

PATELLA ALTA IS ASSOCIATED WITH PATELLOFEMORAL MALALIGNMENT AND REDUCED CONTACT AREA

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INTRODUCTION

Patella alta or "high riding patella" is a condition that is thought to predispose individuals to patellofemoral joint dysfunction. The purpose of this study was to compare patellofemoral alignment and contact area in persons with patella alta to subjects with normal patellar position and determined the association between the vertical position of the patella, patellofemoral malalignment, and contact area.

METHODS

Twelve patients with patella alta and thirteen subjects with normal patellar position participated. The presence of patella alta was determined using the Insall-Salvati index as measured on sagittal magnetic resonance images of the knee [1]. Mediolateral patellar displacement, tilt, and patellofemoral joint contact area were quantified from axial MR images of the patellofemoral joint obtained with the quadriceps contracted and the knee at 0°, 20°, 40°, and 60° of flexion.

Statistical comparisons between groups were made as a function of joint angle using two-way ANOVAs with repeated measures. *Post-hoc* Tukey tests were used to identify between group differences at each knee flexion angle when significant interactions were present. Values are reported as mean \pm SE unless otherwise noted.

RESULTS AND DISCUSSION

Lateral patellar displacement was greater in subjects with patella alta compared to subjects with normal patellar position at 0° of knee flexion ($85.4\% \pm 3.6\%$ versus $71.3\% \pm 3.0\%$ of patellar width lateral to midline, $p < 0.007$). However, group differences were not observed between 20° and 60° of knee flexion. Lateral patellar tilt was also greater in subjects with patella alta compared to subjects with normal patellar position ($21.6^\circ \pm 1.9^\circ$ versus $15.5^\circ \pm 1.8^\circ$, $p = 0.028$). Again, group differences were not observed between 20° and 60°. Subjects with patella alta had systematically less patellofemoral joint contact area compared to subjects with normal patellar position. On average, these individuals had 19% less contact area in the range of knee flexion angles tested ($231.2 \pm 9.1 \text{ mm}^2$ vs. $286.7 \pm 8.8 \text{ mm}^2$, $p < 0.001$; Figure 1). However, a maximum difference of 26% was observed at 20° of knee flexion ($158.5 \pm 10.6 \text{ mm}^2$ vs. $214.9 \pm 10.2 \text{ mm}^2$).

The vertical position of the patella was positively associated with lateral patellar displacement ($r^2 = 0.365$, $p < 0.020$) and lateral patellar tilt ($r^2 = 0.274$, $p = 0.002$) at 0° of knee flexion. At knee flexion angles between 20° and 60° these associations were no longer significant. The vertical position of the patella

was negatively correlated with patellofemoral joint contact area at all knee flexion angles tested ($r^2 = 0.404 - 0.196$, $p < 0.05$) with greater degrees of patella alta being associated with less contact area.

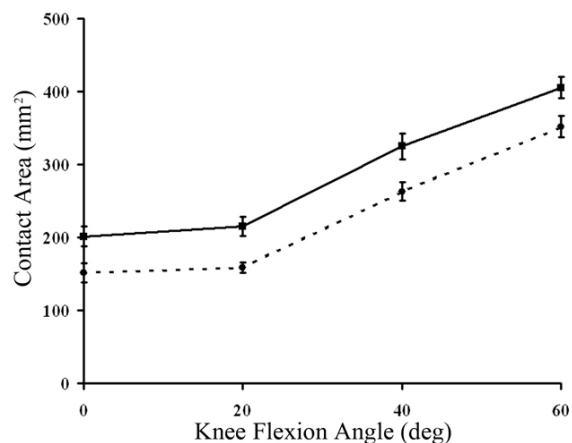


Figure 1. Total patellofemoral joint contact area was measured as a function of knee flexion angle in control subjects (solid line) and patients with patella alta (dotted line). There was a significant reduction in contact area in the patients with patella alta across all knee flexion angles tested.

CONCLUSIONS

Our data confirm the clinical assumption that patients with patella alta have greater degrees of patellofemoral joint malalignment compared to persons with normal patellar position. The reduced contact area observed in this population supports previous investigations that have found persons with patella alta demonstrate elevated patellofemoral joint stress (force per unit area) during functional tasks [2]. The association between patellar position and patellar malalignment was strongest at full knee extension, which suggests that this is a position of instability in this patient population.

REFERENCES

1. Insall J and Salvati E: *Radiology* **101**, 101-104, 1971.
2. Ward SR and Powers CM. *Clin Biomech* **19**, 1040-1047, 2004.

ACKNOWLEDGEMENTS

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