activities in the young adult population.

2. Materials and methods

In this prospective cohort study, the patients in the age group between 18-30 years of age with overuse injuries and exposed to unorganized exercise and physical activities were included in the study. Patients having obvious deformity of lower limb, with old history of injury of lower limbs (old fractures, burns etc), those engaged in organized sports (patients having qualified supervision, such as in sports colleges, in stadium or under sports teachers at schools etc), patients with catastrophic sports related injuries (head injuries, obvious fractures etc.) and person having apparent / known intrinsic factors (as list given above) making them more prone to overuse injuries were excluded from the study. After obtaining ethical clearance from institutional ethical review committee, a total of 252 patients were included in this study from 2012 to 2014. After the written informed consent, demographic data of all enrolled patients were collected. Any anatomical abnormality in the relationship of the bones forming the joint and thus affecting the joint kinematics was considered as 'mal-alignment abnormalities'. We diagnosed these malalignment only by standard clinico-radiological methods (see Table-1), as restriction of resources was our limitation. Certain characteristics can clue us in to the possible over training or overuse injuries. Mild discomfort or soreness after physical activity, rating no higher than 2 or 3 on a pain scale of 0 to 10, is common. If pain exists during the sports activity and persists even after activity rating to higher than 3 / 10 on a visual pain scale (VAS),[1] then that amount of sports activity (whether single shot or after multiple episodes of these activities) is perhaps "too much," "too fast," or "too soon" and were considered as overuse injury in that particular adult.

3. Results & Discussion

A total of 252 prospective cases of overuse injuries was seen during the study period from 2012 to 2014. All the demographic data of the enrolled patients, divided on the basis on their gender show statistically non-significant difference (Table 2). Out of total patients with overuse injuries, majorities of these were males (81.3%). The mean age at diagnosis of overuse injuries was 22.7years.The age of onset of overuse injury was earlier in females for all conditions. The most common overuse injury in both genders was sprain ankle (30.2%) (Table-3). The recreational jogging was the commonest unorganized activity in males (30.6%), whereas recreational running was common (6.3%) in females (Table-4). Amongst all patients, most of the unorganized activity was performed on a hard surface (n=197; 78.2%), than on soft surface (n=55; 21.8%). Out of these 132 (67.0%) had overuse injuries performed on a hard surface and 07(12.7%) on the soft surface. However, the overall percentage of mal-alignment in total enrolled patients was 64.3%, in which the internal tibial torsion had the highest percentage both in male and female patients (Table-5 & 6). In simple terms, overuse injuries can be defined as the product of an activity performed "Too much, Too fast, Too soon". How much is too much? How fast is too fast? How soon is too soon? The answers vary from person to person. The acute injuries draw immediate attention, but as overuse injuries occur slowly and are not debilitating at an early stage, so these injuries are often neglected or misdiagnosed. Overuse injuries occur when a tissue is injured due to repetitive submaximal loading. The process starts when repetitive activity fatigues a specific structure such as tendon or bone. With sufficient recovery, the tissue adapts to the demand and is able to undergo further loading without injury. Without adequate recovery, micro trauma develops and stimulates the body's inflammatory response, causing the release of vasoactive substances, inflammatory cells, and enzymes that damage local tissue [4]. Cumulative micro trauma from further repetitive activity ultimately causes clinical injury. In chronic or recurrent cases, continued loading produces degenerative changes leading to weakness, loss of flexibility, and chronic pain [5]. Thus, in overuse injuries the problem is often not acute tissue inflammation, but chronic degeneration (i.e. tendinosis instead of tendinitis). In the present study, we have been trying to find out the association of male-alignment as a risk factor for overuse injuries in wide variety of unorganized sports activities in the young adult population. The unorganized exercises and physical activities need more attention because of the following reasons, i.e. The incidence of these overuse injuries in unorganized activities is many fold more than the organized sports and affect a large proportion of the population; No documented protocol is available or being followed during these activities and its real impact / burden on the society is not well documented [6]. In the present study, percentage of most of the overuse injury patients were male (81.3%). We found that most of the overuse injuries are of lower extremity was ankle sprain (30.2%). The similar observation was made by Bruns et al. (2000) and Leok Lim Lau et al.(2008). Plantar fasciitis was the most common injury of the plantar fascia in other studies [7-13]. In the present study, we also landed up with the same conclusion and it was the second most common overuse injury next to sprain ankle. It was commonly associated in individual having flat feet (13.2%). The present study shows that more than half (64.3%) of the overuse injury patients were also associated with some mal-alignments, which may imply that the mal-alignment may be a risk factor for the overuse injuries. We observed that, reliable findings will be obtained by designing the case-control study, which is in progress and after accomplishing the adequate cases and controls, the author will analyse the same. This study had some limitations. Firstly, it was a cohort observational study and secondly, the sample size was less. Both of the above mentioned limitations affected the proper knowledge and reliability of the present study.

