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Level of Functional Disability in Hockey Players with Turf Toe Using Foot Function Index Questionnaire

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ABSTRACT

Background: Turf toe is a hyper-extension injury to the soft tissue of the first or hallux metatarsophalangeal joint. It results in significant functional disability and affect the performance of players in hockey games. Push off, all important in hockey is markedly impaired. To some extent, forward drive and running may also be compromised. **Objective:** The purpose of the study is to evaluate the level of functional disability in male hockey players with turf toe by using a foot function index questionnaire. **Methods:** This cross-sectional study was conducted over one hundred and twenty turf toe male patients according to inclusion and exclusion criteria. Non-probability purposive sampling was used to assemble data from various sports complexes in Lahore. Male hockey players aged between 18to 35 years, having turf surface used as playing surface and unilateral turf toe were included The level of function disability was evaluated by Foot Function Index Questionnaire. The data was analyzed through the Statistical Package for Social Science version 20 and that software was also used for the data analysis. The study variables are presented in form of the descriptive statistics (tables, graphs and percentages). The ethical approval was obtained from the ethical committee of the University of Lahore. The questionnaire is accompanied by an information sheet that explains the nature and purpose of the study and describes that the consent was taken by every player. **Results:** The mean of the functional disability in 120 male hockey players with turf toe was 76.78 and the standard deviation of 23.51. The level of functional disability related to turf toe was measured with Foot Function Index and it varied from mild to severe. Most of the players with turf toe have moderate functional disability. **Conclusion:** It was concluded that among 120 participants, most of the adult male hockey players presented with turf toe were lie between 24 to 29 age had moderate disability and were suffering from moderate functional disability. A comparison can be made between the level of functional disability caused by the injury to the first MTP among hockey players playing on a turf field and natural grassy surface.

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INTRODUCTION

Turf toe injury is a hyper-extension injury resulting in a planter-capsular ligamentous sprain or disruption of surrounding fleshy tissue of the first or hallux metatarsophalangeal joint (MTP). Nowadays, it has drawn an increasing amount of attention from physicians, trainers, and athletes.[1] Turf field or synthetic turf surface (STS) is an artificial surface used as a substitute for grass fields in covered or indoor sports facilities. The turf field was used 25 years ago for the very first time in a covered sports facility. It has some benefits as well as some disadvantages. When there is a shortage of land, there is high use of fields or the climate is harsh turf field offers the best option as compared to natural grass fields. However, there is also an increased risk of injuries on the turf field.[2] Functional disability is a loss of functional capacity affecting a person's capacity to work or play. Turf toe injuries result in significant functional disability. Push off, all important in hockey is markedly impaired. To some extent, forward drive and running may also be compromised. Although minor sprains result in limited activity for some days, severe strains may limit the participation of athletes for months.[3] Disorders of the joint at the base of the hallux are common in energetic patients. Great-toe strains (turf toe) can assortment from minor to rigorous with conjoined ruptures.

Hallux rigidus, a painful flexion deformity, is often seen in athletes who stress the joint repeatedly. Nonoperative measures can decrease pain, but surgery is an option for unmanageable cases.[4] Initial discomfort varies with the degree of sprain but in all instances, pain has become progressively more intense after several hours. Pain and disability may not reach maximum until twenty-four hours following injury. The joint becomes uniformly swollen and the overlying skin tense and hyperemic. Marked point tenderness is noted on the planter surface, especially over the metatarsal head. Passive extension is resisted and produces significant discomfort. X-ray studies have revealed only generalized soft tissue swelling. No fractures have been encountered.

While the treatment is immediate ice immersion therapy is begun and continued three times daily until swelling and soft tissue reaction have generally subsided. Activity is restricted until the discomfort is minimal to absent. As activity is progressively increased, protective taping is maintained and a firm insole insert is added to the shoe. Recurrent episodes have occurred and though usually less severe are treated similarly to initial cases. The prevalence rate of turf toe according to the latest study carried out in athletes playing on turf field is around 0.062 per 1000 players per team each season.[5] Turf surface and shoe flexibility index may be the main cause or risk factors of turf field-related injuries. About 85% of turf toe injuries are caused by excessive hallux dorsiflexion caused by hyper-flexible shoes or relatively fewer cushions providing turf surface as compared to grass fields. Steel shanks may be placed in shoes to limit their flexibility to prevent hyper-dorsiflexion of the first metatarsophalangeal joint complex. Unfortunately, these shanks aggressively limit the range of motion (ROM) at joints impairing player performance.[6]

The great toe metatarsophalangeal joint is the ellipsoidal joint formed by the concave base of the proximal phalanx receiving the curved metatarsal head. That joint is stabled on sides by fan-shaped collateral ligaments and dorsally by spreading out of the extensor tendon mechanism. On the plantar surface, stability is afforded by the transformation of the capsule into the heavy plantar ligament. Being a hinge joint, medial-lateral motion is minimal. From the neutral position, there are

approximately 30 degrees of flexion and 50 degrees of extension. Forced extension beyond the physiologic limit results in a sprain of the plantar capsular ligament complex.[7] The patient presents with pain, swelling, reduced ROM and disability, of the first metatarsal phalangeal joint.

