

ANTERIOR KNEE PAIN AND LOWER EXTREMITY FUNCTIONS IN INDIAN ADOLESCENT POPULATION

Riddhi Shroff¹, Vrushali Panhale²

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Authors details: ¹Clinical physiotherapist, Mumbai, India.

²Associate Professor, MGM College of Physiotherapy, Navi Mumbai India

Corresponding author: Riddhi Shroff
Clinical physiotherapist, Mumbai, India.

Email: ridz_shroff@yahoo.com

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ABSTRACT

Background & Purpose - Anterior knee pain is one of the most common musculoskeletal complain seen in Indian adolescent population with high incidence among those who are active in sports and recreation. The purpose of this study was to investigate the age of onset of anterior knee pain, to find its effect on sports participation and also to find the activities which are maximally affected due to anterior knee pain in Indian population. **Method**- A questionnaire based survey was conducted among 50 subjects using three outcome measures namely self made demographic questionnaire, anterior knee pain scale and lower extremity functional scale. **Result**- Maximally affected activities are running, jumping & squatting and maximally affected functions are squatting, running on uneven ground, making sharp turns while running and hopping with increase incidence of anterior knee pain among those who participate daily in sports. **Conclusion**- The study concluded, that in adolescent age group of 11-17 years, anterior knee pain is more prevalent in adolescent girls with the age of onset being around 13 years for girls & 14.5 years in boys and it also showed moderate positive correlation between anterior knee pain and lower extremity functions

INTRODUCTION

Anterior knee pain is one of the most common musculoskeletal complain seen in the Indian pediatric population with high prevalence among those who are active in sports and recreation^[1]. One of the most common abnormalities involving the knee joint is disturbance of the patello-femoral mechanism^[2]. Most causes of anterior knee pain in adolescent Indian population involve the patellofemoral joint and the extensor mechanism of the knee^[1]. An extensive differential diagnosis exists as anterior knee pain is a fairly nonspecific phenomenon with various etiology^[1]. Despite being such highly prevalent problem in Indian population, we still do not know the etiology and the best possible treatment for this group^[3]. Identification of early signs and symptoms will help in finding the cause which in turn would help in determining which cases may require further evaluation and the management protocol to be followed to prevent the condition from worsening and leading to complications. The condition is usually caused by an irritation and inflammation of the extensor mechanism of the knee either at the attachment to the tibial tuberosity, in the patella tendon, in the cartilage on the back of the knee cap (patella), or at the attachment of the quadriceps muscles to the patella^[4]. The exact etiology is unknown but a number of previous studies are being done and various predisposing factors have been suggested as possible causes^[5,6,7]. The studies have also been done which proves that growth-related factors unique to the adolescent population may be important contributing factors in the epidemiology of anterior knee pain^[8,9,10]. If ignored, anterior knee pain may interfere with sporting and daily activities of adolescents, and as a result of pain a large number of adolescents may be forced to limit their physical activity which they perform daily or they may deliver sub optimally on the sports field if they are active sports participants^[11].

If anterior knee pain is leading to hindrance of physical activity it will negatively affect the developing child as it will lead to retardation of physical development, general fitness, endurance, body composition, the development of motor skills, and psychosocial development^[12,13], pain may also lead to adoption of sedentary lifestyle habits which poses a health risk in later life^[11]. Anterior knee pain scale and lower extremity functional scale has high test-retest reliability and appears to be moderately responsive to clinical changes in patients with anterior knee pain so this scales are used as outcome measures^[14]. It has been observed that Indian adolescent age group has a varied interest in all sporting activity. Literature reviews showed unavailability of studies in Indian subjects in this age group, the growing incidence of anterior knee pain in this age group justifies the need of the study. So, aim of the study was to find the age of onset of anterior knee pain, to find if this affects functional activities and sports participation and to correlate anterior knee pain scale and lower extremity functional scale in Indian adolescent population

Methods

It is prospective and cross sectional Descriptive type of study. All the 50 participants were recruited from school set of Kamothe, Navi Mumbai, however there was no gender discrimination. An informed consent was obtained from all participants prior to data collection and the total study duration was of 6 months.

