

Simultaneous EMG measurements with Mpower (Fibrux) and Telemyo G2 (Noraxon): Comparing amplitude

Purpose. To compare the Fibrux Mpower EMG amplitude output during isometric contractions with the simultaneous output of a standard EMG device.

Methods. Noraxon (www.noraxon.com) is a leading manufacturer of EMG devices and Noraxon's Telemyo G2 was therefore chosen as the reference device. As the muscle site the Biceps Brachii was selected (figure 1, right). The protocol consisted in keeping hand weights at 90 deg elbow angle for about 10 seconds (figure 1, left). The weights used were 5, 7.5 and 9.1 kg. The final test was an MVC test which was also recorded for 10 seconds. For G2 the Ambu Blue sensors M-00-S were used with typical electrode cc-distance of 35 mm. A reference electrode was attached to a nearby bony part (acromion or epicondyle). With Mpower the Fibrux FX dry electrode sensor was used. The G2 sampling rate was set to 1500 Hz and the Mpower sampling rate was set to 500 Hz (defaults for the devices). Eight volunteers (2F + 6M) from the staff participated in the tests (43 ± 10 yr, 74 ± 12 kg, 179 ± 9 cm). For calculating EMG envelopes a 2 Hz low-pass filter was applied to rectified EMG according to a method described in Borg et al (2007).¹

Results: Figure 2 shows the recordings (raw and envelope EMG) of a typical trial. The vertical lines indicate the subsections corresponding to 5, 7.5, 9.1 kg and the MVC sub-trials. These subsections of the duration of 7 seconds each were used for further analysis such as calculating the RMS values.



Figure 1. Left: The arm position during the isometric tests. Right: The arrangement of the sensors during the simultaneous measurements.

¹ F Borg, M Finell, I Hakala and M Herrala, "Analyzing gastrocnemius EMG-activity and sway data from quiet and perturbed standing", *J of Electromyography and Kinesiology* 17 (2007) 622-634.

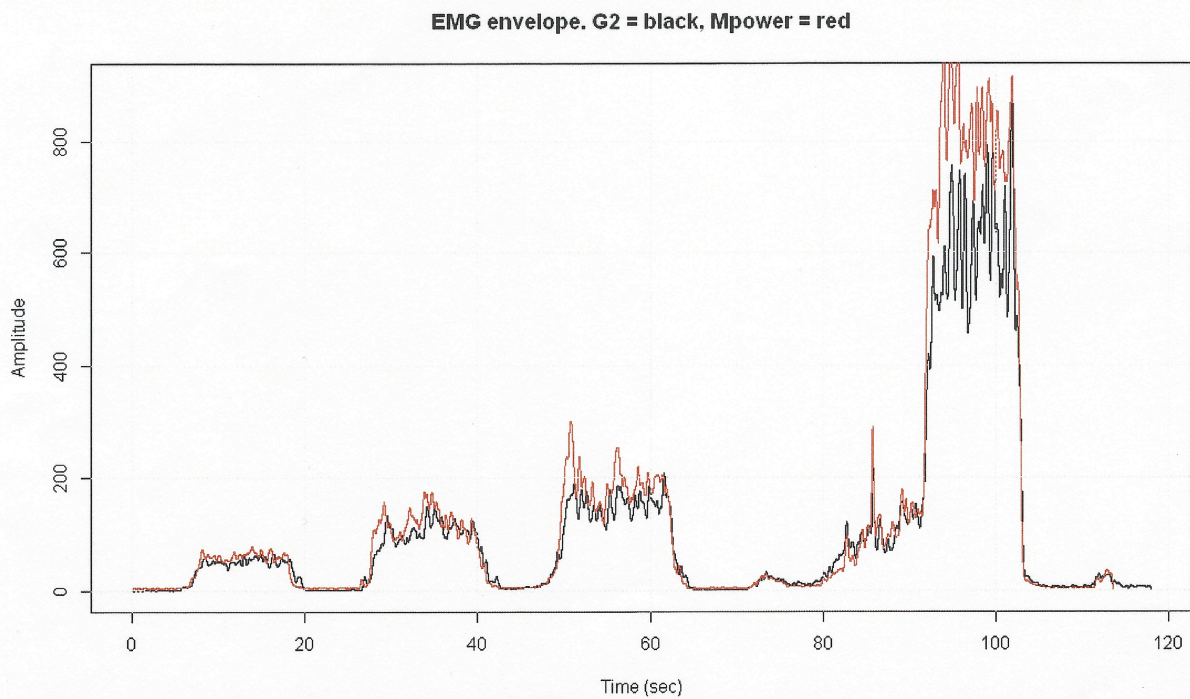
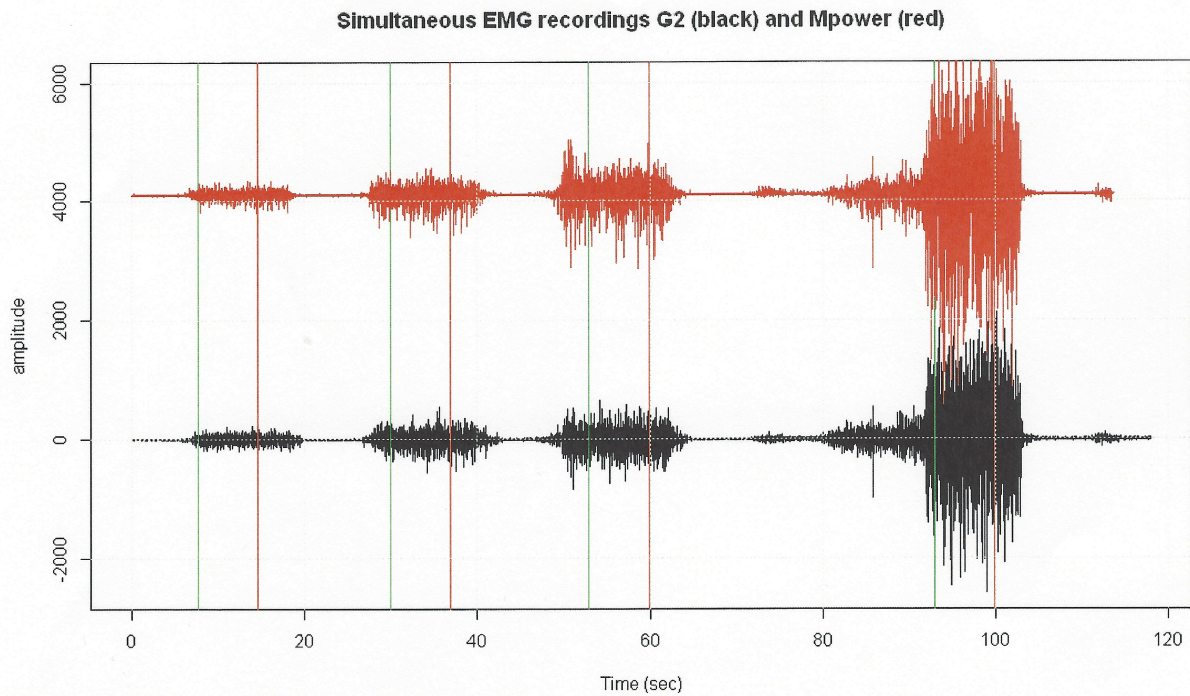


