A Comparison of Balance and Postural Sway in Surfers vs. Non Surfers

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ABSTRACT

Surfing is an activity that requires a high level of balance and postural control, and it is often assumed that surfers exhibit greater balance than non-surfers. However, previous research on this idea is relatively sparse and inconclusive. PURPOSE: The purpose of this study was to test the hypothesis that there are differences in postural sway, squat asymmetry, weight shift, and limits of stability between surfers and non-surfers. METHODS: Seven surfers and nine age-matched controls (mean age=22.81±2.6 yrs) performed a series of balance-related tests. Two Bertec force platforms were used to assess sway during 60 seconds of quiet standing and bilateral differences in ground reaction force during a body-weight bearing squat. A HUMAC balance assessment board was used to assess limits of stability in eight directions and rhythmic weight shift accuracy while subjects stood on both a hard/stable and soft/unstable surface. RESULTS: No significant differences were found in any tests between surfers and non-surfers (magnitude of change in weight shift without foam: 26±6.63 sec vs. 27.56±14.72 sec; with foam: 19.85±4.98 sec vs. 21.56±12.49 sec, limits of stability without foam: 44±7% accuracy vs. 40±10% accuracy; with foam 40±7% accuracy vs. 41±8% accuracy, bilateral GRF differences 89.3±61.97 N vs. 62.4±58.97 N, medial-lateral sway excursion 12.58±10.45 cm vs. 11.07±6.86 cm, and anterior-posterior sway excursion 13.44±3.78 cm vs. 15.17±5.44 cm). DISCUSSION: These data support the idea that there is little difference in performance on standard balance assessment protocols between young healthy surfers and age-matched non-surfers. However, because surfing requires balance on a moving surface, use of more dynamic tests may yield different results. Further, surfing may have a larger effect in older adults who are more likely to exhibit deficiencies in balance and control of posture.

BACKGROUND

- **Surfing is increasing in popularity.** There are approximately 10-20 million people participating in surfing worldwide more more than 2.1 million surfers in the United States alone.[1]
- **Athletes who engage in challenging balance related activities often demonstrate superior balance when compared to that of the general population.** This may be the result of a number of factors including an enhanced ability to respond to proprioceptive information and visual cues,[2] muscular strength and power,[3] and the complex coordination of multiple degrees of freedom.[4,5]
- **Balance and postural control are often assessed by measuring center of pressure movement (COP) during quiet standing and goal-directed movements.[4,5]** COP can be viewed as a primary output of the postural motor system, which involves the complex coordination of several muscles and joint movements. Surfing requires a precise awareness of body position and successful execution of goal-directed postural adjustments, so it is reasonable to suggest that benefits in balance and postural control might be realized with repeated practice of this nature.[6,7] These improvements may be observable in COP movement.
- **Others have studied balance and postural control in surfers,[6-8] but have yielded conflicting results.** Some have suggested that surfing has little effect on postural control,[8] while others have reported a relationship between surfing experience and performance on balance-related tests.[6-7]

The purpose of this study was to test the hypotheses that there are differences in postural sway during quiet standing, squat asymmetry, weight shift, and limits of stability performance between surfers and non-surfers.

METHODS

Subjects

7 recreational surfers and 9 age-matched controls performed a series of balance-related tests. Surfers were required to have at least 3 years of surfing experience and considered surfing to be their primary form of exercise.

Age [yrs]	Height [m]	Mass [kg]
22.81±2.6	1.75±0.08	71.62±11.85

Equipment

- Two Bertec force platforms and Matlab software were used to assess sway during 60 seconds of quiet standing and bilateral differences in ground reaction force during a body-weight bearing squat (Figures 1-2).
- A HUMAC balance assessment board was used to assess limits of stability and rhythmic weight shift accuracy.

Procedures

- Each subject performed six exercises.
- Limits of stability were assessed in eight directions on a HUMAC balance assessment board with and without a foam pad (Figures 3-5).
- Rhythmic weight shift accuracy was determined on a HUMAC balance assessment board with and without a foam pad (Figure 6).
- A body-weight bearing squat was performed to measure bilateral differences in ground reaction force on the two Bertec force platforms (Figure 1,7).
- Standing postural sway was assessed for 60 seconds on a single Bertec force platform (Figure 2, 8).
- Paired t-test was used to compare differences in weight, limits of stability, bilateral ground reaction forces, medial-lateral sway excursion, and anterior-posterior sway excursion.

