Selected Characteristics of Patients with Chondromalacia Patellae

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ABSTRACT

The knees of 18 people with chondromalacia patellae (CMP) were compared to 18 less or non-involved knees of patients and to 21 non-involved dominance-matched extremities in a non-CMP patient group in 4 variables.

The knees with CMP had larger Q-angles ($p < 0.0003$), tighter hamstring muscles ($p<0.0001$), tighter quadriceps muscles ($p \leqslant .001$) and tighter iliotibial bands (ITBs) than the non-involved extremities in the patient group. No significant differences were found between lower extremities of the non-patients in the above variables. When these variables were compared between the patient and the non-patient groups, a difference was found only in the flexibility of the ITBs which was less in the involved extremities ($p<0.01$) of the patient group. The clinical implications of these differences are discussed.

Chondromalacia patellae (CMP) is a common orthopaedic problem referred to physiotherapy departments. Williams [1] reported that 10% of all knee injuries are CMP. Structural malalignment and soft tissue tightness in the lower extremities has been reported in the literature to associate and contribute to the problem of CMP. Outerbridge[2] mentioned that congenital, postural or traumatic factors, alone or in combination, may contribute to CMP. Malalignment factors such as a wide pelvis and a valgus knee[2], lateral knee retinacular tightness[3], trauma [4,5] and overuse[6] were reported to cause CMP.

Conventionally, the conservative treatment of CMP included strengthening exercises to the quadriceps muscle, reduction in the knee flexion activity, manual therapy, EMG biofeedback[7] and faradic stimulation. With the treatment mentioned above the reported percentages of recovery is 27-29%, while 41% of the patients will complain of episodic reoccurrence of patellofemoral pain and 30% will complain of persisting pain[8].

The aetiology of CMP is a controversial issue. Bentely[4] reported 40-60% of CMP to be post-traumatic, while Ficat [5] reported this figure to be 75%. However, both of these researchers suggested structural and mechanical abnormalities to be the prime aetiology for CMP, where trauma or overuse may be superimposed on a pre-existing structural abnormality.

Four variables were selected for investigation in this study : 1) Q-angle value, 2) Iliotibial band (ITB) tightness, 3) Quadriceps muscle tightness, and 4) Hamstring muscle tightness. The purpose of this study was to ascertain whether significant differences in each of the four variables exist between : 1) involved and non-involved extremities within patients with CMP, 2) both lower extremities in individuals without abnormal patellofemoral symptoms, and 3) involved extremities in patients versus corresponding in dominance normal extremities.

METHODS

The research was a two-group comparative study. The patient group consisted of 18 patients who had been diagnosed as having CMP by consultant physicians. The non-patient group consisted of 21 individuals with no previous or present history of knee disorders. All those included in the patient group had had this problem for at least two months. Individuals with a previous history of a surgery, fracture or acute inflammatory diseases in the lower extremities, or if they were over 40 years old, were excluded from both groups.

The Q-angle was measured from full weight bearing on the evaluated lower extremity and the

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angle between the anterior superior iliac spine, mid-point of the patella and the tibial tubercle was measured by a goniometer[9]. The quadriceps muscle tightness was measured from a prone lying position with the pelvis stabilized by a strap and the angle of maximum active knee flexion was measured[10]. The hamstring muscle tightness was measured from a supine lying position with the hip joint stabilized in 90° by an assistant while the pelvis was stabilized by a strap and the angle of maximum active knee extension was measured [11]. The Ober test[12] was used to measure the tightness in the ITB. From the side lying position the top lower extremity was abducted and extended from the hip and then lowered against the table. ITB tightness was considered present if the abducted lower extremity remained above the neutral position of the hip joint adduction / abduction range, and ITB tightness was absent if the abducted lower extremity lowered beyond this range.

Age, sex, athletic status, body weight and height and deviation from optimal body weight were collected from each subject. The correlated group's t test was used to compare lower extremities within the same group and the independent t test was used to compare the patient to the non-patient group in the four variables.

RESULTS

The characteristics of subjects included in the patient and non-patient groups are listed in Table 1.

Measurement of the Q-angle indicated that in the patient group, involved extremities had greater Q-angle values than the non-involved (p.<0003). In the non-patient group no significant difference was found between both lower extremities and in comparing the involved extremities to the corresponding extremities in the non-patient group no significant difference was found between the patient and non-patient groups. (Fig 1)

Evaluation of quadriceps muscle tightness revealed that in the patient group involved extremities had greater quadriceps muscle tightness than non-involved (p.<01). In the non-patient group no significant differences were found between both lower extremities. When the involved extremities were compared to the corresponding extremities in the non-patient group, no significant difference was found betwen patient and non-patient groups (Fig 2).