Inclusion criteria: Subjects in the age group of 11-17 years who indicated pain on anterior surface of knee on pain assessment body chart with the complain of pain for more than 1 month

Exclusion criteria: Those with radiographic evidence of fracture on lower extremity, unhealed fracture on lower

extremity, recent surgery on lower extremity, recent trauma to lower extremity (fracture, soft tissue injury)
 A questionnaire based survey, was carried out by interviewing participant using
 1 Self Made Demographic data questionnaire
 2 Anterior Knee Pain Scale [14]
 3 Lower Extremity Functional Scale [14]

Scales

1. Demographic data questionnaire

It is a self made questionnaire, documenting response to 9 questions within which 1st section investigates about demographic details of participants like age, gender, 2nd section about anterior knee pain in which questions included site of pain, duration, 3rd section asked about anterior knee pain affecting functional activities and sports participation

2) Anterior knee pain scale

It is a 13 item knee specific self report questionnaire which documents response to six activities. Anterior knee pain scale documents response to Walking, Running, Jumping, Using stairs, Squatting, Sitting for prolonged periods with knees flexed as well as symptoms such as Limp, inability to bear weight through the affected limb, Swelling, abnormal patellar movement, muscle atrophy & limitation of knee flexion [15]. Scoring was out of 100. Test reliability of the scale was 95% [14]. Higher the score of scale, lesser is the pain.

3) The Lower Extremity Functional Scale

It is a questionnaire containing 20 questions about a person's ability to perform their daily tasks, The Lower extremity functional scale (LEFS) can be used by clinicians as a measure of patients initial function, ongoing progress and outcome, as well as to set functional goals [4]. Scoring was out of 80. Test reliability was 98% [14]. The lower the score greater the disability.

Statistical analysis: Data analysis and graphical representation was done using SPSS 16 of all the 50 subjects, which is depicted in tables below.

RESULTS

It was found that, out of the 50 participants 30 were girls and 20 were boys. Thus, 40% adolescent boys and 60% adolescent girls experienced anterior knee pain of which 87.5% of the participants experienced anterior knee pain from 1 month to 1 year and 12.5% since 1-3 years, within which 43% had pain on right lower extremity, 27% had left lower extremity and 30% had bilateral lower extremity pain. 25% of the participants experienced their activities of daily living affected due to pain. 77.5% of them were active in sports out of which 52% of them participated daily in sports and among them 63% had their sports participation affected due to pain.

Karl Pearson correlation was done between anterior knee pain scale and lower extremity functional scale which showed moderate positive correlation of $r = 0.77$ ($p=0.000$)

TABLE 1: Correlation of anterior knee

Item	p-value	r-value
Correlation of Anterior knee pain and lower extremity scale.	0.000	0.77

Figure 1 shows, the anterior knee pain scale showed which activities were maximally affected, and it showed 75% had running affected, 50% jumping, 32% squatting, 27% walking, and 20% stairs. Lower extremity functional scale showed functions which were affected due to pain which were 61% squatting, 54% running on uneven ground, 40% making sharp turns while running and 48% hopping.

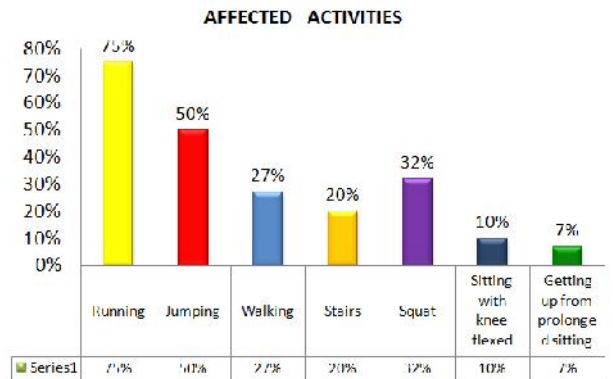


Fig 1: Affected activities due to anterior knee pain in adolescents.

Table 1: Characteristics of participants

Item	Percentage
Gender	
Boys	40%
Girls	60%
Duration of pain	
1 month to 1 years	87.50%
1 year to 3 years	12.50%
Site of pain	
Right knee	43%
Left knee	27%
Bilateral	30%
Activities Of Daily Living	
Affected	25%
Not Affected	75%
Subjects active in sports participation	
Yes	77.50%
No	22.50%
Frequency Of Sports Participation	
Daily	52%
> 3 times per week	43%
Once a week	5%
Affection Of Sports Participation due to pain	
Yes	63%
No	37%

DISCUSSION

According to survey, results of the study shows that adolescent girls have higher prevalence of anterior knee pain as compared to boys, mean age of onset for adolescent girls is 12.7 years (S.D +/-1.4 & boys is 14.6 years S.D (+/- 1.6). A previous study done concludes that age of onset for anterior knee pain is of 12-13 years in girls & 14-15 years in boys which is similar to what our study result shows correlates with adolescent growth spurt [11]. Previous studies have reported that during growth spurt, linear growth occurs in bones first followed by soft tissues [11], and during this growth spurt boys experience reduced

flexibility while girls have increased flexibility^[13]. Girls are at a higher risk of joint pain and injury at this stage due to this increased flexibility, and possible ligament laxity or muscle weakness^[16]. Anterior knee pain among adolescents is thought to result from sub maximal, repetitive, tensile stresses acting on the immature junction of the patellar tendon, tibial tubercle, and tibia, if there is excess load on patella tendon, particularly if there are insufficient rest periods which is commonly seen in people participating in sports activities.

