The ratios of rolling and sliding movements of humeral head during axial rotation in the dynamic glenohumeral instability using real-time cine MRI

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[Purpose]
This study aimed to quantitatively clarify the rolling and sliding movements of humeral head (HH) in the dynamic instability of the glenohumeral joint.

[Methods]
Four patients with bilateral multidirectional instability of glenohumeral joint (eight shoulders) (DI) and four healthy adults (eight shoulders) (DS) participated in this study. All subjects were instructed to rotate their shoulders at the arm by side of the body with 15 cycles in one minute while scanning by a 0.4 T open MRI device (Aoiert Eterna, Hitachi Medical Corporation, Japan) and recording by a video camera, simultaneously.

The ratios of rolling and sliding of HH were computed from the MR imaging and video camera data obtained. The humeral translation (ΔH) is the summation of rolling and sliding movement. The rolling movement is the product of the radius of HH (Rh) and the change in rotation angle of HH (Δθ). Hence, the ratios of rolling, R and sliding, S, movements were given by R : S = RhΔH : (RhΔθ − ΔH). Mann–Whitney U test were used to compare the ratios between DI and DS (p<0.01). This study was approved by the Ethics Committee.

[Results]
The ratios of rolling and sliding were 1 : −0.87 in DI and 1 : −0.18 in DS during internal rotation (IR). The predominant sliding ratios in DI were typical at neutral positions during shoulder rotations, with 1 : −2.0 and 1 : 2.41 (p=0.0209), respectively.

[Discussion]
The HH in DI might be unable to centre on the glenoid fossa as closer to the end of IR due to the insufficient muscle control of agonist and antagonist muscles during shoulder rotation. The deviation of HH might be as a consequence of that HH was extruded to the slackened side of glenohumeral joint by activation of dominant rotator muscles while antagonist rotator muscles did not function as force couple.