Measurement of hamstring muscle flexibility indicated that in the patient group, involved extremities had greater hamstring muscle tightness than the non-involved (p.<0001). In the non-patient group, no significant difference was found between both lower extremities and when the involved extremities were compared to the corresponding extremities in the non-patient group, no significant difference was found between both lower extremities. (Fig 3).

Evaluation of ITB tightness revealed that in the patient group the involved extremities had greater

TABLE 1

Characteristics of Subjects Included in the Patient and Non-Patient Groups

Variable		*Patient Group*	*Non-Patient Group*
Age (In years)		23.5 ± 5.5 *	26.2 ± 6.3
Sex	Males	27%	38%
	Females	73%	62%
Athletic Status	Athletes	88%	52%
	Non-Athletes	12%	48%
Body Weight (in lbs)		150.7 ± 27.9	143.9 ± 28
Body Height (in inches)		68.1 ± 3.8	66.2 ± 3.7

* Mean ± Standard Deviation

Figure 1*

Q-angles values

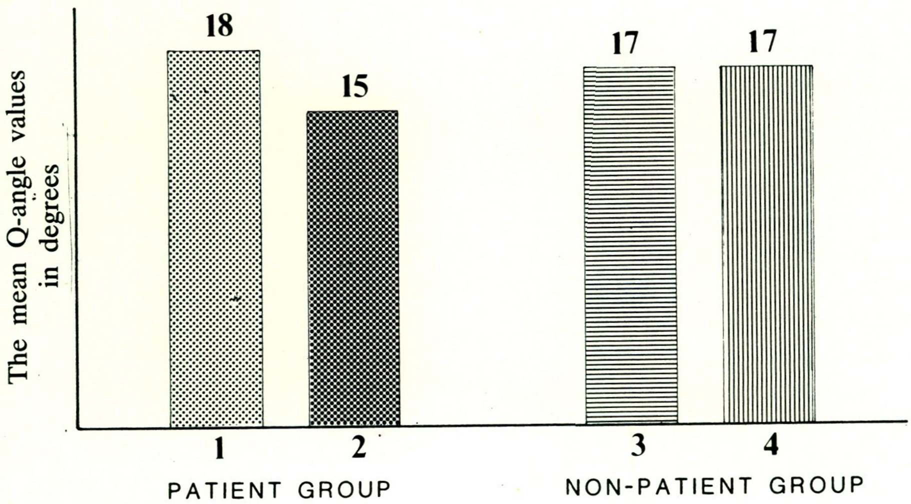
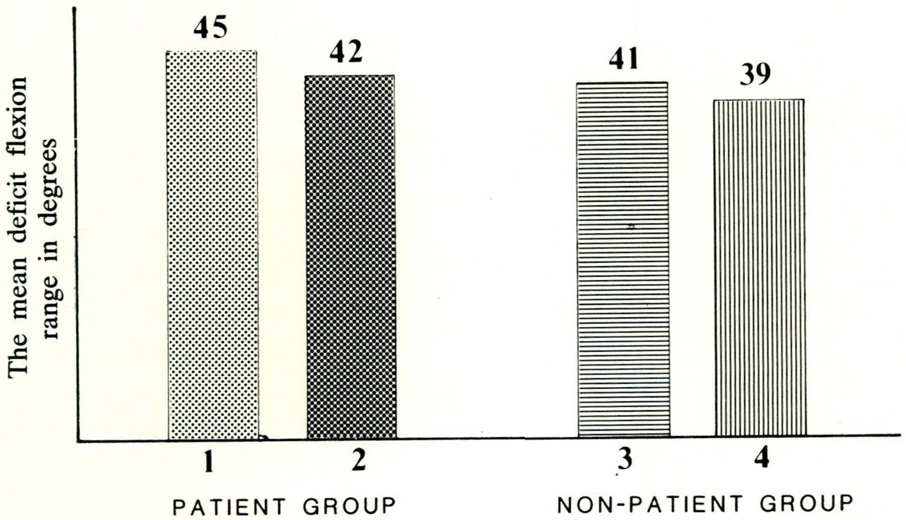


Figure 2*

Results of quadriceps muscle tightness measurement



* 1 *Involved extremities in the patient group.*
2 *Non-involved extremities in the patient group.*
3 *Non-patient extremities that correspond in dominance to the involved extremities in the patient group.*
4 *Non-patient extremities that correspond in dominance to the non-involved extremities in the patient group.*

