Longitudinal Study of the Effects of an Adjustable Ergonomic Keyboard on Upper Body Musculoskeletal Symptoms

Alan Hedge *et al*.

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Hedge, A, Goldstein, M, Hettinger, L, Varner, C, Silva, D., Malafronte, J, and Goodyear, C. (2002) Longitudinal study of the effects of an adjustable ergonomic keyboard on upper body musculoskeletal symptoms. Proceedings of the Human Factors and Ergonomics Society 46th Annual Meeting, Sept. 30-Oct. 4, Baltimore, MD: 602-606

Research Team

- Mark Goldstein, Goldtouch technologies Inc.
- Lawrence Hettinger, Northrop Grumman Information Technology
- Cari Varner, Cornell University
- Don Silva, Blue Cross Blue Shield
- Jean Malafonte, Blue Cross Blue Shield
- Chuck Goodyear, Goodyear Statistics

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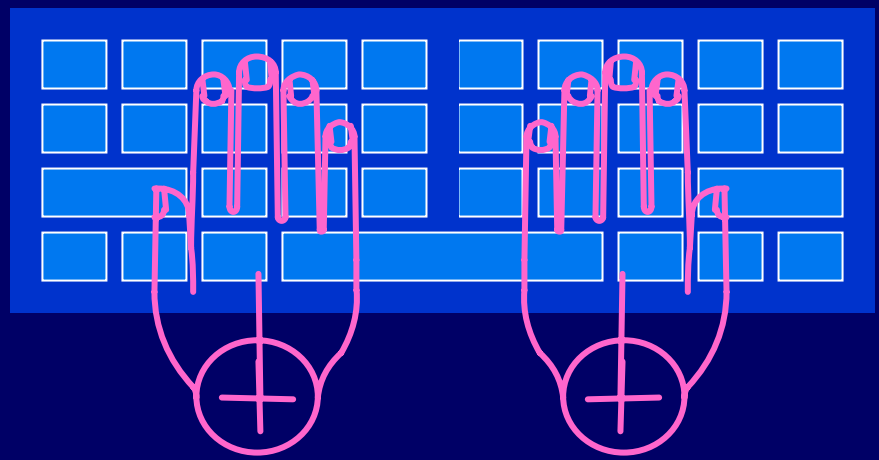
Keyboard Design Issues

- Conventional keyboards – keypad is linear and can encourage ulnar deviation



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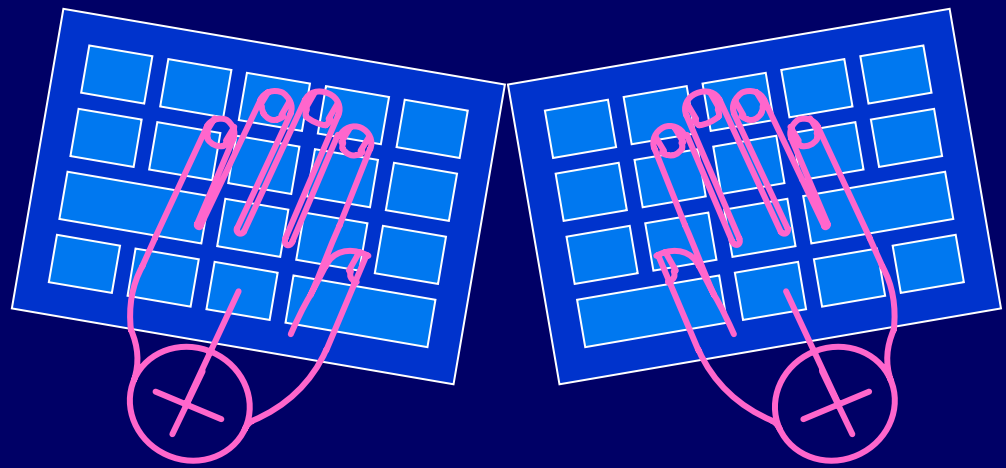
Keyboard Design Issues

- Splayed keyboards – keypad is halved and each half laterally rotated to minimize ulnar deviation



