Morphological changes of the infrapatellar fat pad during in patients with patellofemoral cartilage lesions

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Summary

Patellofemoral knee osteoarthritis (OA) is involved with cartilage degeneration and describes more severe symptoms rather than that in the tibiofemoral joint. The infrapatellar fat pad (IFP) stabilizes the patellofemoral joint and describes abnormalities with inflammation and cartilage degradation. This study evaluated IFP dynamics in 24 knee OA patients during squatting using dynamic ultrasonography. Our data revealed that patients with cartilage lesions, the IFP movement during squatting was significantly lower than that without lesions ($p = 0.045$). Insufficient IFP mobility might be identified as a sign of impaired morphological changes and an abnormal feature with cartilage lesions.

Introduction

The knee OA involves cartilage degeneration, particularly patellofemoral lesions are often more problematic than those in tibiofemoral ones [1,2]. The IFP plays a crucial role in stabilizing the patellofemoral joint and acts as a buffer [3,4]. The IFP abnormalities are linked to inflammation markers and cartilage degradation, making evaluation of IFP a valuable tool for assessing patellofemoral lesions [5].

Recently, dynamic ultrasonography has emerged as a method to analyze IFP movement under mechanical stress during daily activities [6]. This study investigated the IFP dynamics during squatting and identified the features of patellofemoral cartilage lesions.

Methods

Twenty-four knee OA patients (mean age 53.9 years, 13 females) participated in this study. Participants were evaluated their cartilage lesions according to the international Cartilage Repair Society (ICRS) and divided into two groups: the normal group (ICRS grade 0) and the abnormal group (ICRS grade $\geq$ Ⅰ).

The participant's kinetic data and dynamic IFP during squatting were obtained by motion analyses system (Vicon Motion Systems, Oxford, UK) with ultrasonography (SNiBLE, KONICA MINOLTA, Japan). On the dynamics of IFP, it was obtained using a prototype special linear-array transducer (KONICA MINOLTA, Japan), and their movement was analyzed based on imaging technics with optical flow.

Results and Discussion

The two groups did not differ significantly in terms of demographic data, except for age. No significant difference was found in the knee flexion angles during squatting, whereas the IFP movement in extension phase was significantly smaller in the abnormal group when compared with the normal group ($p = 0.045$).

Table 1: Comparison between normal and abnormal IFP movement during the squatting

	normal	abnormal	p
Extension phase	66.0 ± 7.3 mm	61.4 ± 9.7 mm	0.045
Flexion phase	76.9 ± 23.1 mm	71.1 ± 23.5 mm	0.557

This study revealed that patients who had cartilage lesions on the patellofemoral joint, involved insufficient IFP movement during squatting. Thus, patients with patellofemoral cartilage lesions might describe that the ability of the IFP morphological changes declined. This specific feature on declining the ability of IFP morphological change, causes confinement pressure on IFP and inflammation [7,8], resulting in creates the IFP fibrosis. Additionally, a previous study reported that the IFP fibrosis is a predictor to patellofemoral cartilage lesions [9]. Therefore, the morphological changes of IFP would explain the features of patellofemoral cartilage lesions associated with fibrosis.

Conclusions

This study revealed that the patellofemoral cartilage lesions was correlated with the insufficient morphological changes of IFP during squatting.

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