PRELIMINARY ASSESSMENT OF REARFOOT ALIGNMENT AND ITS EFFECT ON STATIC AND DYNAMIC STABILITY IN ROLLER HOCKEY PLAYERS BY USING Y BALANCE TEST- A PILOT STUDY

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Abstract: This pilot study aimed to evaluate the rearfoot alignment and its impact on static and dynamic stability among roller hockey players, employing the Y Balance Test. Twelve roller hockey players (age:15 to 25 years) participated in this study. Rearfoot alignment was assessed using standardized measures, while static and dynamic stability were evaluated through the Y Balance Test anterior, posteromedial, and posterolateral reach directions. The findings revealed significant associations between rearfoot alignment and static stability in the posterolateral direction ($p < 0.05$). However, no significant relationship was observed between rearfoot alignment and dynamic stability ($p > 0.05$). This pilot study provides initial insights into the potential influence of rearfoot alignment on static and dynamic stability among roller hockey players, warranting further investigation with larger sample sizes to establish conclusive findings and implications for injury prevention and performance optimization in roller hockey.

Conclusion-The study concludes that there is weak positive correlation between the rearfoot alignment and the static and dynamic stability. Even if the rearfoot alignment is positive, there is no effect on the static and dynamic balance of the individual or there is a probability that they are at minimal risk of injury.

Keywords: Roller Hockey players, Rearfoot alignment, Static and Dynamic Stability, Y-balance test.

INTRODUCTION-

Roller hockey is a form of hockey played on a dry surface using wheeled skates. It can be played with traditional roller skates or with inliner skates and use either a ball or a puck. Combined, roller hockey is played in nearly 60 countries worldwide. [1][2][3] Roller hockey or inline hockey is a variant of hockey played on a hard or smooth surface using inline skates to move and ice hockey stick to shoot a hard, plastic puck into opponents' goal to score points [1] The sport is a very fast paced and free flowing game and is considered a contact sport, but body checking is prohibited. There are five players including the goalkeeper from each team on the rink at a time, while teams normally consist of 16 players.[2] There are professional leagues, one of which is the National Roller Hockey League (NRHL). This along with fewer players on the rink allows for faster gameplay. There are traditionally two 20-minute periods or four 10-minutes periods with a stopped clock.

In sport such as roller hockey, which is characterized physiologically by its intermittent nature, alternating the effort intensities between the aerobic and anaerobic regimes with a predominance of short actions of maximum intensity makes it clear that power and speed are physical qualities of extreme relevance for the physical performance of the players. [5][6] Rearfoot is made up of talus and calcaneus. Talus is the uppermost bone of the foot which connects the foot to the ankle by forming a joint with the tibia and fibula bones of the lower leg. The ankle and the subtalar joints involved in ankle strategy for maintaining balance are both located in the rearfoot, it was considered that the rearfoot alignment measured in both weight bearing and non-weight bearing positions have a significant relationship to static and dynamic postural stability. Both static and dynamic stability are maximally challenged in all activities while playing roller hockey.[3] Balance has often been used as a measure of lower extremity function and is defined as the process of maintaining the center of gravity within the body's base of support.[3] To maintain upright stance, the central and peripheral components of the nervous system are constantly interacting to control body alignment and the center of gravity over the base of support.[4][5]Peripheral components in balance include the somatosensory,

visual, and vestibular systems. Considering that the foot is the most distal segment in the lower extremity chain and represents a relatively small base of support upon which the body maintains balance (particularly in single-leg stance), it seems reasonable that even minor biomechanical alterations in the support surface may influence postural-control strategies. Specifically, excessively supinated or pronated foot postures may influence peripheral (somatosensory) input via changes in joint mobility or surface contact area [9] or, secondarily, through changes in muscular strategies [6] to maintain a stable base of support. An excessively supinated foot, characterized by a high arch and hypomobile midfoot, may not adequately adapt to the underlying surface, increasing the demand on the surrounding musculoskeletal structures to maintain postural stability and balance [6]. Postural stability has emerged to be an important element in activities of daily living as well as for the sports community, as it reduces the risk of falls and injury. It improves the performance of athletic activities by providing essential balance. It has been postulated that foot alignment plays an important role in postural stability [10].

NEED OF STUDY-

The rearfoot alignment plays a role in postural stability. It is the ability to control the position of the body in space for the purpose of movement and balance.

