AVALIATION OF PREDISPOSING FACTORS IN PATELLOFEMORAL INSTABILITIES

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ABSTRACT

Objective: To evaluate the prevalence of predisposing factors for femoropatelar instability (dysplasia of the trochlea, high patella, TTTG, and patellar tilt) in a group of patients in outpatient follow-up. Methods: 70 patients were evaluated; 52 (74.28 %) female and 18 (25.72 %) male, with an average age of 17.71 years and a total of 127 knees. The evaluation by imaging was carried out through radiologic examination and computerized tomography. The femoropatelar instabilities were classified according to Henri Dejour's classification (major, objective and potential instability). The trochlear dysplasia was classified according to David Dejour's classification (type A, B, C, D). Results: Trochlear dysplasia was observed in 118 knees (92.91%), with 91 knees (77.11%) being of type A and B. The average for patellar height was 1.23, with 44 (34.64%) considered high patellas and 83 (65.36%) within the normal range. Abnormal patellae tilt was found in 92 knees (72.44%) and an elevation of TTTG in 63 knees (49.60%). The was a prevalence of objective instabilities with 89 knees (70.07%). In relation to the association of predisposing factors, 117 knees (92.13%) presented more than one factor. Conclusions: Femoropatelar instability is a multifactorial disease, with trochlear disorders being the most frequent, and there is a strong association between two or more predisposing factors.

Keywords: *Knee. Patella. Joint instability.*

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INTRODUCTION

Patellofemoral joint disorders are certainly those considered most frustrating by the orthopedist, both due to their high prevalence and to the considerable number of insolvable cases, particularly in young adolescents.[1]

This joint is the site of numerous pathologies, mainly due to its anatomical features. It is a joint that centralizes forces of the quadriceps in the command of a large lever responsible for the erect position. Its structural balance is fragile, and any disturbance in its stability may represent a functional change capable of producing symptoms that are sometimes incapacitating.[2]

During the performance of the background check and of the physical exam it is important for us to know the predisposing factors associated with patellofemoral instability. These factors are responsible for the physiopathology of patellar instability. They are: trochlear dysplasia, high patella, rotational and angular deviations of the lower limbs, muscular dysplasia (vastus medialis obliquus), retinacular dysplasia, hereditary factors and family history.[2,3]

These factors were classified by Dejour *et al*.[4] according to their importance: primary factors (high patella, trochlear dysplasia, VMO dysplasia (quadriceps), anterior tibial tuberosity lateralization, medial patellofemoral ligament (MPFL) insufficiency) and secondary factors (rotational deviations of the lower limbs, genu recurvatum, genu valgum).

Each one of these factors can be identified in supplementary exams, using radiography and computed tomography according to a specific protocol idealized by Dejour *et al*.[4] In this manner, the radiography allows us to evaluate and identify high patella and trochlear dysplasia while Computed Tomography allows us to identify and measure VMO (vastus medialis obliquus) dysplasia and MPFL insufficiency through the patellar tilt, and ATT lateralization through the measurement of the TTTG. The CT also assists in the identification of trochlear dysplasia.

The aim of this study is to evaluate the prevalence of these primary factors, in a group of patients with complaints of pain and/or patellofemoral instability.[4]

All the authors declare that there is no potential conflict of interest referring to this article.

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MATERIAL AND METHODS

Patients with patellofemoral instability in outpatient follow-up with patellofemoral complaints in at least one of the knees were evaluated in this study.

Seventy patients with patellofemoral instability were included; 52 female (74.28%) and 18 male (25.72%), totaling 127 knees evaluated.

Of this total, 99 knees were symptomatic (77.95%) and 28 asymptomatic (22.05%). The patients' age varied from 10 to 40 years, with mean age of 17.71 years.

The identification of the TT-TG and of the patellar tilt was performed by Computed Tomography (CT) according to the Lyon protocol.

The normal value for the TTTG is between 10 and 15 mm. TTGT means the distance between the anterior tibial tuberosity (TT) and the trochlear groove (TG) within a sagittal plane.

