Back muscle activity in musicians: comparison between two different chairs

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Introduction. Back pain is a common disorder presented in musicians having a direct impact on their posture and life. This may likely be prevented by the use of a seat with lumbar support [1,2]. High density sEMG investigates the muscle activity with potential for training (biofeedback).

Materials and methods. A total of 25 musicians from the Music Schools of Alessandria, Aosta and Cuneo, Italy, took part in this study. Nine violinists (8F, 1M) and 16 pianists (9F, 7M) played during 2h and 1h respectively, a standard piece of music while sitting on an orchestra chair (O-chair) and on an alternative saddle chair (A-chair), Varier Move with lumbar support that forces a different hip angle (Fig. 1a, 1b), on separate days. HDsEMG was acquired for 20 s every 5 min from a right and a left array (8x8 electrodes with Ø = 3 mm and center-to-center distance of 10 mm) placed between T11 and L4 (Fig. 1c). The raw sEMG, the RMS value of each longitudinal differential channel (Fig. 2), and the RMS map of each side, over each 20s epoch (Fig. 3), were investigated. A region of activity (ROA) was defined for each map and the spatial mean RMS value was computed over the ROA.

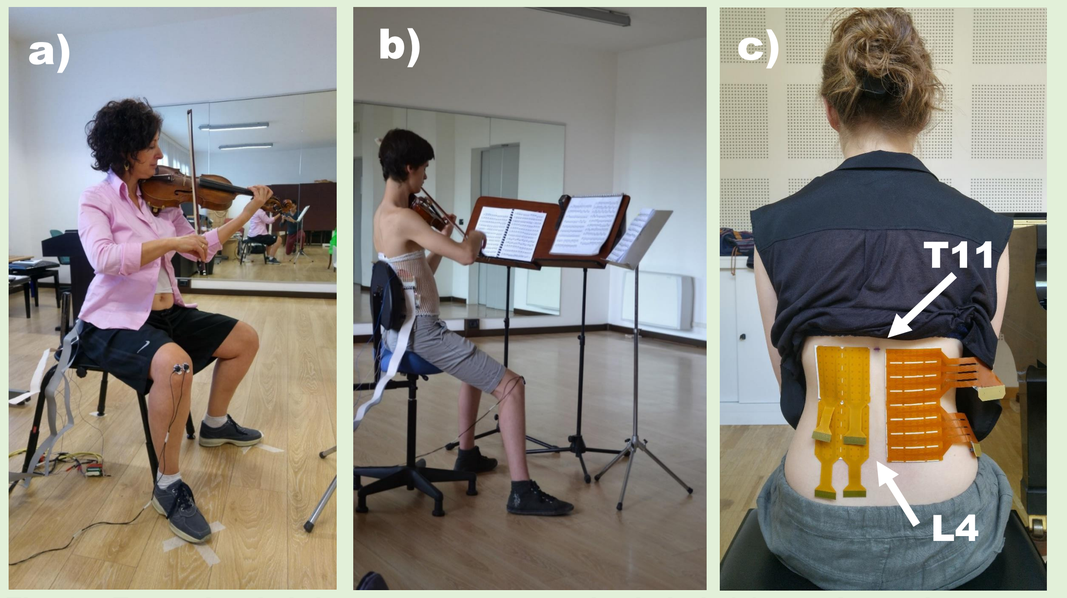

Fig. 1 – Example of sitting posture on standard chair (a), on alternative chair (b), and grid positioning on a subject's back (c). The two chairs imply different trunk-thigh angles.

Results. In 8 (out of 9) violinists and 7 (out of 16) pianists the raw sEMG showed a "burst-like" activity with lower amplitude on the alternative chair (Fig. 2 and 4). In both players the ROA (area of about 40x80 mm) was close to the spine and its mean sEMG RMS value was significantly lower for the A-chair (decrement of 11.9 - 78.3% for violinist and 12.9 - 62.3% for pianists, $p<0.01$). The A-chair presented a smaller ROA RMS map. Burst frequency was 2.9 ± 0.7 burst/s (mean ± st.dev) for violinists and 3.2 ± 0.8 burst/s for pianists (no statistical difference between chairs). No significant myoelectric manifestations of fatigue or changes of the ROA centroid were observed during either playing session.