In this game, players postural stability plays an important role it is necessary to maintain the static position and for assisting body co-ordination in dynamic position changes. Rearfoot varus or valgus may have an influence on static and dynamic balance in this player and might have a risk of fall and injury due to it.

As the rearfoot alignment plays a role in static and dynamic stability, it will make us recognize whether the overall performance in the game is hampered due to the rearfoot malalignment.

AIM-

To find the effect of rearfoot alignment on static and dynamic stability in roller hockey players with Y balance test.

OBJECTIVE-

To find the effect of rearfoot alignment on static stability in roller hockey players with Y balance test.
To find the effect of rearfoot alignment on dynamic stability in roller hockey players with Y balance test.
To find whether there is static and dynamic stability in the roller hockey players due to rearfoot mal-alignment with Y balance test.
To find the prevalence of effect of rearfoot alignment on static and dynamic stability in roller hockey players.

METHODOLOGY-

Research design: Pilot study

Study population: Roller hockey players.

Sample size: 30

Sampling technique: Purposive sampling

Study duration: 6 Months

Study set-up: PCMC, Pune

INCLUSION CRITERIA-

Age between 15 to 25 years.[1]

At least 1 year of experience in professional roller hockey game.

Practicing professional roller hockey with weekly training of 2 days.

Includes males and females.

The one whose rearfoot alignment test is positive.

EXCLUSION CRITERIA-

Players with history of recent lower limb injuries or any surgery.

Any systemic illness.

Players receiving any physical therapy intervention.

Players with any congenital foot deformity.

The one who plays it occasionally as a passion.

PROCEDURE-

Ethical approval was taken.

Subjects were selected as per the inclusion and exclusion criteria.

Procedure was explained to subjects. Informed consent was taken.

Rearfoot alignment test was performed on each subject and the positive ones were assessed for Y balance test.

The subject performed each test 3 times and we used the average of 3

trails for further analysis.

STATISTICAL ANALYSIS AND INTERPRETATION-

Total Population	30
Need for Y-balance test	11.80%

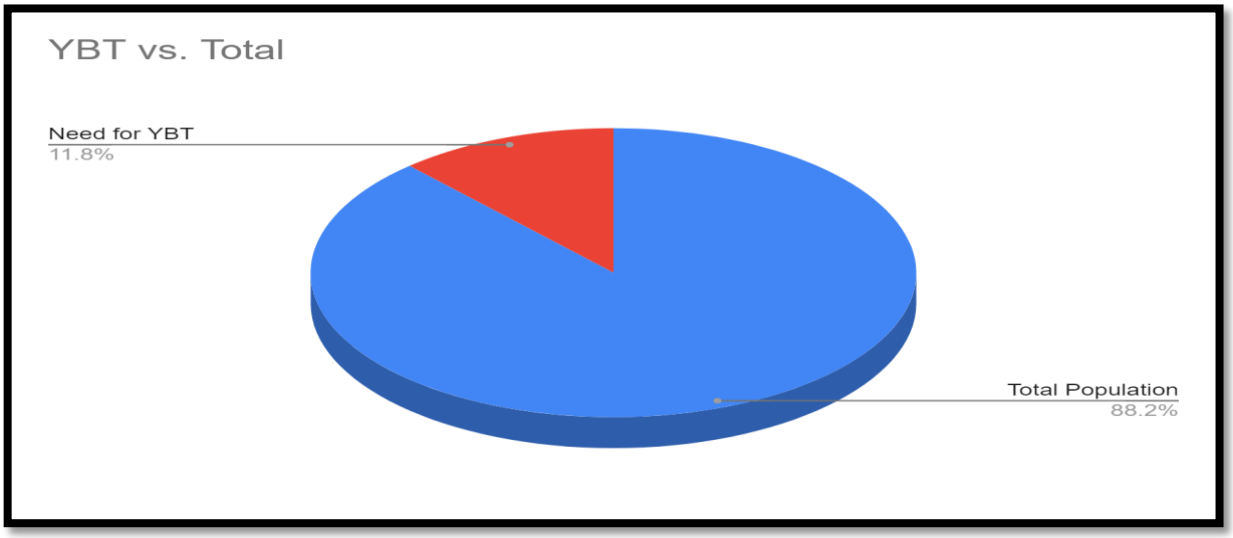

Figure No.1

Out of a total population of 30 individuals, 11.8% of patients have been identified with a positive result in the rear foot alignment test, indicating a need for further evaluation through the Y balance test.

