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Original Article:

Correlation between subtalar varus angle and disability in patients with patellofemoral arthritis

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Abstract:
Aim: To find the correlation between subtalar varus angle & disability in patients with patellofemoral arthritis. **Methods:** A total of 30 subjects aged (48.86±5.74) referred to the department of physiotherapy, with patellofemoral arthritis and fulfilling the criteria of inclusion were recruited for the study, sampling method being convenient sampling. Disability score was measured of each patient by WOMAC index (Western Ontario and McMaster Universities Index of Osteoarthritis) disability questionnaire and subtalar varus angle was measured in non weight bearing position in prone lying. **Results:** Pearson's correlation coefficient test showed a highly significant (p=0.000) positive correlation (r=0.821) between disability scores and subtalar varus angle. **Conclusion:** There is a highly significant relation between disabilities due to patellofemoral pain in patellofemoral arthritis patients and sub talar varus angle

Key Words: Patellofemoral arthritis, Subtalar varus angle, Rear foot, Disability, Osteoarthritis knee.

Introduction:

Knee Osteoarthritis (OA) is a commonly encountered pathological joint affliction that leads to chronic disability, reduced mobility and functional limitation.[1] OA in particular causes degeneration of the entire knee joint affecting the integrity of the joint arrangement and could result in chronic disability.[2]

Rear foot varus was found to be one of the most common bony deformities of the foot which is present in 83% of a normal population.[3,4] It was suggested however that subjects with patellofemoral pain (PFP) had higher incidence of rear foot varus deformity.[5] It was reported a varus rear foot posture of subjects with PFP when measuring subtalar joint neutral. Therefore, rear foot varus was suggested to be a factor in contributing to PFP.[5] Thus rear foot varus may be a factor in contributing to PFP.

Many studies have shown relation between patellofemoral pain & subtalar varus angle, but there have been minimal studies done on the relationship between disability due to patellofemoral pain and subtalar varus angle in cases with identical clinical findings and distribution of symptoms.

This study aimed at establishing a relationship if any between subtalar varus angle and disability in patient with patellofemoral pain.

Materials and Methods:
A total of 30 subjects aged (48.86±5.74) referred to the department of physiotherapy, Dhiraj General Hospital, Baroda, Gujarat with patellofemoral arthritis and fulfilling the criteria of inclusion and exclusion were recruited for the study, sampling method being convenient sampling.
All subjects were informed of the procedures and signed a written informed consent prior to participation in this study .

Inclusion Criteria –

- Age – 40 to 65 years
- Sex – both males & females
- Clinically and radiographically diagnosed patient of patellofemoral arthritis with unilateral involvement.

Exclusion Criteria –

- Patellar dislocation
- Knee surgery
- Concomitant diagnosis of prepatellar bursitis or tendonitis
- Ligamentous knee injury or laxity
- Plica syndrome
- Bilateral involvement of patellofemoral arthritis
- Sinding Larsen's disease
- Osgood Schlatter's disease
- Infection
- Malignancy

Materials / Appratus

- Goniometer
- Womac index
- Pen
- Marker
- Pencil and Paper
- Sliding Calipers

Dependent variables of this study are the following.