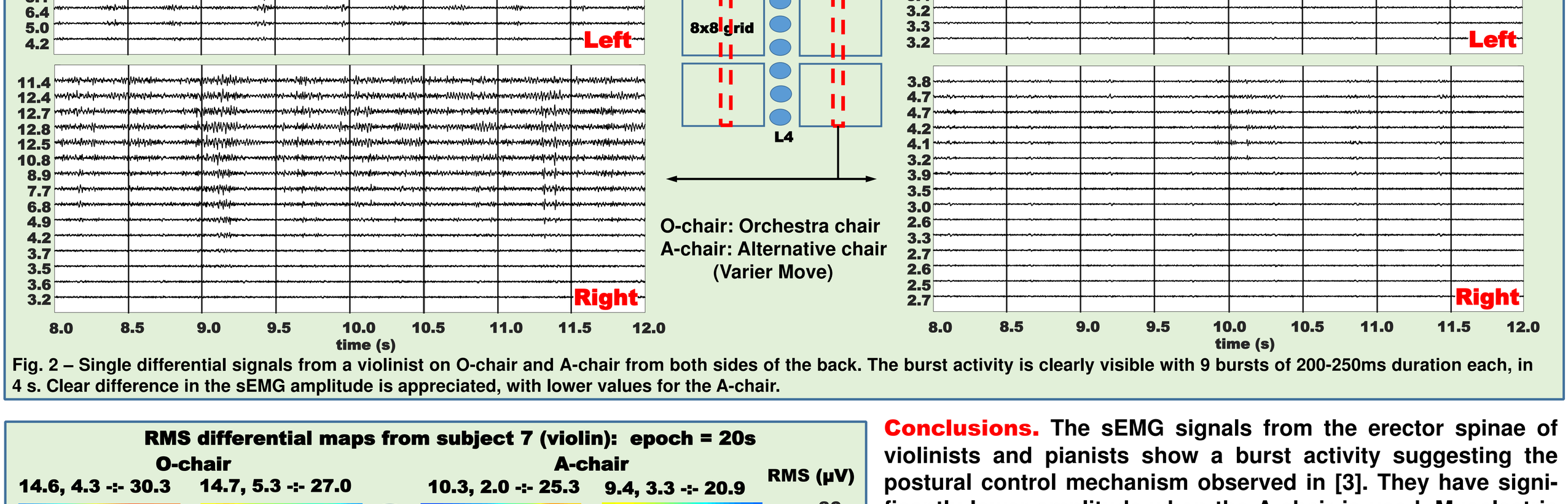

Fig. 2 – Single differential signals from a violinist on O-chair and A-chair from both sides of the back. The burst activity is clearly visible with 9 bursts of 200-250ms duration each, in 4 s. Clear difference in the sEMG amplitude is appreciated, with lower values for the A-chair.

