ABSTRACT

**Background:** The side-bridge (SB) is a commonly used closed-chain task to assess trunk muscle endurance and side-to-side endurance asymmetry. An open-chain variation of the SB, that positions the participant in an inclined side-lying posture, may be useful for those who report shoulder pain or fatigue as the reason for terminating the closed-chain SB. Low back loading demands of the open- and closed-chain variations should be matched to facilitate comparison of SB endurance measures.

**Purpose:** To quantify the low back reaction moments during the open- and closed-chain SB and determine the appropriate open-chain angle of inclination that matches the lateral bend moment magnitude of the closed-chain SB.

**Study Design:** Observational cohort

**Methods:** Upper body and trunk postural data were obtained during the closed-chain SB and during the open-chain SB at each of four inclination angles from a group of eight healthy male adults. Ground reaction force (GRF) data were also collected during the closed-chain SB. Low back reaction moments were calculated using a static ‘top-down’ linked segment model in both SB variations. Latent growth modeling was used to determine the angle of inclination in the open-chain SB that produced a low back lateral bend moment that matched the closed-chain SB. Sensitivity of the matching open-chain inclination angle was evaluated by rotating the measured GRF vector from the closed-chain SB by five degrees clockwise and counter-clockwise in the frontal plane.

**Results:** The open-chain inclination angle that best matched the loading demands of the closed-chain SB was 38±12 degrees. Clockwise rotation of the measured GRF in the closed-chain SB increased the matching inclination angle to 56±17 degrees. Counter-clockwise rotation reduced the matching inclination angle to 17±11 degrees. Secondary descriptive analysis of spine posture and off-axis low back moments revealed biomechanically relevant differences between SB positions.

**Conclusion:** The average open-chain SB angle of inclination that matched the closed-chain SB approximated the 45-degree recommendation offered in the literature. Differences in spine posture and off-axis low back reaction moments, and the potential impact on holding times, should be considered if using the open-chain SB.

**Level of Evidence:** 2b

**Keywords:** lateral bend, linked-segment, low back pain, trunk endurance

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**Conflict of interest:** The authors have no conflicts of interest to declare.