Sports performance by the player may also be affected due to pain and sometimes instability caused due to collateral ligament sprain. A high level of doubt is key to diagnosis and management.[8] Depending on the strength of impact, a variety of injuries can occur from strain or sprain of the plantar capsular organization to frank dorsal displacement of the toe. In addition, varieties of typical hyper-extension injuries occurred based on the location of the hallux as well as the direction of the injury force. The utmost communal variant includes valgus-directed force that produces greater injury at medial and plantar-medial ligamentous structures and tibial sesamoid bone composite. That injury pattern can lead to traumatic hallux valgus deformity.[9] Grade I injury is a sprain and weakening of the plantar capsular ligamentous complex of the hallux MTP joint; athletes are commonly able to return to performance as tolerated. Grade II injury is the partial rupture of plantar soft tissue structures of the hallux metatarsophalangeal joint, commonly needing around two weeks for recovery. Grade III injury is a complete rupture of plantar structures of hallux metatarsophalangeal joint, that requires at least 10 to 16 weeks for recovery. Some complete ruptures need to be surgically repaired. Despite increased responsiveness of the turf toe injury, misperceptions still present about structural anatomy, mechanism, diagnosis, and management of that hyper-extension injury at the hallux metatarsal phalangeal joint. However, through precise diagnosis, athletes have suitable management plans, and their prospects can be strengthened about the degree of injury. Careful treatment also allow effective reappearance to sports at preinjury level of involvement.[8]

The prevalence rate of turf toe according to the latest study carried out on athletes playing on turf field is around 0.062 per 1000 players per team each season.[5] Turf surface and shoe flexibility index may be the main cause or risk factors of turf field-related injuries. 85% of turf toe injuries are caused by excessive hallux dorsiflexion caused by hyper-flexible shoes or relatively fewer cushions providing turf surface as compared to grass fields. Steel shanks may be placed in shoes to limit their flexibility to prevent hyper-dorsiflexion of the first metatarsal phalangeal joint compound. Unfortunately, these shanks aggressively limit the ranges of the motion at joints impairing player performance.[6] The prevalence rate of turf toe according to the latest study carried out in athletes playing on turf field is around 0.062 per 1000 players per team each season.[5]

The gap of the study is to explore the level of foot function disability in adult male hockey players who are playing on artificial turf surfaces. This study is more about the function index of the foot having turf toe while other studies focused on mainly turf toe anatomy, pathology and mechanism of injury. The rationale of the study is to describe foot-related functional disability in adult male hockey players with turf toe. It will be helpful for other practicing sports therapists in a quick understanding of the functional disability and problems caused due to turf toe and helps in making the right choice for diagnosis of such injuries. Research was conducted in 2015 by Mark C Drakos *et al.* on planter-plate disruptions, a severe turf toe injury. It was a case report of three cases of planter-plate and turf-related injuries of first hallux among contact athletes of a university and their effects on the infield performance of the players. The study aimed to deliberate the

diagnosis as well as management strategies for each case. Turf toe is an umbrella term under which multiple injuries of the greater toe lie. Some patients present with minor sprains of ligaments of the greater toe and are managed conservatively with casting or a stiff-soled shoe. While others with planter plate disruption and sesamoid apparatus damage are treated surgically with the repair of the planter plate or accordingly.[10] Faltus J *et al.* in 2014 presented a series of the first MTP joint damages in division one college players. Turf toe with planter plate injuries seemed similar terms but are different. They are typically diagnosed similarly. It is difficult to diagnose accurately these MTP injuries of hallux as they both have compromised the integrity of soft tissues and ligamentous structures.