Another probable reason is that pain receptors are present within several knee structures, including the patella, synovium, fat pad, tendon, subchondral bone, and quadriceps retinaculum^[17,18,19] any of these structures, individually or in combination, can cause anterior knee pain^[1], this results in pain usually made worse by running, and jumping. Our study showed that, maximally affected activities in adolescents are running, jumping and squatting the reason for which may be that the patellofemoral joint reaction force (PFJR) acts perpendicular to the articular surface and increases with increasing knee flexion. PFJR is calculated to be 7 to 8 times when squatting and 20 times bodyweight when jumping^[20]. Previous study also concludes that as compared to adults the long bones in children are able to absorb more energy before breaking, and the presence of growth plates and apophysis for the attachment of musculotendinous structures lead to a different spectrum of injuries compared with those in adults. Both epiphyses and apophysis have physes that grow and develop by endochondral ossification, Apophysis have physes similar to epiphyses, but in contrast to epiphyses do not participate in longitudinal growth, are usually not perpendicular to the long axis of bone, are not articular, and are subjected to tension forces rather than to compression^[21].

Another probable reason which is proved as a cause of anterior knee pain may be soft tissue tightness which is common during the adolescent growth spurt which results in inflexibilities altering the stress through the patellofemoral joint which include tight quadriceps as they are less able to absorb eccentric loads and off load stress to the quadriceps, patellar tendons and hamstrings, thus increasing the PFJR, also inflexibility of the gastrocnemius leads to increased subtalar pronation which may influence patellar tracking and also the hamstring tightness increases the patellofemoral joint reaction (PFJR), Other inflexibilities includes, tightness of the lateral retinaculum, iliotibial band and lateral structures which can cause increased lateral tracking of the patella and excessive stress on the lateral patellofemoral joint^[1]. Quadriceps muscle weakness or imbalance with relative vastus medialis (VMO) weakness or imbalance in neuromuscular control of the VMO and vastus lateralis (VL) may cause PFP, VMO weakness results in lateral shifting and tracking of the patella during the last 30° of extension with resultant reduction in patellofemoral contact area and increased patellofemoral stress^[1]. However our study did not examine muscle tightness and so its effect on knee pain cannot be commented upon.

In a study done by LaBella C, 2004 it is seen that, malalignment of the lower extremity influences patellar tracking and may include genu valgum, genu varum, genu recurvatum, leg length discrepancy, femoral anteversion, external tibial torsion, lateral displacement of the tibial tubercle, and excessive pronation of the subtalar joint^[22].

Larger Q angles (genu valgum, femoral anteversion, external tibial torsion and subtalar joint pronation) are associated with increased static patellofemoral joint stress. Lateral displacement of the tibial tubercle greater than 10° from the midpoint of the patella may cause lateral tracking of the patella^[22]. Previous studies also show that the condition occurs at a time when increasing demands are made on a still immature skeleton. The adult patellar tendon is firmly anchored to bone by Sharpey's fibers, but in the growing child the attachment is more tenuous^[23]. Repeated micro-avulsion injuries accompanied by half-hearted fibro-osseous repair results in prominence of the tubercle^[24]. Since, our studies show moderate positive correlation between anterior knee pain scale and lower extremity scale it reports that lower extremity functions are affected to a great extent because of anterior knee pain, as pain increases more functions are affected, So we as physiotherapists should consider all the probable reasons for anterior knee pain and frame a rehabilitation protocol for adolescent age group which gives them pain relief & develops adequate strength of all muscles. Lower extremity and quadriceps exercises to restore patellofemoral load acceptance capacity could be the strategy used to increase participation in sports.

The limitation of our study is that we did not perform any radiological or clinical test like measurement of Q-angle, J-sign, apprehension test etc.

Conclusion

In age group of 11-17 years, anterior knee pain is more prevalent in adolescent girls. It begins at the age of around 13 years for girls & 14.5 years for boys. Anterior knee pain shows increase incidence in those participating in sports & it also indicates that sports participation is affected due to anterior knee pain. Maximally affected activities are running, jumping & squatting and maximally affected functions are squatting, running on uneven ground, making sharp turns while running and hopping with increase incidence of anterior knee pain among those who participate daily in sports.

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Conflict of interest

There is no conflict of interest

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