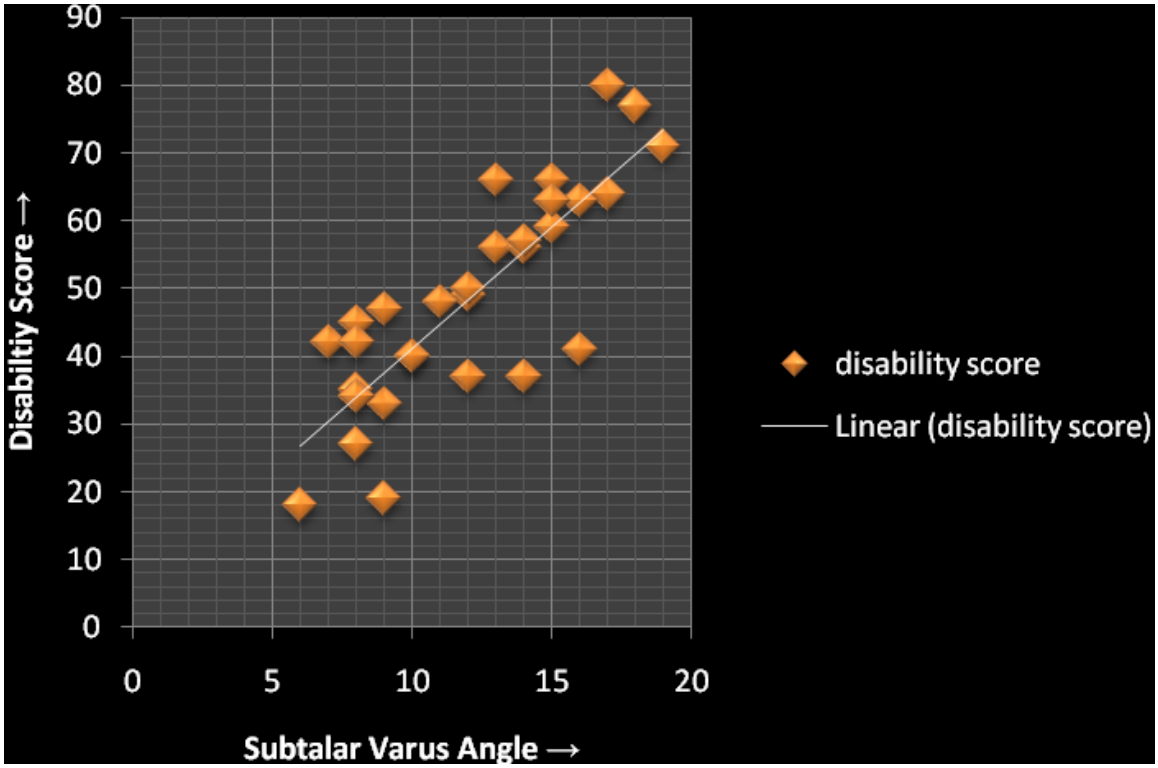
1. *Measurement of disability score*

   Subjects with petellofemoral arthritis with unilateral involvement were selected & their disability scores were taken on WOMAC index disability questionnaire on the first day before starting any physiotherapy interventions and any medical treatment

2. *Measurement of subtalar varus angle*

   The subject laid down in prone position with the foot and ankle (to be measured) hanging 15-20 cm over the end of the table. The opposite limb was positioned in hip flexion, abduction and external rotation with the knee flexed and resting on the supporting surface.[6] With the foot perpendicular to the floor the examiner bisected the posterior lower leg and the posterior calcaneus using Sliding Calipers. The palpation method of measuring the Subtalar Joint Neutral position was based on Wooden[7] and Elveru et al.[6] The foot to be measured was in dorsiflexion and the rear foot passively pronated and supinated. When the head of the talus was felt equally between the lateral and medial sides, the subtalar joint was in neutral position.[6] The position of the subtalar in the neutral position was maintained and the angle formed by the longitudinal midline of the posterior calcaneus and the line drawn on the posterior lower leg was measured.[6] One arm of the goniometer was placed on the lower leg bisection line while the other arm was placed on the calcaneal bisection line .The axis of the goniometer was placed between the malleoli in the frontal plane.[8][See Fig below]

Statistical Analysis: Statistical analysis was done with the help of SPSS software by Pearson's correlation coefficient test. Significance was accepted at $p < 0.05$.



Results:

There was a highly significant (p=0.000) positive correlation (r=0.821) between disability scores and sub talar varus angle.

		DIS	STJ
DIS	Pearson correlation	1.000	.821**
	Sig. (2 tailed)	.	.000
	N	30	30
STJ	Pearson correlation	.821**	1.000
	Sig. (2 tailed)	.000	.
	N	30	30
**Correlation is significant at the 0.01 level			

The result analysis [See Graph above] shows that null hypothesis can be cancelled, so it is clear that there is a relationship between subtalar varus angle and disability in patellofemoral arthritis.

Discussion: The relationship between the subtalar joint and the lower extremity has been well documented.[3,9-12] The motions of pronation and supination occur at the subtalar joint and assist in normal locomotion.