This study suggested radiographic imaging and the Lachman test are acceptable measures of instability in the occurrence of first metatarsophalangeal joint lesions. Proper investigation and assessment are necessary to evaluate the extent of injury and the intervention required to correct it. Intervention may be surgical or conservative based on the degree of sprain, and a multidisciplinary approach is required for a proper return to pre-injury activity level.[3] Daniel K Lee *et al.* in 2011 studied the hallux, sesamoid and first metatarsal injuries. These are common foot injuries and could have serious implications on forefoot biomechanics. They can cause participation restrictions for an athlete. Damage to any one of these structures can cause pain, disability, swelling and reduced range of motion. A high suspicion is a key to diagnosis in the case of sportsmen or athletes to rule out such conditions. Imaging techniques confirm the diagnosis.[11] Namik Sahin et al in 2004 proposed a case report on turf toe in taekwondo players. This study suggested that the MTP joint injury of hallux can occur in many sports-related activities. Before that case report turf toe was never sstudied among taekwondo players.

These injuries are a significant cause of morbidity and restricted participation in sports activities for players. This report was about a 19 years old taekwondo player presented at a clinic in 2002 who got injured while attempting to kick. On further examination, he developed posteromedial instability. He was treated conservatively for a year but did not improve then at the end he was referred for surgical repair, so the study supports the operative intervention for those patients who were not responding to conservative management.[12] In 2002, Robert B Anderson conducted a randomized controlled study on turf toe injuries of the hallux metatarsophalangeal joint. In this study, he evaluated that the utmost communal reason for the first MTP joint injury is produced by hyper-extension force on the foot fixed to the ground.

It may be followed by FHL tear, hallux valgus or varus, cock-up deformity with interphalangeal joint contracture and deteriorating joint diseases in long-term sequels. Its treatment may be non-operative or surgical based on the severity and degree of the instability of the injury.[1] In another study conducted by Martin Levy *et al.* in 1990 on artificial grass or synthetic turf. It was a two-part study. The first part focused on the development and characteristics of artificial playing surfaces and their influence on American football players. Artificial turf was initially designed to provide extra space for city children to play to maintain their fitness level like that of their peers who lived in rural localities. Today there is an increased use of artificial turf on an international level. Turf fields became a part of international sports arenas where there was a limited availability of fields or as a grass substitute where grass would not grow. However, with the change of playing surface from grass to artificial turf,

there is an increased risk of lower extremity injuries among American football players according to this study.[13] Scott A Rodeo *et al.* in 1990 investigated the metatarsal phalangeal joint strains or sprains in professional footballers and their effects on the functional abilities of the player.

Injuries of a first metatarsophalangeal joint due to artificial turf are common nowadays and have received a lot of focus in literature as well as in routine sports medicine practice. The main cause of this injury is either synthetic surface or to some extent lighter more flexible shoes. In this study, eight active professional American footballers were analyzed. 85% of the players were with hyperextension injury mechanisms. While 83% of the players stated their preliminary injury while playing on the artificial turf. Other factors that contribute towards this injury may include the age of the player, number of the years in professional football, and the range of the ankle dorsiflexion. This research concludes that turf toe injuries result in decreased ranges of motion of the first MTP joint.[14]

METHODS

The study design is a cross-sectional case series. The data is collected from Johar Town Hockey Stadium, Wapda Sports Complex, DHA Hockey Ground, Quaid-e-Azam Hockey Club Township Lahore, National Hockey Stadium, Nawaz Sharif Hockey Stadium, Punjab University Hockey Ground and Unique Hockey Ground. The duration of the study is 6 months after approval. The sampling technique is a non-probability convenience sampling technique. The sample size is 120 by using the formula

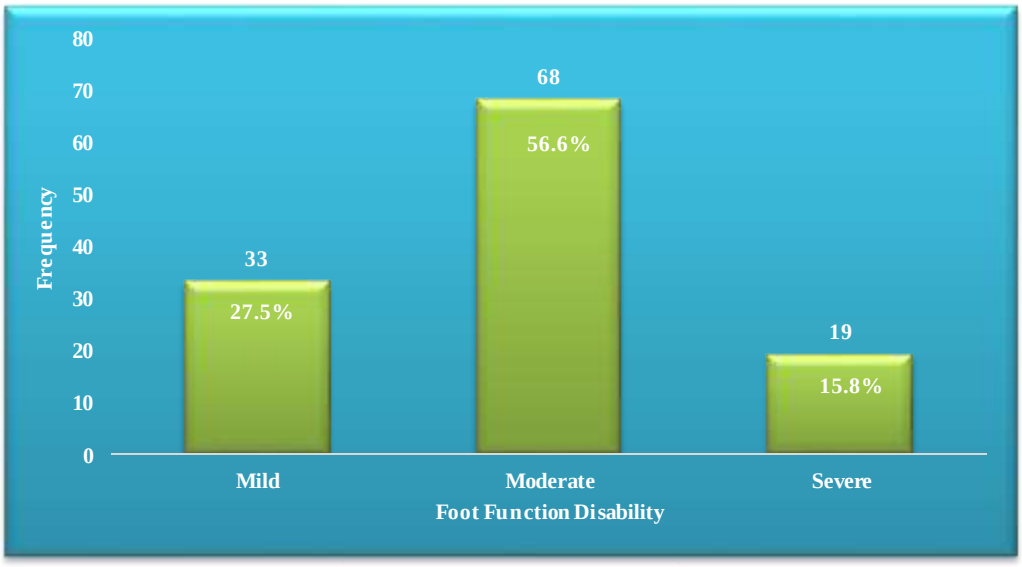
$n= \frac{z^2_{1-\alpha/s}\ P(1-P)}{d^2}$ where r=0.36, α = 0.05, β = 0.10, n = 120. In the sample selection criteria, the inclusion criteria include the age between 18-35 years, male hockey players, turf surface used as playing surface and unilateral turf toe whereas exclusion criteria involve players with a past surgical history of foot or toe, diabetic foot disease, arthritis of the ankle or small joints of hands, player who have left the hockey or retired and player having a foot with any neurological disorders. Data was collected from 120 adult male hockey players with turf toe who had been playing on the turf surface. Players who met the inclusion criteria were assessed with a Foot Function Index questionnaire. The validity of this questionnaire was 0.97 and the reliability was 0.80[15] which was used to assess the foot functional disability level of the hockey players with turf toe. A previous consent from all players was taken.