3.1 Tables and Figures

Table 1: Clinico-radiological Assessment of Mal-alignments

Clinical Assessment	Radiological Assessment
• Wt. bearing foot prints – planus / cavus • Hallux valgus • Valgus heel • Clinical test for subtalar movements • Q-angle • Distance between med. femoral condyles with both feet touching • Distance between two med. malleolus with knees touching • Lateral thigh / leg angle • Patella Alta (LP/LT) • Tubercle Sulcus Angle • Clinical tests for patella mobility • Inter malleolar axis • Tibial torsion • Femoral Torsion • Carrying Angle	• Genu Valgum / Varus (wt. bearing) • Femoral Neck-Shaft angle • Q-angle • Tibial – Metaphyseal angle • Carrying Angle

Table 2: Patients demographic data

Parameters	Male (n=205) n (range)	Female (n=47) n (range)	Overall (n=252) n (range)
Age	23.3 (18-30)	22.1 (18-25)	22.7 (18- 30)
Weight	67.5 (48-82)	62.3 (45- 70)	64.9 (45-82)
Height	160.2((155- 174)	157.6 (145- 160)	158.9(145- 174)
BMI	22.17	21.86	22.01
Average Duration of Unorganised Activity	6.5 (5-19)	5.2 (3-12)	5.8 (3-19)

Table 3: Common Overuse Injuries According to Gender

Type of unorganised activity	Male (n=205) n (%)	Female (n=47) n (%)	Overall (n=252) n (%)
Recreational running	71 (28.2)	20 (7.9)	91 (36.1)
Short Running (100 mt)	53 (21.0)	16 (6.3)	67 (26.6)
Longer Running (>100 mt)	19 (7.5)	04 (1.6)	22 (8.7)
Recreational Jogging	77 (30.6)	16 (6.3)	93 (36.9)
Recreational Playing	57 (22.6)	11 (4.4)	68 (27.0)
Cricket	40 (15.9)	05 (5.0)	45 (17.9)
Football	09 (3.6)	01 (0.4)	10 (4.0)
Badminton	05 (2.0)	04 (1.6)	09 (3.6)
Lawn Tennis	03 (1.2)	01 (0.4)	04 (1.6)

Table 4: Type of unorganised activity among the young adult

Type of mal-alignment	Male (n=123) n (%)	Female (n=39) n (%)	Overall (n=162) n (%)
Heel Varus	08 (4.9)	04 (2.5)	12 (7.4)
Heel Valgus	10 (04)	04 (2.5)	14 (5.5)
Flat Feet	15 (9.3)	07 (4.3)	22 (13.6)
Tight TA	26 (16.0)	08 (4.9)	34 (21.0)
Internal Tibial Torsion	30 (18.5)	10 (6.2)	40 (24.7)
External Tibial Torsion	19 (11.7)	03 (1.9)	22 (13.6)
Abnormal Q angle	15 (9.3)	03 (1.9)	18 (11.1)

Table 5: Type of mal-alignment among the young adult.

Type of overuse injury	Male (n=205) n (%)	Female(n=47) n (%)	Overall (n=252) n (%)
Planter fasciatis	52 (20.6)	10 (4.0)	62 (24.6)
Osgood – Schlatter disease	18 (7.1)	04 (1.6)	22 (8.7)
Osteochondritis	03 (1.2)	01 (0.4)	04 (1.6)
Sprain Ankle	76 (30.1)	11 (4.4)	87 (34.5)
Stress fracture	02 (0.8)	00 (0.0)	02 (0.8)
Sinding- Larson Johansson Syndrome	03 (1.2)	04 (1.6)	07 (2.8)
Sever's Disease	07 (2.8)	03 (1.2)	10 (4.0)
Stenosing Tenosynovitis Ankle	12 (4.8)	02 (0.8)	14 (5.6)
Retrocalcaneal Tendinitis	20 (7.9)	03 (1.2)	23 (9.1)
Anterior Knee Pain	19 (7.5)	02 (0.8)	21 (8.3)

Table 6: Association of overused injuries with mal-alignment.

Mal-Alingments	Overuse Injuries									
	PF (62)	OS (22)	OC (04)	SA (87)	SF (02)	SLJ (07)	SD (10)	ST (14)	RT (23)	AKP (21)
Heel Varus (12)	4			7					1	
Heel Valgus (12)	8			2						2
Flat Feet (22)	14								3	5
Tight TA (34)				3			5	4	1	21
Internal Tibial Torsion (40)	10			26						4
External Tibial Torsion (22)	1	1	1			3	2			14
Abnormal Q Angle (18)		5	1							12

4. Conclusions

But even then our observations conclude that overuse injuries in young adults are frequently associated with mal-alignments. An adequate understanding of the anatomy of the adults may assist in better primary care treatment. It is also recommended that health professionals should be aware of organized and unorganized activities as well as their risk and safety factors.

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