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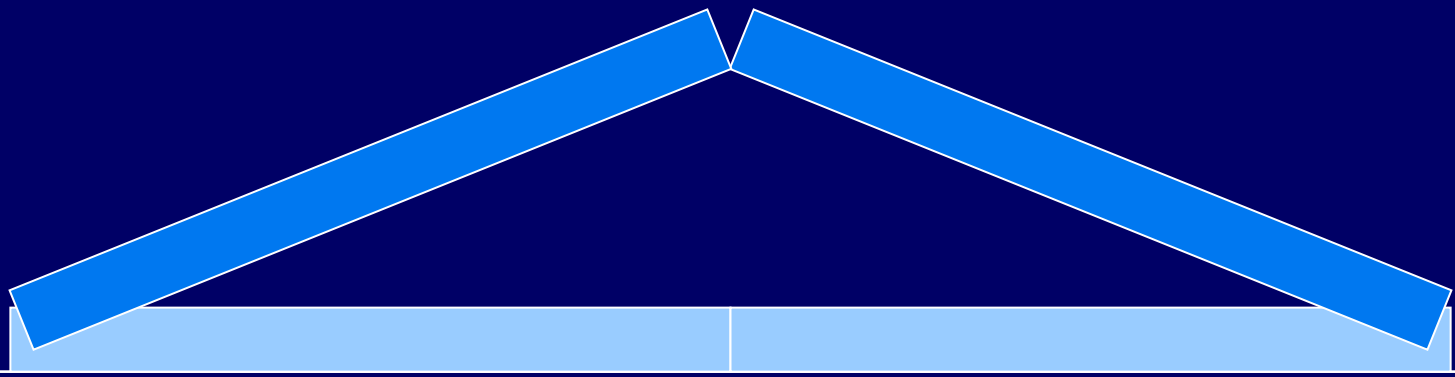
Keyboard Design Issues

- Tented keyboards – keypad halves are angled to an apex to minimize wrist pronation



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Keyboard Design Issues

- Fixed designs – splay and tent angles are fixed
- Adjustable designs – splay and tent angles are adjustable

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Alternative Keyboards Field Studies

- Tittiranonda et al. (1999)
  - Tested 4 keyboards with 80 users for 6 months (20 per kbd)
  - Results most positive for kbd2 (adjustable), but 9 dropouts from sample – unreliable results
  - Kbds 1&3 showed some improvements in pain compared with control
  - Users may experience decreased hand pain after several months of using alternative geometry keyboard

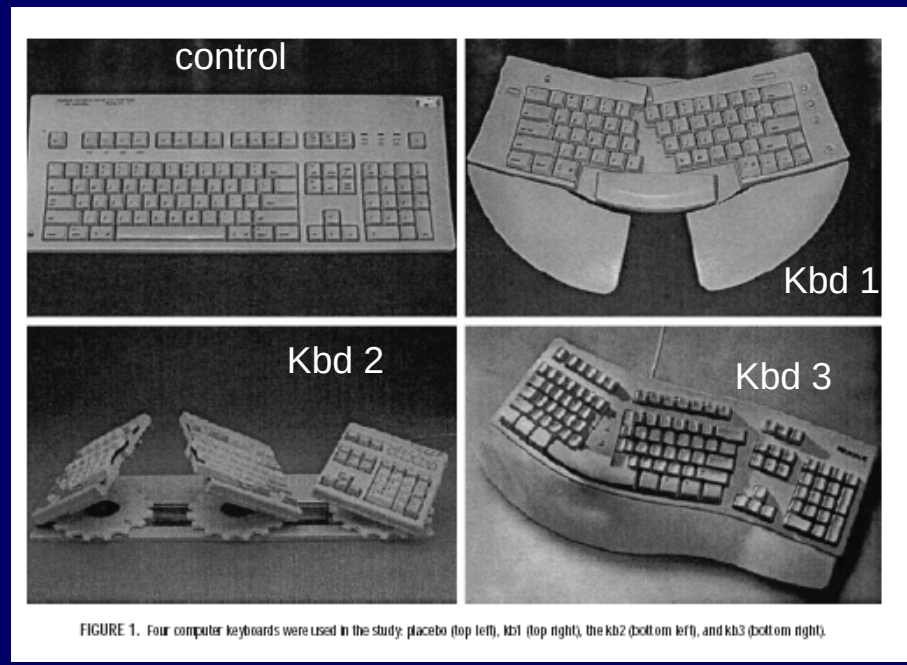

FIGURE 1. Four computer keyboards were used in the study: placebo (top left), kb1 (top right), the kb2 (bottom left), and kb3 (bottom right).

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Research Issues

- Does the use of an adjustable keyboard over an extended period of time result in an effect on symptoms of upper body musculoskeletal disorders (MSDs)?

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Research Study

- Site – large, urban insurance office
- Subjects – 80 subjects selected and allocated into 2 groups based on results from a wellness survey. Subjects matched for age, gender and initial MSD reports.
  Complete data for 73 subjects:
  - Test group – 37 subjects
  - Control group – 34 subjects

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Research Design

- Baseline survey – all subjects completed an initial survey of computer use and MSDs.
- All subjects received instruction and guidance on setting up their office workspace (chair use, desk surface height, etc.)
- Control group – no other intervention
- Test group – subjects provided with an adjustable keyboard and given some instruction on how to adjust and use this keyboard.

