

Development and evaluation of a seating aid cushion system

M. NAGAMACHI, S. ISHIHARA, H. HASHIMOTO, M. KOUCHI. **Development and evaluation of a seating aid cushion system for wheelchair bound, paralyzed people.** *Gerontechnology* 2014;13(2):265; doi:10.4017/gt.2014.13.02.175.00 **Purpose** Paralyzed people spend most of their time in wheel chairs, although the reasons for paralysis vary. The seating postures of paralyzed people commonly involve leaning forward and/or to the side. Although a harness is widely used to prevent leaning, physical restrictions compromise user comfort. To address this problem, we developed a supportive cushion system using Breath-air, a three-dimensional interwoven polyester fiber material. The support system consists of back, side, and lumbar support cushions (*Figure 1*). We examined the effectiveness of the Breath-air system at a rehabilitation institution. An electromyogram (EMG) was used for measurement. Different paralyzed people have larger differences between right and left erector spinae EMGs than able-bodied people. If support by the cushion system is effective, the difference of EMGs will be smaller. **Method** Eight paralyzed and wheelchair bound people participated in the experiment (four females, four males; one person was age 65; the others were in their 30s or 40s). Cerebral palsy, strokes or meningitis had caused their paralysis. EMGs were used to measure from the right and left erector spinae and were compared with and without side support cushions. Tests were conducted using stationary sitting and self-propulsion movement positions. One subject was unable to use self-propulsion techniques. EMG was quantified every two seconds, by integrals of absolute voltage. **Results & Discussion** Overall, in all conditions and with all subjects, side supported positions had a smaller right/left erector spinae EMG difference than positions without support (one-way ANOVA, $p=0.003$, $F(1,164)=8.95$). *Table 1* compared EMGs between each subject, including statistical significance. In stationary and self-propulsion position, three out of eight participants and six out of seven participants experienced improvements. The results suggest our side support cushions have the potential to assist paralyzed patients, especially those who are capable of self-propulsion in their wheelchair. We will present a more detailed analysis in future evaluations.

Reference

1. Ishihara S, Nagamachi M, Nakamura M, Morishima K. *Gerontechnology* 2010;9(2):222; doi:10.4017/gt.2010.09.02.255.00

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Table 1. Left/right EMG [∫ (mV)] differences in still and mobile conditions; a downward, flat, two-sided arrow indicates smaller EMG's with side support cushions, almost the same value, and slightly larger values, respectively; real improvement by support shows as '↓'; n.d.=not done

Subject	Still EMG	Move EMG
1	↓**	↓**
2	→	n.d.
3	↔	↓+
4	↓	↓
5	→	↓
6	↓**	↓*
7	→	→
8	↔	↓



Figure 1. Supportive cushions and EMG measurement