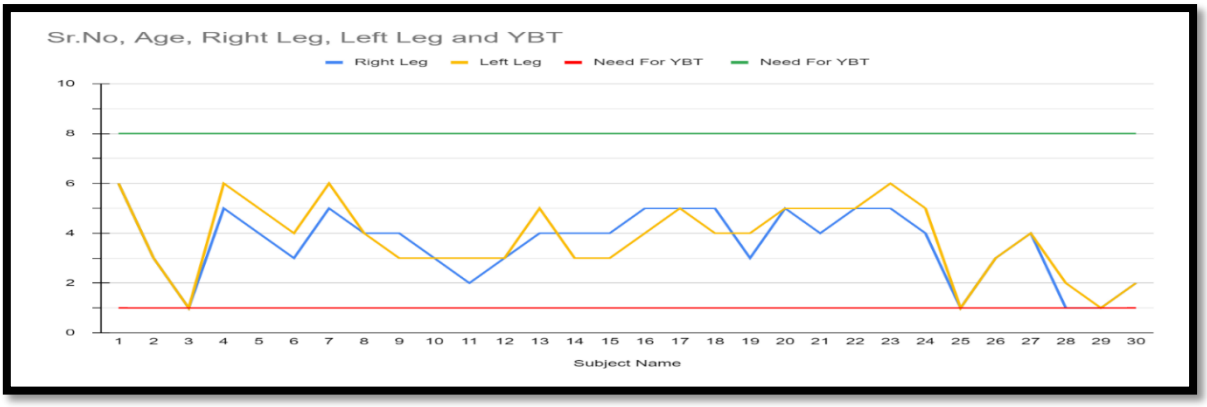

Figure No.2

The rearfoot alignment and Y balance test results lie in the potential association between foot biomechanics and static and dynamic stability. The patient's rearfoot alignment test values falling within the range of more than 1 and less than 8 indicate a negative rearfoot alignment. Conversely, if the values are 1 or less than 1 or 8 or greater, the rearfoot alignment test yields a positive result. In such cases, it is recommended for the patient to undergo the Y balance test for further assessment and evaluation. This synchronized graph clarifies the criteria for determining the outcome of the rearfoot alignment test and outlines the subsequent steps based on the results obtained.

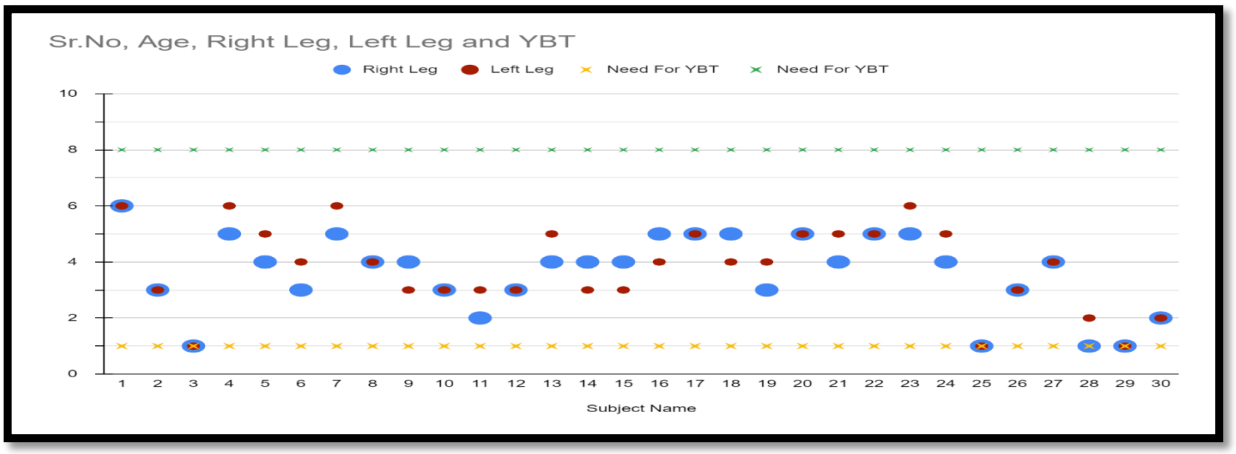

Figure No.3

The scattered data depicted in the figure 3 provides insight into the rearfoot alignment test and the Y balance test. From this analysis, it is apparent that only a small fraction of the assessed patient population necessitates the Y balance test. Specifically, if either the rearfoot alignment test for the left or right leg shows positive result, indicating potential alignment issues or asymmetries, the patient is recommended to undergo the Y balance test for further assessment.