The patellar tilt is calculated by the mean value of three different positions: knee in full extension with contracting of quadriceps (position 1), knee in full extension with relaxation of the quadriceps (position 2) and knee at 15° of flexion with relaxation of the quadriceps (position 3). (Figure 1)

The normal value for patellar tilt is from 0 to 20°. The patellar height was measured by narrow lateral view radiography at 30° of flexion, by the Caton-Deschamps method. The values considered normal are between 0.8 and 1.2. (Figure 2)

Trochlear dysplasia was evaluated by radiography and by CT. The Dejour classification,[5] modified by David Dejour,[6] which differentiates types A, B, C and D, was adopted here. (Figures 3 and 4)

Moreover, the patients were divided into groups according to Henri Dejour's classification, for the three clinical presentations of patellofemoral instabilities:

- Major Patellar Instability
- Objective Patellar Instability
- Potential Patellar Instability

Patients with associated lesions and patients submitted to previous surgical procedures on the knee evaluated were excluded.

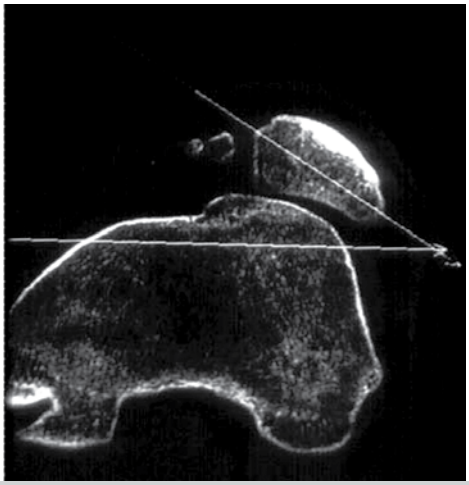

Figure 1. *Patellar Tilt (CT).*

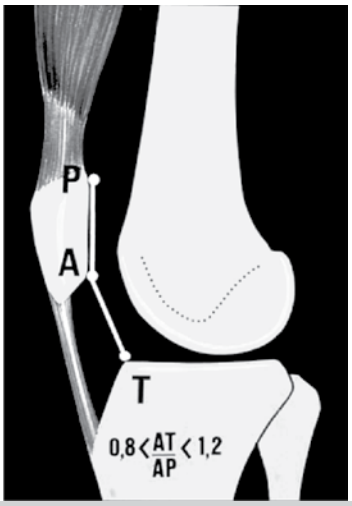

Figure 2. *Patellar Height (RX)*

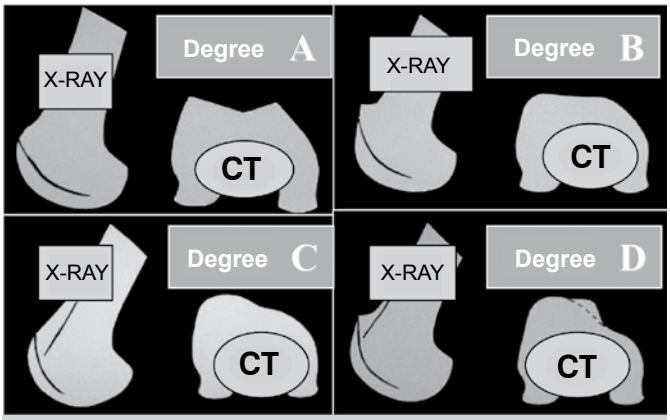

Figure 3. *Classification of Trochlear Dysplasia (D.Dejour[6]) (X-ray + CT).*

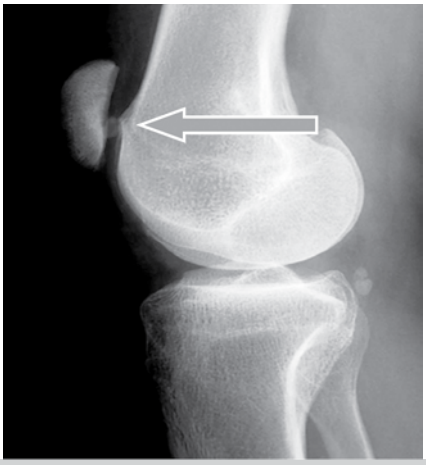

Figure 4. *Trochlear dysplasia (X-Ray).*

RESULTS

The following findings were made in this study sample (total of 127 knees):

1. Trochlear dysplasia in 118 knees (92, 91%), with 61 knees of type A (51.69%), 30 knees of type B (25.42%), 20 knees of type C (16.95%) and only 7 knees classified as type D (5.93%).