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Adjustable Keyboard

- Test keyboard with adjustable splay and tent angles

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Research Measures

- Baseline survey results
- Weekly “keyboard evaluation survey” results gathered for both groups for a 6 months period
- Terminal Interviews - Test subjects were interviewed at the end of the study

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Results

- Data from a total of 1,442 surveys were analyzed
- Subjects in both groups were full-time keyboard users (median weekly keyboard use = 30 hours)
- Over the course of the study MSDs were reported by all users:
  - 50% lower back pain
  - 43% neck pain
  - 40% shoulder/forearm/wrist pain

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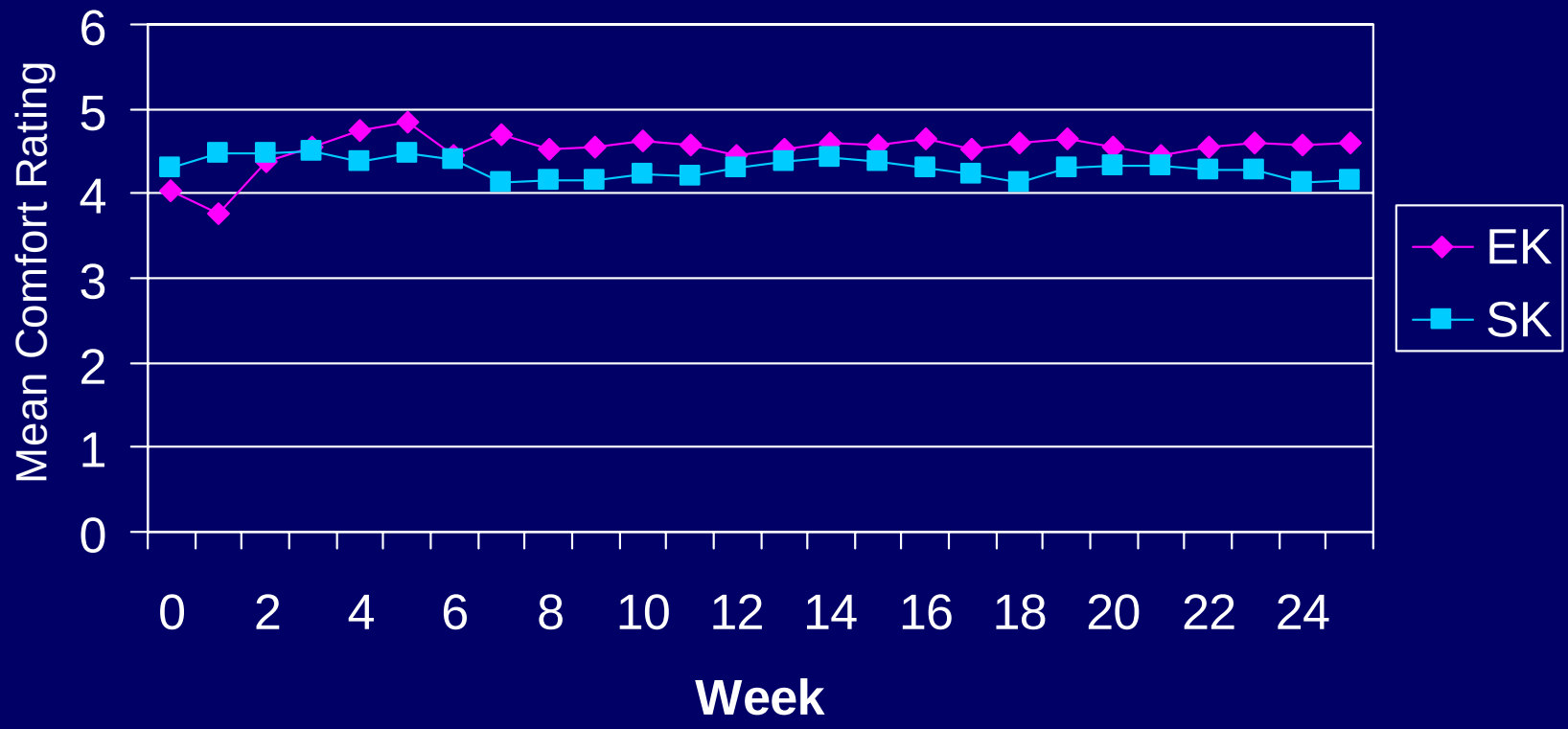
Mean Keyboard Comfort Ratings