Figure 2. Top: Simultaneous EMG recordings with Telemyo G2 (black) and Mpower (red). The four bursts correspond to 5, 7.5, 9.1 kg and MVC performances. The green/red vertical lines indicate the 7 seconds long subsections used for further analysis of the performances. Bottom: EMG-envelopes for the same data computed with a 2 Hz low-pass filter applied to the rectified EMG.

As figure 2 shows there is an apparently good correlation between the EMG envelopes. Mean Pearson correlation for the 8 trials is found to be $87 \pm 7\%$ (range 72 – 95 %).

We can compare the mean amplitudes of G2 and Mpower for the sub-trials by computing the means of the EMG-envelope subsections and presenting the result as a ratio

$$\text{mean.Mpower}:\text{mean.G2}$$

The result for all sub-trials and all participants is presented in figure 3. Averaged over all trials the mean ratio becomes 1.17 ± 0.39 . The ratio varies both over participants and sub-trials.

pid	5 kg	7.5 kg	9.1 kg	MVC
1	1.63	1.69	1.46	1.09
2	1.08	1.08	1.21	0.95
3	1.09	1.39	1.44	1.08
4	1.2	1.2	1.22	1.36
5	1.55	1.76	1.92	1.82
6	1.03	1.31	1.23	1
7	0.9	0.88	0.82	1.27
8	0.39	0.43	0.4	0.57

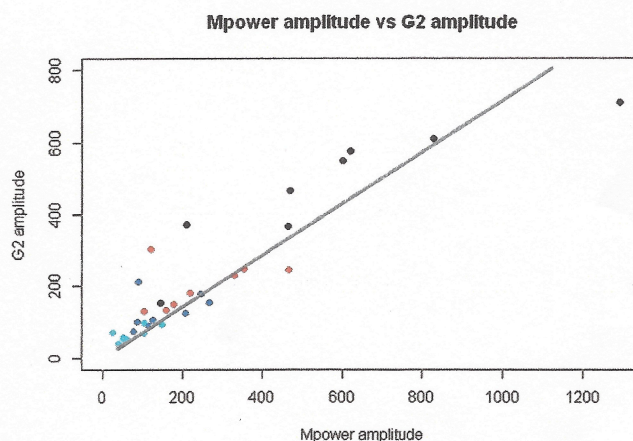


Figure 3. Left: The numeric table shows the ratio $\text{meanMpower}:\text{meanG2}$ for the 4 sub-trials and for each participant (pid = 1 to 8). The means are calculated as the means of the EMG envelopes. The envelopes are calculated as described in the caption of figure 2. Right: The points show the mean amplitudes for Mpower and G2 for all the trials (cyan = 5 kg, blue = 7.5 kg, red = 9.1 kg, and black = MVC trials). The correlation between G2 and Mpower amplitudes based on these (envelope) points is 91 %.

Conclusion. The Telemyo G2 and Mpower EMG devices show similar amplitude outputs. There is a good correlation between EMG envelopes. The amplitude relation may though vary with participant characteristics and test conditions. The difference in electrode types probably contributes to this variation.

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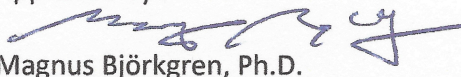
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