2. Forty-four (44) high patellae (34.64%) and 83 patellae with height within normal limits (65.36%). No cases of low patella were detected. The general average was 1.23.
3. Ninety-two (92) knees presented patellar tilt above 20º(72.44%), while 35 knees (27.56%) had normal tilt.
4. Sixty-three (63) knees presented increased TTTG (49.60%).

The association of primary instability factors, in the same knee, is demonstrated in Figure 5 and the prevalence of the types of instability in Table 1.

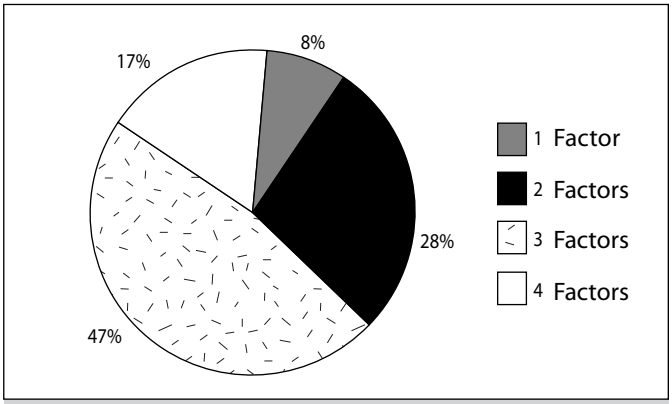

Figure 5. *Association of patellofemoral instability factors in percentage, in the same knee.*

Table 1. *Prevalence of the types of instability according to the Dejour classification.*

Type	Number of knees
Objective instability	89 (70.07%)
Potential instability	32 (25.19%)
Major instability	06 (4.72%)

DISCUSSION

Patellar dislocation is a painful experience that occurs suddenly, with the first episode mainly affecting young patients. There is a series of factors that can result in objective patellar instability. Radiographic and tomographic characteristics of patellar instability were defined in the attempt to identify some of these factors.[7]

Literature has shown a greater frequency of patellofemoral instabilities in the female gender (58%).[8] A greater prevalence in female patients was also found in the sample studied (74.28%). In relation to age, there was prevalence in the second decade, similar to that reported in literature.[9]

Trochlear dysplasia has been considered a patellar instability factor since 1915, when Albee proposed its correction by a superolateral osteotomy of the trochlea.[10] Brattström[11] was the first to study trochlear dysplasia in the axial view radiography with 30º of flexion.

Maldague and Malghem[12] were the first to define the importance of the true lateral view of the knee in studies of the trochlea and its dysplasia.

In a study by Dejour *et al*.[4] the crossing sign was identified in 96% of the knees with patellar instability, whereas 85% of the knees with instability presented trochlear spur. This study by Dejour *et al*.[4] analyzed a total sample of 143 knees with objective instability, of which only 0.7% did not present criteria for trochlear dysplasia.

However, trochlear dysplasia is a constant (pathognomonic) of patellar instability. The frequency of bilateralism was 92,5%, which leads us to believe in constitutional abnormality.[4]

In a study by Dejour and Le Coultre,[13] trochlear dysplasia was found in 96% of the patients with true history of patellar dislocation.[13] In the study in question, the presence of trochlear dysplasia was found in 92.91% of the knees evaluated, which ratifies the high prevalence of trochlear dysplasia in patellofemoral instability. This percentage, which is slightly below the average found in literature, was probably due to the fact that knees with a diagnosis of potential instability were included in this study.

Hughston *et al*.[14] and Insall *et al*.[15] focused their studies on dysplasia of the vastus medialis.

Hughston *et al*.[14] believed that the vastus medialis was composed of two independent muscles, the vastus medialis longus and the vastus medialis obliquus (VMO), whose majority of distal fibers have horizontal orientation and insertion along the superomedial edge of the patella. The fibers of the vastus medialis obliquus exert medialization force during the first degrees of flexion.