Figure 3*

Results of hamstring muscle tightness measurement

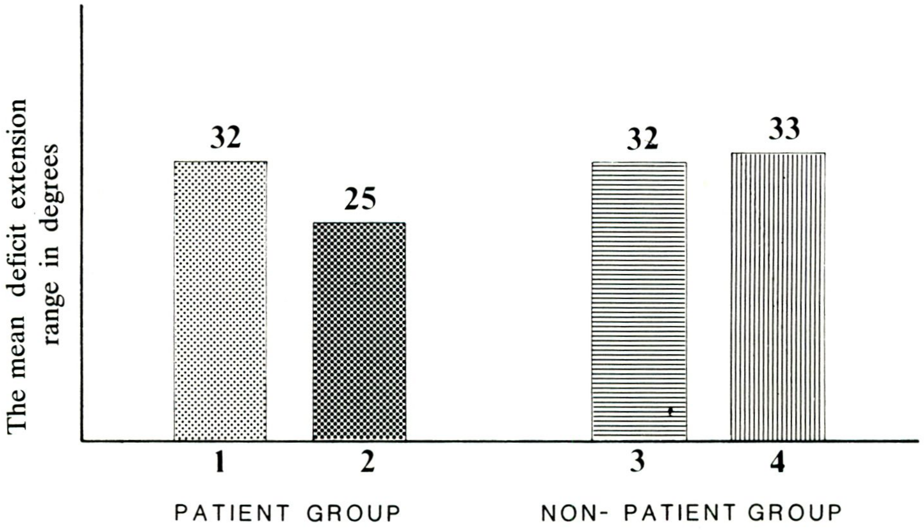
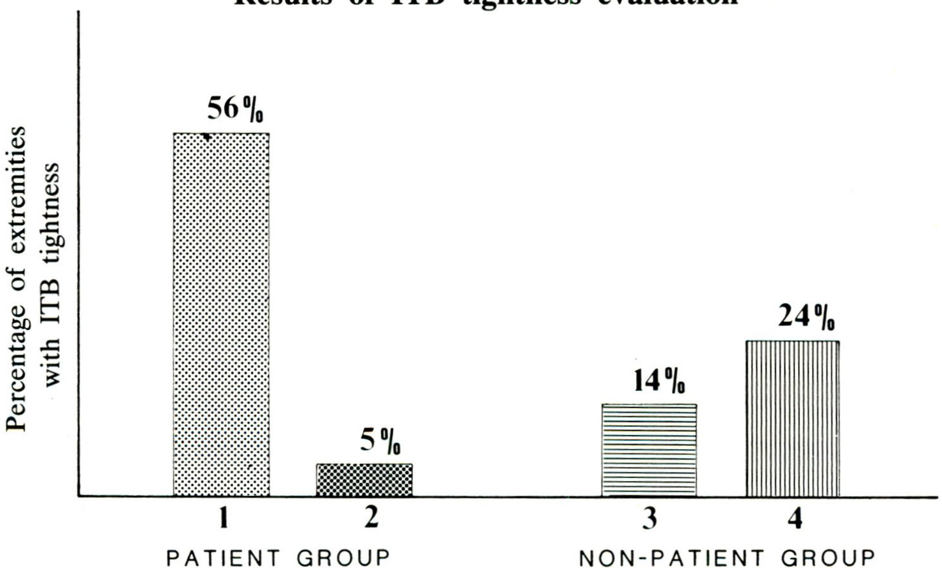


Figure 4*

Results of ITB tightness evaluation



*1 *Involved extremities in the patient group.*

2 *Non-involved extremities in the patient group.*

3 *Non-patient extremities that correspond in dominance to the involved extremities in the patient group.*

4 *Non-patient extremities that correspond in dominance to the non-involved extremities in the patient group.*

ITB tightness than the non-involved extremities (p.<001). In the non-patient group no significant difference was found between both lower extremities and when comparing the involved extremities to the corresponding extremities in the non-patient group, unlike in the previous three variables, the involved extremities had greater ITB tightness than the non-patient group (p.<01) (Fig 4).

DISCUSSION

This study indicated the presence of an asymmetry in the value of Q-angle and the flexibility of quadriceps and hamstring muscles and ITB between extremities involved with CMP and those without this problem. For the Q-angle value, quadriceps and hamstring muscles flexibility, differences were within the patient rather than between patients and non-patients, where for the ITB flexibility, differences were within patient and between patients and non-patients.

The absence of significant differences between the Q-angles of the involved extremities and the corresponding extremities in the non-patient group obtained in this study disagreed with the results obtained in some studies and agreed with the results of others[13, 14].

The findings that the involved extremities had greater Q-angels than the non-involved in the patient group, and the absence of this difference in the non-patient group, has clinical implications. When physicians or physiotherapists evaluate patients with CMP, attention should be directed towards evaluating differences between involved versus non-involved extremities rather than comparing the obtained values of the involved extremity to an "accepted range" of Q-angle values.

Patients with a high Q-angle asymmetry should continue a quadriceps strength maintenance programme after complete recovery of their symptoms in order to maintain a good quadriceps muscle function. It is the observation of this author that a high asymmetry of the Q-angle values, i.e. 5° or more, is correlated with less favourable outcomes of treatment in CMP patients.