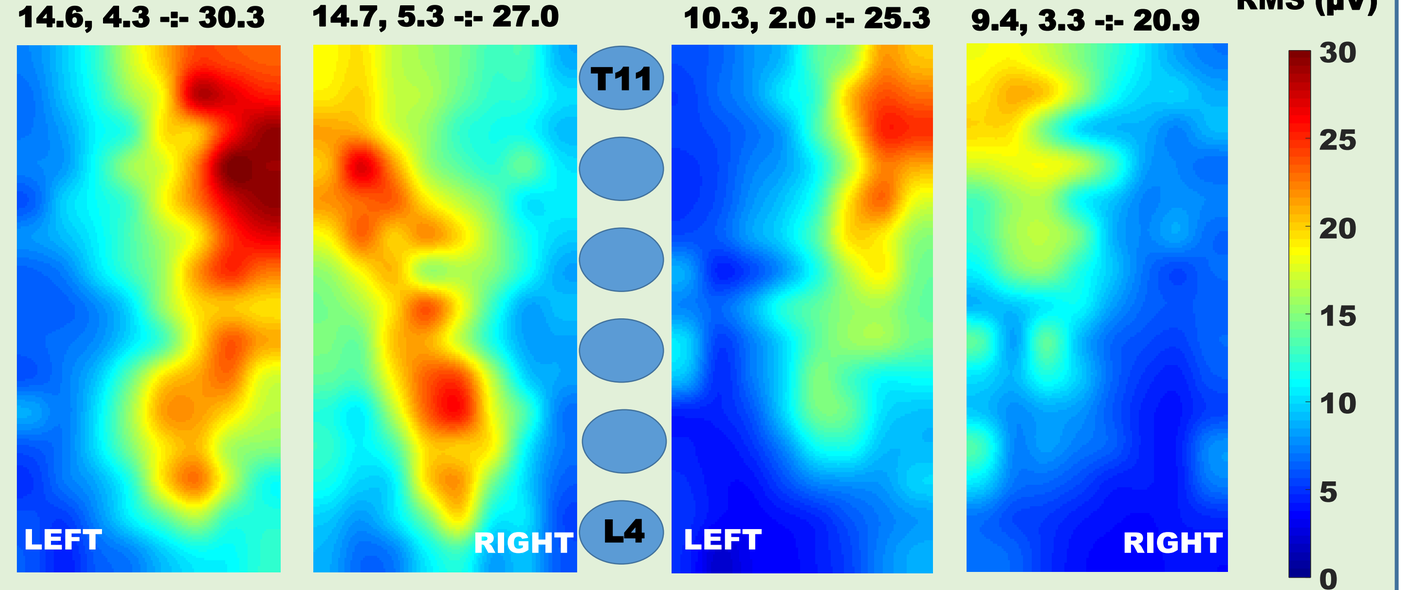

Fig. 3 – Single differential RMS maps from a violinist, comparison between O-chair and A-chair. On the top of each map the mean, min and max values in μV are indicated.

Conclusions. The sEMG signals from the erector spinae of violinists and pianists show a burst activity suggesting the postural control mechanism observed in [3]. They have significantly lower amplitude when the A-chair is used. Myoelectric manifestations of fatigue are not evident in either case [4]. Research on optimization of the lumbar support is justified.

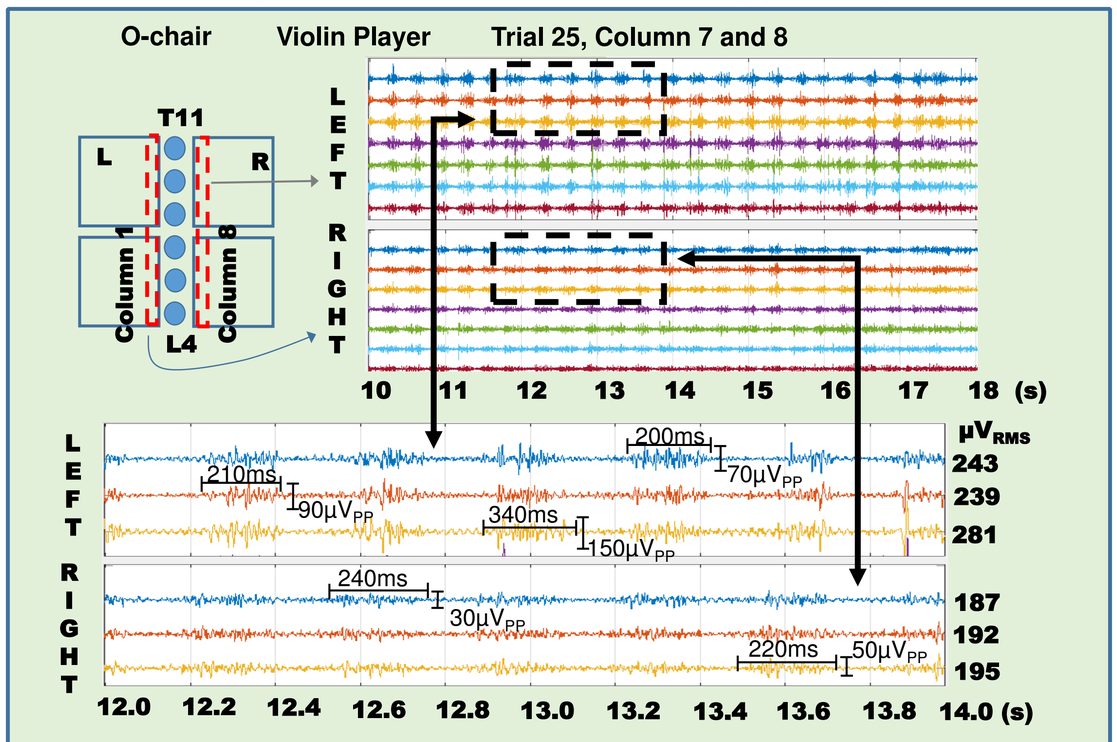

Fig. 4 Example of EMG burst activity on differential signals.

References

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Acknowledgment. Financial support from Progetto Lagrange (Fond. CRT), Varier Furniture s.r.l. and Glasgow Research Partnership in Engineering.