INTERPRETATION-

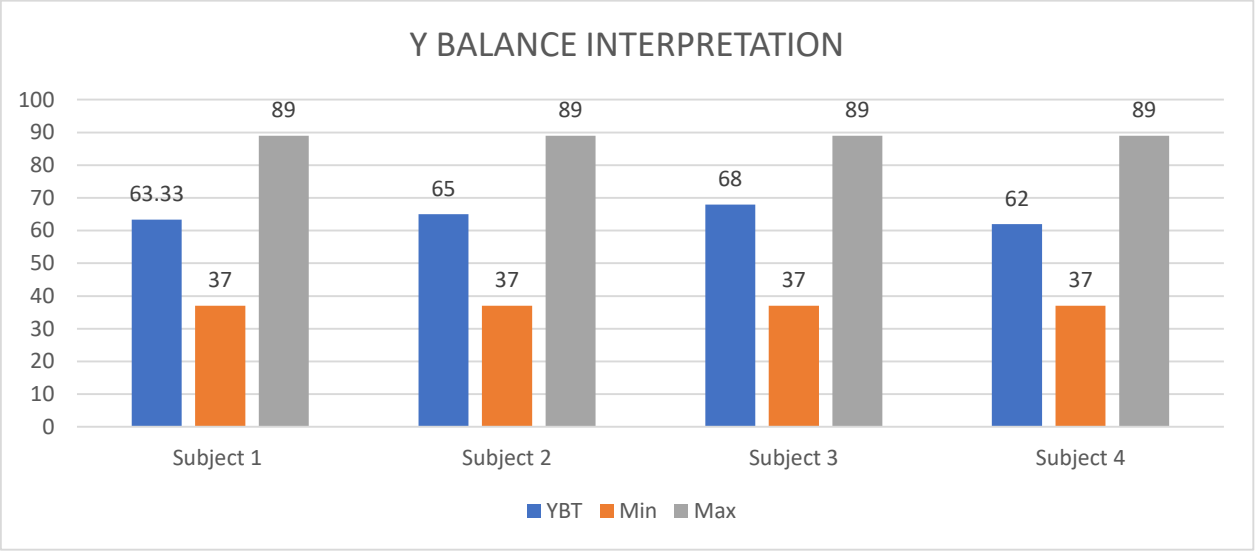

Figure No.4

In the given fig 04, it shows the result for Y balance test which indicates that 11.8% of population i.e. 4 subjects have a probability of minimal risk of injury. The score between 37% to 89% indicates that the person is it minimal risk of injury. The score below 37% indicates maximum risk of injury. The score above 89% indicates a good balance score.

RESULTS-

In fig.1out of a total population of 30 individuals, 11.8% of patients have been identified with a positive result in the rearfoot alignment test, indicating a need for further evaluation through the Y balance test. This subset of patients, comprising approximately 4 individuals, requires additional scrutiny to assess their balance and alignment more comprehensively.

In fig.2 The rearfoot alignment and Y balance test results lie in the potential association between foot biomechanics and dynamic stability. The patient's rearfoot alignment test values falling within the range of more than 1 and less than 8 indicate a negative rearfoot alignment. Conversely, if the values are 1 or less than 1 or 8 or greater, the rearfoot alignment test yields a positive result. In such cases, it is recommended for the patient to undergo the Y balance test for further assessment and evaluation. This synchronized graph clarifies the criteria for determining the outcome of the rearfoot alignment test and outlines the subsequent steps based on the results obtained.

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DISCUSSION-

The present study was carried out to investigate preliminary assessment of rearfoot alignment and its effect on static and dynamic stability in roller hockey players. The findings underscore the importance of assessing rearfoot alignment as a precursor to evaluating overall balance and alignment in individuals.

With a population of 30 individuals, comprising of roller hockey player, the study aimed to work on rearfoot alignment test outcomes and the subsequent need for Y balance testing.