In evaluating hamstring muscle tightness, the fact that a significant difference in tightness was found within the patient, between involved and non-involved, rather than between patients and non-patients indicated that hamstring muscle tightness is relative to the non-involved extremity and not to the non-patients. A tight hamstring muscle will increase the patellofemoral compressive forces resulting from quadriceps muscle contraction because of the increased passive resistance during the swing phase of ambulation and running induced by the tight hamstring muscle.[15].

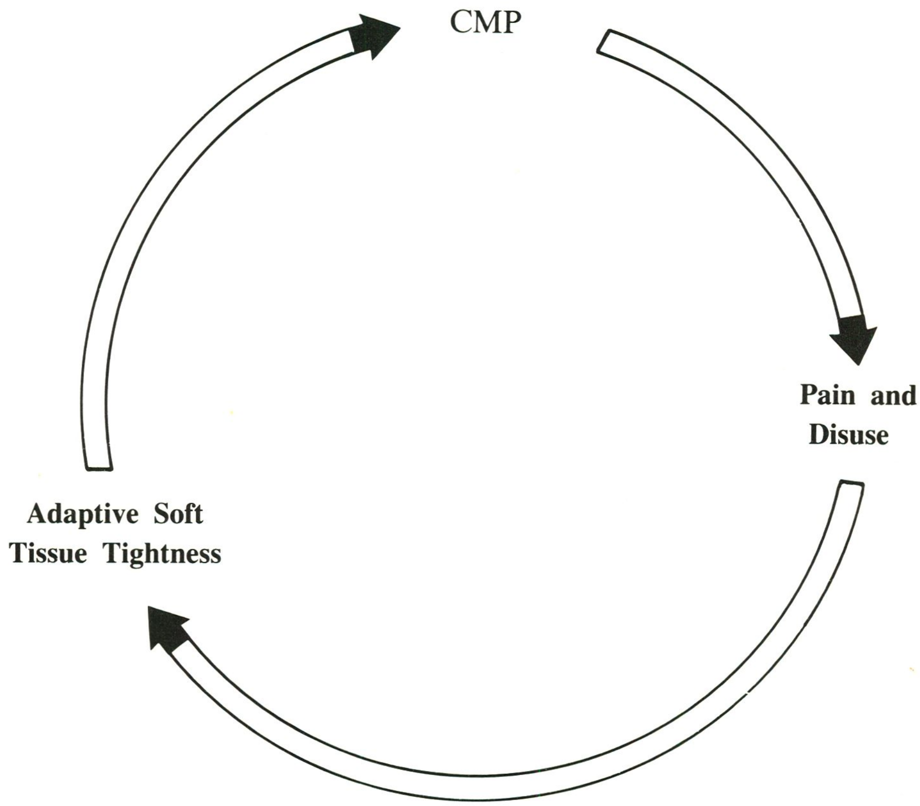
In evaluating quadriceps muscle tightness the findings support the concept that decrease in soft tissue flexibility is manifested through asymmetry between both extremities in patients with CMP. Tightness of the quadriceps muscle in the involved extremity may be due to avoidance of extreme knee flexion positions which cause discomfort in patients with CMP[16]. A tight quadriceps muscle could increase patellofemoral joint compressive force. This may initiate or aggravate an existing patellofemoral pain.

The use of the findings of this study concerning ITB tightness in the treatment of patients with CMP may be limited by the controversial reliability and validity of the Ober test. Tightness of other structures at the lateral side of the hip joint such as the abductors or the lateral capsule of the hip joint may have contributed to the results obtained by the Ober test. A tight ITB could contribute to patellofemoral joint pain through the deep, fibrous lateral knee retinaculum which is connected to the ITB laterally and the lateral border of the patella medially. Tightness in the ITB may deviates the patella laterally and lead to an increse in the joint compressive force. Articular cartilage abnormality may be the end result of these events [17].

Several theories exist concerning the relationship between CMP and malalignment of lower extremities. One theory is that CMP causes the malalignment. Another one is that malalignment factors cause CMP, while the third theory is that both CMP and malalignment factors are caused by a third factor.

It is the impression of this researcher that a vicious cycle [18] between CMP and these malalignment factors does exist (Fig 5). Whichever end of this cycle occurs first, it has the potential to develop the other end. Impairment of function is the end result of this cycle. The therapeutic intervention should be based on restoring function, by correcting asymmetry, regardless of what factor initiates this circle.

The vicious circle of patellofemoral joint dysfunction



CONCLUSION

The findings of this study support the theory that the problem of CMP is associated with the increase in the Q-angle value, hamstrings and quadriceps muscles and ITB tightness in the involved extremity. The non-involved extremity should be evaluated. Values obtained from this evaluation may be used as a baseline for correction of asymmetry, if it is present.

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