INTRODUCTION
It has been shown that anticipatory postural adjustments (APAs) display non-monotonic changes with stability, i.e. they are attenuated during both very stable and unstable standing (Aruin et al., 1998, Nardone and Shieppati, 1988). Maintaining a stable upright posture has two components; one is reflected in the postural sway during quiet standing, while the other is reflected in the ability to maintain balance in the presence of perturbations. It has been shown that a light touch by a finger leads to a dramatic decrease in postural sway (Jeka et al., 1998), which may be viewed as very stable standing. On the other hand, such a touch is apparently ineffective as a balance-keeping factor in the presence of mechanical perturbations.

The purpose of the present study has been to investigate changes in APA in unstable conditions, with and without the presence of an additional finger touch or hand grasp support.

METHODS
Eight healthy adults (aged 26-52 yr.) participated in the experiment. Subjects performed a fast unilateral shoulder flexion (focal movement) during quiet standing, while balancing on a special board (with instability in the sagittal or frontal plane). The manual support was provided by having the subject hold on to a solid support surface with a light touch with the index finger or a firm grasp to a handle. EMG activity of postural muscles (rectus abdominis (RA), erector spinae (ES), rectus femoris (RF), biceps femoris (BF), tibialis anterior (TA) and soleus (SOL)) as well as arm muscles (biceps brachii (BIC), triceps brachii (TRIC), flexor carpi ulnaris (Wrfl) and extensor carpi ulnaris (Wrex)) were recorded. From force platform data the center of pressure (COP) displacements in anterior-posterior (a-p) and medial-lateral (m-l) directions were calculated. Also the forces exerted by the supporting arm were registered. Statistical methods included repeated measures analysis of variance (ANOVA) and Student’s t-test.

RESULTS
COP: Instability in sagittal or frontal planes decreased in COP excursions in corresponding (a-p and m-l) directions. The influence of manual support was not reflected in significant changes in COP displacement.

Forces: Applied forces were about 2.9 times higher in grasp than in touch, but independent of stability conditions.

EMG: Unstable conditions caused an attenuation of the APA activity, as expressed by the integrated EMG activity from 100 ms prior to till 50 ms after the focal movement. APAs were lower for RF and BF, other postural muscles showed also a decrease but it was non-significant. Furthermore, normalized APA integrals for muscle pairs were summed and subtracted from each other to characterize their overall effects at the joint level (cf. Feldman et al., 1998).

The main findings of this study are:
1) In unstable conditions, there were different changes in APAs in arm and trunk/leg muscles with a touch and a grasp.

Figure 1 shows that APAs in leg and trunk muscles (ES, BF, RF, and TA) decreased with touch and did not show further changes when a touch was substituted with a grasp.
APAs in arm muscles (Wrfl, BIC) showed a drop or no changes in the presence of touch and a substantial increase when touch was substituted with a grasp. Shown are means with standard error bars.

However, the touch could not be used for body stabilization, which is shown in the basically unchanged or decreased APAs in the arm muscles. As suggested by the significant results for the summed activity in muscle pairs, this pattern is reflected in parallel changes in the activity of antagonist muscle pairs.

**SUMMARY**

We observed different changes in APAs in the arm and the leg/ trunk muscles under manipulations of postural instability and additional hand support. Changes in postural sway may be dissociated from changes in APAs under manipulations of stability, so the magnitude of APA is at least partly defined by the subjective perception of the stability in the postural task. Parallel changes in APA activity at the joints seem to be associated with this pattern.

**REFERENCES**


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