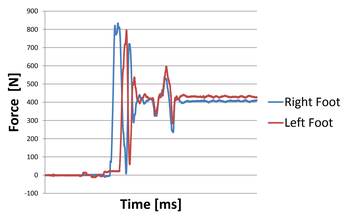

Figure 1 Ground reaction force exerted by the right and left foot during a body-weight bearing squat by a representative subject.

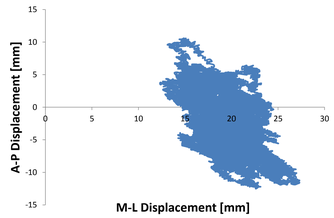

Figure 2 Anteroposterior (AP) and mediolateral (ML) excursion during quiet standing by a representative subject.

RESULTS

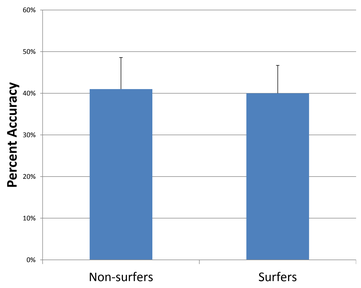

Figure 3 Percent accuracy of Limits of Stability assessment with foam (unstable environment) in surfers vs non-surfers.

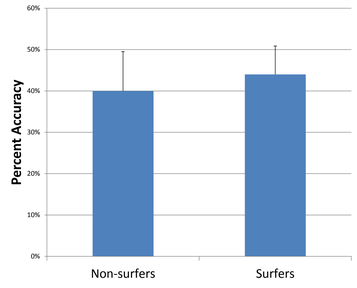

Figure 4 Percent accuracy of Limits of Stability assessment without foam (stable environment) in surfers vs non-surfers.

RESULTS

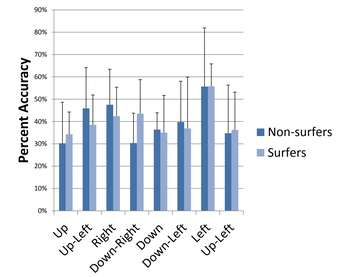

Figure 5 Limits of Stability assessment percent accuracy across eight directions with foam in surfers and non-surfers.

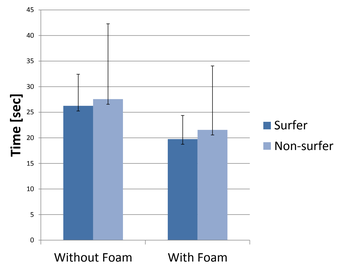

Figure 6 Total time to complete weight shift assessment in surfers and non-surfers with and without foam.

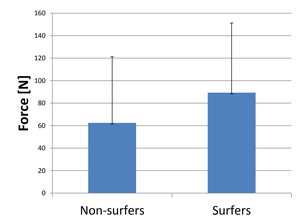

Figure 7 Difference in ground reaction force exerted between right and left foot during body-weight bearing squat in surfers and non-surfers.

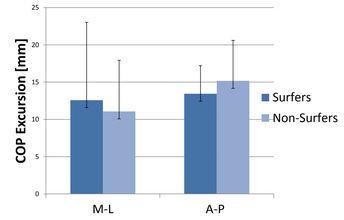

Figure 8 Anteroposterior (AP) and mediolateral (ML) COP excursion (mm) during quiet standing in surfers and non-surfers.

These results suggest that there are no significant differences in postural sway, squat asymmetry, weight shift, and limits of stability between surfers and non-surfers.

CONCLUSIONS

1. There is minimal difference in performance on standard balance assessment protocols between young healthy individuals with at least 3 years of surfing experience and age-matched non-surfers.
2. However, because surfing requires balance on a moving surface, the use of more dynamic tests may yield different results.
3. Surfing may have a larger effect in older adults who are more likely to display deficiencies in balance and control of posture.
4. Additional research is needed to elucidate the impact of surfing on balance and postural control.

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