The data was analyzed through the Statistical Package for Social Science (SPSS) version 20 and that software was also used for the data analysis. The study variables are presented in form of the descriptive statistics (tables, graphs and percentages). Ethical approval was obtained from the ethical committee of the University of Lahore. The questionnaire is accompanied by an information sheet that explains the nature and purpose of the study and describes that the consent was taken by every player. The respondents assured that their responses would remain private. The cultural and religious considerations were duly taken into account at the time of collection of data.

RESULTS

Out of 120 players the age of 30.8% (n=37) was between 18-23, and the age of 45% (n=54) was between 24-29 years. While that of 24.16% (n=29) was between 30-35 years. The sample size of 120 adult male hockey players with turf toe was assessed with a foot function index questionnaire, 76.78 is the mean functional disability and has a standard deviation of 23.51. Figure I shows that in a sample size of 120 adult male hockey players with turf toe, 33 players (27.5%) have a mild

Figure I: Frequency of Foot Functional Disability



functional disability, 68 players (56.6%) have a moderate disability, and 19 players (15.08%) have a severe functional disability.

DISCUSSION

The usage of artificial turf in the United States created a considerable increase in the first metatarsal-phalangeal joint dorsiflexion injuries. Turf toe was been reported to occur in athletes who participated in sports activities. An injury to the plantar capsular ligamentous complex results in acute and chronic pain, resulting in the time lost from sports participation for short or long-term periods. Classification of injury based on the clinical conclusions and imaging studies includes plain radiographs and magnetic resonance imaging.[16] Research conducted in 2015 by Drakos, Fiore *et al.* showed turf toe injuries are communal and moderately inactivating. Athletes usually present with wide-ranging injuries and commonly have much trouble recurring to play and have severe foot functional disability. This study shows that most hockey players or other athletes who play on artificial turf surfaces and have turf toe injuries usually have mild to moderate foot functional disability. Research conducted by Scott A Rodeo *et al.* metatarsophalangeal joint injuries of the great toe (turf toe) are receiving increasing attention in the literature because of the prevalence of synthetic surfaces and lighter, more flexible shoes. He evaluated eighty active professional football players in the study while this research evaluates 150 active professional hockey players. This study evaluates that artificial surface is the major reason for turf toe as it increases the risk of injury and this study states that turf surface is the main contributing factor of injury among hockey players.

The sample size could be increased to reduce the probability of error. A cohort-type study can be designed to evaluate the incidence and risk factors causing turf toe injuries among hockey players. More demographic differences should be taken into account while measuring functional disability among athletes. The study time duration was too short. The sample size was small which limited the settings for the study. Another limitation faced by me during my study was the lack of financial resources for extensive study.

CONCLUSION

It was concluded that among 120 participants, most of the adult male hockey players presented with turf toe were lie between 24 to 29 age had moderate disability, and were suffering from moderate functional disability. A comparison can be made between the level of functional disability caused by the injury to the first MTP among hockey players playing on a turf field and the natural grassy surface.

DECLARATIONS

Consent to participate: Written consent had been taken from patients. All methods were performed following the relevant guidelines and regulations.

Availability of data and materials: Data will be available on request. The corresponding author will submit all dataset files.

Competing Interests: None

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Author contributions: The author read and approved the final manuscript.

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