Effect of Valgus Bracing on the Loading of the Medial Knee Compartment

INTRODUCTION

In most patients gonarthrosis starts at the medial compartment which is typically loaded more than the lateral one [1]. To prevent or delay implantation of an endoprosthesis, valgus bracing with orthoses is sometimes used. These braces induce an additional valgus (abduction) moment at the knee joint which is expected to shift the axial knee force more to the lateral compartment. Until now a biomechanical effect could only be shown by measuring the external knee abduction moment. The maximum reduction reported for the medial force was about 9-13% [2].

METHODS

Instrumented knee implants measure the forces and moments directly in patients [3]. During walking the frictional moment acts in the sagittal plane. The moment in the frontal plane is therefore only caused by a medio-lateral shift of the axial force. From the measured moment and force the distribution of the axial force between medial and lateral condyle can therefore be calculated [4]. Laboratory experiments and finite element calculations [5] showed an error of less than 3% if the condyle can therefore be calculated [4].

DISCUSSION

The peak resultant forces were not much changed by the braces in K1L and K3R, but lowered by 14% - 17% in K3R (Table, first lines). The moments in the frontal plane were always adduction moments. They were drastically reduced by 25% to 71% with the MOS but by only 5% to 24% with the GA (Table, middle). These reductions proved that the orthoses reduced the adduction moments by inducing an additional abduction moment in the leg.

Without brace, up to 76% - 92% of the total axial force was transferred medially (Fig. 2, 3). Patient K3R with the lowest varus angle loaded the medial condyle less than the others. The weight shift to the medial condyle was most pronounced around the instant of the first peak of the resultant force, when the leg was in a nearly vertical position. At other times the medial force decreased, both in absolute values and in relation to the lateral side. Both braces lead to a shift of the axial force to the lateral side throughout the whole stance phase (Fig. 2, 3, dashed → solid lines). The load shifting effect was much more pronounced for MOS than for GA. In K1L and K3R with GA even an initially slightly reversed effect was seen. The most pronounced load shift occurred in K3R (arrow in Fig.2): without brace 92% of the peak axial force acted in the medial compartment, but only 64% with MOS. The reduction of the absolute medial peak force was 30% in this case (Table, last lines).

REFERENCES


Acknowledgments

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Table 1: Changes of peak loads [% of values without brace, averages]

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<tr>
<th>Patient</th>
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<th>K3R</th>
<th>K5R</th>
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