Our study underscores the importance of considering rearfoot alignment in the assessment of static and dynamic stability, particularly through the utilization of the Y balance test.

The Y balance test emerges as a valuable tool in our study, enabling comprehensive assessment of static and dynamic balance. By evaluating participants' ability to maintain stability and control during multidirectional reaches, this test

offers insights into their functional movement patterns and potential areas of weakness or imbalance. These findings hold particular relevance for athletes, especially the skaters, whose performance relies heavily on precise movements, agility, and balance.

In our investigation, we observed that approximately 11.8% of the participants exhibited a positive result in the rearfoot alignment test, indicating potential alignment issues warranting further evaluation through the Y balance test. This subset of individuals, constituting around 4 subjects, highlights the significance of targeted assessment strategies in identifying specific concerns related to lower extremity alignment and balance.

Out of the 4 people 2 people had flatfeet because of which the rearfoot alignment was positive for them.

Research by Cowan et al. (2009) demonstrated that individuals with flat feet had altered rearfoot kinematics, predisposing them to overuse injuries.

This study concluded that, Structural abnormalities such as flat feet (pes planus) or high arches (pes cavus) can affect rearfoot alignment and contribute to biomechanical imbalances. Flat feet may result in excessive pronation, while high arches may lead to increased supination.

The other 2 people might have muscular imbalance surrounding the rearfoot alignment or altered biomechanical stresses on the rearfoot while the game play.

A study by McKeon et al. (2008) highlighted the role of muscle weakness in contributing to altered foot biomechanics and increased injury risk.

This study concluded that Weakness or imbalance in the muscles surrounding the rearfoot, such as the tibialis posterior or peroneal muscles, can influence rearfoot alignment. Inadequate muscle support may lead to abnormal pronation or supination.

Roller hockey involves rapid movements, including skating, stopping, pivoting, and turning, which place significant stress on the lower limbs, particularly the feet and ankles. These dynamic movements can lead to alterations in foot alignment over time.

A study by Russell et al. (2016) investigated the biomechanics of skating in hockey players and highlighted the substantial forces experienced by the lower extremities during skating maneuvers.

Although, the result for the same individuals for the Y balance test falls in the range of an average score of 65.5% which indicates the probability of minimal risk of injury.

However, previous studies have reported contradicting results regarding the association between the alignment of the feet on postural stability. Several studies have indicated that foot alignment may be one of the contributing factors to postural stability (Anzai et al, 2014; Cobb et al, 2014; Abdulwahab and Kachanathu, 2015). On the other hand, there are also studies that report no association between foot alignment on postural stability (Karthikeyan et al, 2015; Hyong and Kang, 2016). [10]

Hertel et al in 2002 investigated that less plantar sensory information was provided by supinated foot and pronated foot unlike normal foot. They proposed that person with supinated foot and pronated foot uses larger area for cop excursion due to which maintaining balance becomes difficult**.** [11]

Tansu Birinci in 2017, while studying relationship between medial longitudinal arch and postural control proposed that there is a relation between supinated foot and single limb balance test. They found that there was significant increase in the posterior postural way of a person with supinated foot causing knee and hip strategy to get activated and sup in maintaining balance. They concluded the study noting that person with supinated type has lesser stability than normal foot type. [11]

Ribeiro et al (2011) reported plantar fascitis to be a factor influencing rearfoot alignment and the plantar longitudinal arch. However, their study reported that both the control and plantar fascitis group demonstrated the same rearfoot valgus malalignment. [12]

Nikhil Kamble (2021), Dr. Shruti Mulaokar in this study Correlation between medial longitudinal arch height of foot and static, dynamic balance in cricketers, concluded that there is a weak positive correlation between medial longitudinal arch height of foot and static, dynamic balance in cricketers. [13]

CONCLUSION-

The study concludes that there is weak positive correlation between the rearfoot alignment and the static and dynamic stability. Even if the rearfoot alignment is positive, there is no effect on the static and dynamic balance of the individual or there is a probability that they are at minimal risk of injury.

LIMITATION OF STUDY-

The anthropometric data was not considered.

Individual direction's score of Y balance test was not considered.

FUTURE SCOPE OF STUDY-

This study can be done on larger population size.

Same study can be done in athletes with varying sports activities.

This study can be done on smaller age groups.

Same study can be done on only female roller hockey players.

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