Normal subtalar joint pronation occurs during the first 25% of the gait cycle during which the tibia internally rotates 20^0.[13] This is in response to the inward rotation of the talus as it falls into the space created by the inferior and lateral movement of the anterior portion of the calcaneus.[14] Subsequent supination results in external rotation of the tibia. Transfer of subtalar joint motions to the lower extremity is due to the tight fit of the talus into the ankle joint mortise.[15]

Excessive subtalar joint pronation has been described as a compensatory mechanism for rear foot varus.[10-12] Particular concerns are the bony foot deformities that functionally invert the rear foot relative to the ground. In order to achieve medial rear foot and forefoot contact during gait, excessive subtalar joint pronation is required. Subtalar joint pronation required to compensate for a bony deformity is considered abnormal if the amount of pronation is in excess of the normal amount needed for locomotion or occurs at the wrong time (when the foot should be supinating).[11] Excessive pronation will delay the external rotation of the tibia which normally accompanies subtalar joint supination.[3]

If excessive or prolonged pronation is evident in midstance, then excessive internal rotation of the tibia will be evident.[3] To achieve knee extension during mid stance, the tibia must externally rotate relative to the femur to ensure adequate motion for the screw-home mechanism. In order to compensate for this lack of tibial external rotation as a result of abnormal pronation, the femur internally more predisposed to patellofemoral pain than others.

Support for a relationship between ankle and knee kinematics has been presented by Eng and Pierrynowski[16] who found that the correction of structural foot abnormalities with soft foot orthotics resulted in small changes in frontal and transverse motion at the knee. In a follow up study, the same authors reported that use of this orthotics was more effective in reducing patellofemoral pain than a traditional exercise program.[17] Although a small patient group was studied, these results gave clinical credence to this biomechanical relationship.

Rear foot varus was found to be one of the most common bony deformities of the foot which is present in 83% of a normal population.[4] The present study shows that subjects with patella femoral pain syndrome (PFPS) have higher incidence of rear foot varus deformity which is similar with the study of Powers et al.[5] & Pazit leveinger and Wendy Gillieard.[18] Thomee et al. reported no differences in the Relaxed Calcaneus Standing (RCS) angle relative to the lower leg or to the horizontal between controls and subjects with PFPS.[19]

The current study is an attempt at establishing a relationship between sub talar varus angle and disability in symptomatic subjects with comparable clinical presentation. The study was carried out on subjects from Baroda, a city in western India. Disability of subjects measured with The **WOMAC** (Western Ontario and McMaster Universities) Index of Osteoarthritis and the sub talar varus angle measured by using non weight bearing position in prone position. Present study shows a very highly significant positive correlation between sub talar varus angle and disability scores on The **WOMAC** (Western Ontario and McMaster Universities) Index of Osteoarthritis (r=0.821, p=0.000).

Certain variables were uncontrolled in the current study and their influence on the results was assumed to be null. The major assumption was regarding the drugs prescribed by the orthopedician. The effect of drugs could definitely be a direct confounding factor for the pain intensity. But for the credit of the current study the entire outcome measures were collected on the first day of diagnosis before any noticeable effect of the medications would have set in.

Conclusion:

It has been proved that there is a highly significant relation between disabilities due to patellofemoral pain in patellofemoral arthritis patients and subtalar varus angle, but further studies with different set of variables and situation are required to substantiate the current findings.

Recommendations and Limitations:

One major limitation of the current study was the sample size. Though the result obtained was very highly significant, to generalize the findings into a clinically useful data the study has to be replicated in a bigger sample size.

The current study was done of subjects grouped on the basis of anatomical distribution of symptoms. Grouping the subjects on the basis of pathology rather than symptom distribution may give a better insight into the interaction between disability and biomechanical factors. If the uncontrolled variables of the current study could be controlled, the sensitivity and specificity of the findings can be increased.

Future studies should aim at the interaction of multiple variables in the manifestation of patellofemoral pain. Future studies could be done with the aim at studying both the genders separately to obtain a more accurate and specific result.

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