- No significant difference in comfort ratings at the 0.5 level after 6 months



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Effects on MSDs

- 6 month MSD ratings were compared with those at baseline
- No significant changes in MSDs were found for the control group
- Several significant changes were found for the test group

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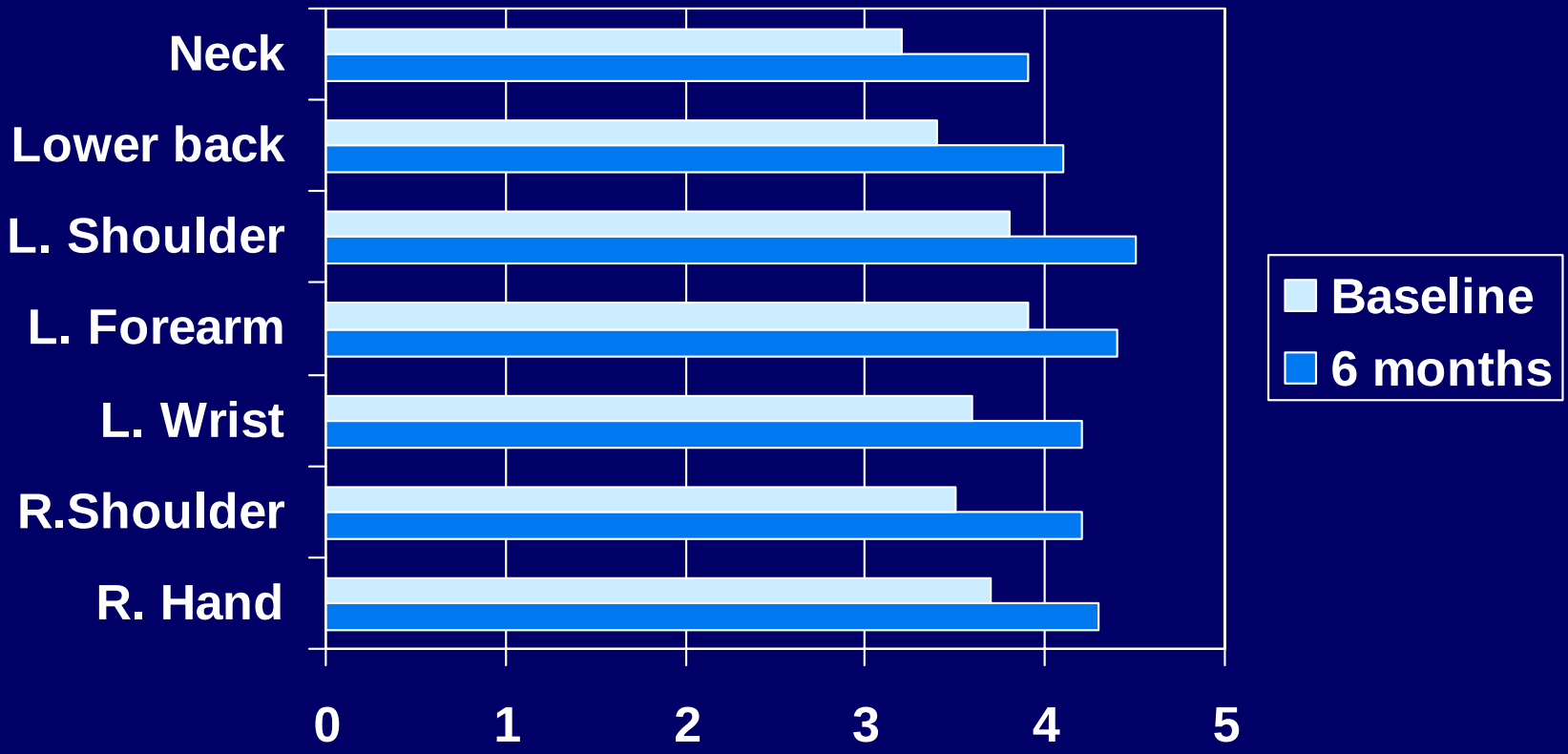
Test Group MSD changes (P<0.05)

(1=great discomfort…..7=great comfort)



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Terminal Interviews and Post-study Behavior

- Over 80% of test groups subjects were enthusiastic about their use of the adjustable keyboard by the end of the study
- 36 of the 37 subjects were continuing their use of the adjustable keyboard at 6 months after the end of the study

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Conclusions

- Upper limb musculoskeletal discomfort ratings showed some significant improvements with the use of the adjustable keyboard by the end of the study
- Keyboard comfort ratings were not substantially higher for the adjustable keyboard than the conventional keyboard
- Results agree with those of Tittiranonda et al. (1999) that beneficial effects of some alternative keyboard designs may appear after longer-term field use.

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