Dejour *et al*.[4] found an association of VMO dysplasia with patellar instability, in which 83% of the cases of instability exhibited quadriceps dysplasia.

The medial patellofemoral ligament is the main static stabilizer in the prevention of lateral patellar displacement and the first structure to be injured in its acute dislocation.[4]

Besides this ligament, special emphasis is placed on the importance of the vastus medialis obliquus (VMO) muscle in patellar stability.[7] In the sample studied, the evaluation of mean patellar tilt was used as a parameter for VMO dysplasia, with a change found in 72.44% of the cases.

The contact between femur and patella has variable characteristics according to the degree of knee flexion. At 0° of flexion there is no contact of the articular surface of the patella with the femoral trochlea. At 30° of flexion, the lower portion of the patella joins with the more upper portion of the femoral condyles.[16] It is important, for joint stability, to have a correct fit of the patella in the femoral patella while the knee flexes.

The existence of high patella is a factor that can predispose to failure of this patellar fit. In a study conducted by Galli *et al*.,[17] in patients with patellofemoral subluxation in extension, no case of low patella was found, 45 cases (45%) appeared normal and 55 (55%) high.

Insall and Salvatti[18] and Blackburne and Peel[19] had already demonstrated the role of high patella in patellar instability. An abnormal high patella is a prerequisite for dislocation.

Studies such as those by Dejour *et al*.[4] observed this finding in 24% of the knees evaluated with objective patellar instability. The Caton-Deschamps method was used in this

study to evaluate patellar height, verifying a change in 34% of the knees evaluated, a higher value than those found in literature, perhaps due to the non-individualization of the prevalence of high patella according to the types of patello-femoral instability.

The change in the TT-TG, pathological when above 20mm, can appear as a specific factor in patellofemoral instability. Literature shows a presence of 56% of this factor in cases of patellar instability. The tomographic measurement of TT-TG was considered abnormal when above 15mm, appearing altered in 49.60% of the cases.[20,21]

The association of a minimum of two predisposing factors was found in 92.13% of the knees studied, reaffirming the multifactorial nature of this pathology.

In all, 70.07% of objective patellofemoral instabilities were found. This predominance might perhaps be explained by the fact that objective instability presents debilitating symptoms at an earlier stage, when compared to potential instabilities, which on average present their symptoms later on and are sometimes asymptomatic until to the fourth or fifth decades of life, when patellofemoral arthrosis occurs.

CONCLUSION

Patellofemoral instability is determined by the association of a minimum of two or more instability factors. The most frequent of these factors is trochlear dysplasia, present in more than 90% of cases. (Figure 6)

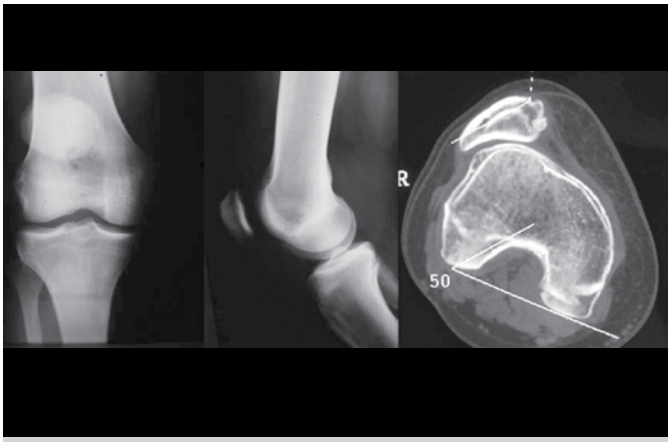

Figure 6. *Radiological exam and computed tomography of a 25-year-old male patient, with objective patellofemoral instability in the right knee, with trochlear dysplasia classified as type C, increased patellar tilt and above normal patellar height.*

In order of frequency, trochlear dysplasia is followed by patellar tilt (70% of cases), then elevated TTTG (49% of cases) and high patella (34% of cases).

Objective instability, according to Dejour's classification, is the most common with 70% of cases.

Our casuistry demonstrated that the association of three instability factors is the most frequent, in almost 50% of the cases evaluated.

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