Treating persistent speech sound disorders with ultrasound visual feedback in Finnish speaking children

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The poster is presented
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Introduction

Accumulating evidence suggests that providing visual feedback with ultrasound increases treatment efficacy of persistent speech sound disorders (SSDs; Sudgen et al., 2019). Visual feedback may help children to recognize intraoral movements and support learning new motor strategies (Preston, Brick & Landi, 2013; Preston, Leece & Maas, 2017; Preston et al., 2017) especially when the place and manner of articulation are difficult to perceive (Cleland et al, 2015). The current study aimed to determine whether Finnish /r/ as [r], i.e., a trill, which is the most typical SSD in FInnish, can be visualized with ultrasound and used as a biofeedback method in treatment. We prepared a web-based application for perceptual evaluation, and controlled if experience as an SLP had an effect on rating of target sound.

Methods

Subjects: n=4 boys, age 8-10 years, typical language skills
SSD: uvular or lateral /r/-sound instead of typical alveolar tremulant /r/
Ultrasound: Seemore PI 7.5 M
Intervention: 10 sessions: pre-therapy + eight therapy sessions 45min. of which 15-20 min. with ultrasound +post therapy assessment
Treatment efficacy control: Three measurements: wordlist with ultrasound at the first therapy, in the middle and at the last therapy session.
Perceptual evaluation: 11 SLPs (5 experienced, 6 SLP students) assessed 169 extracted samples of /r/-sounds (5 practice, 144 test and 20 control samples) with continuous scale (vas-scale with 100 degrees). The mean length of samples was 0.35s, range 0.13-1.00s, samples were repeated 3 times in a row.
Data analysis: Wilcoxon signed-ranked test, ICC2 (two-way random, average score) and Mann-Whitney U-test. All analyses were carried out by comparing means of the vas-rating.

Results

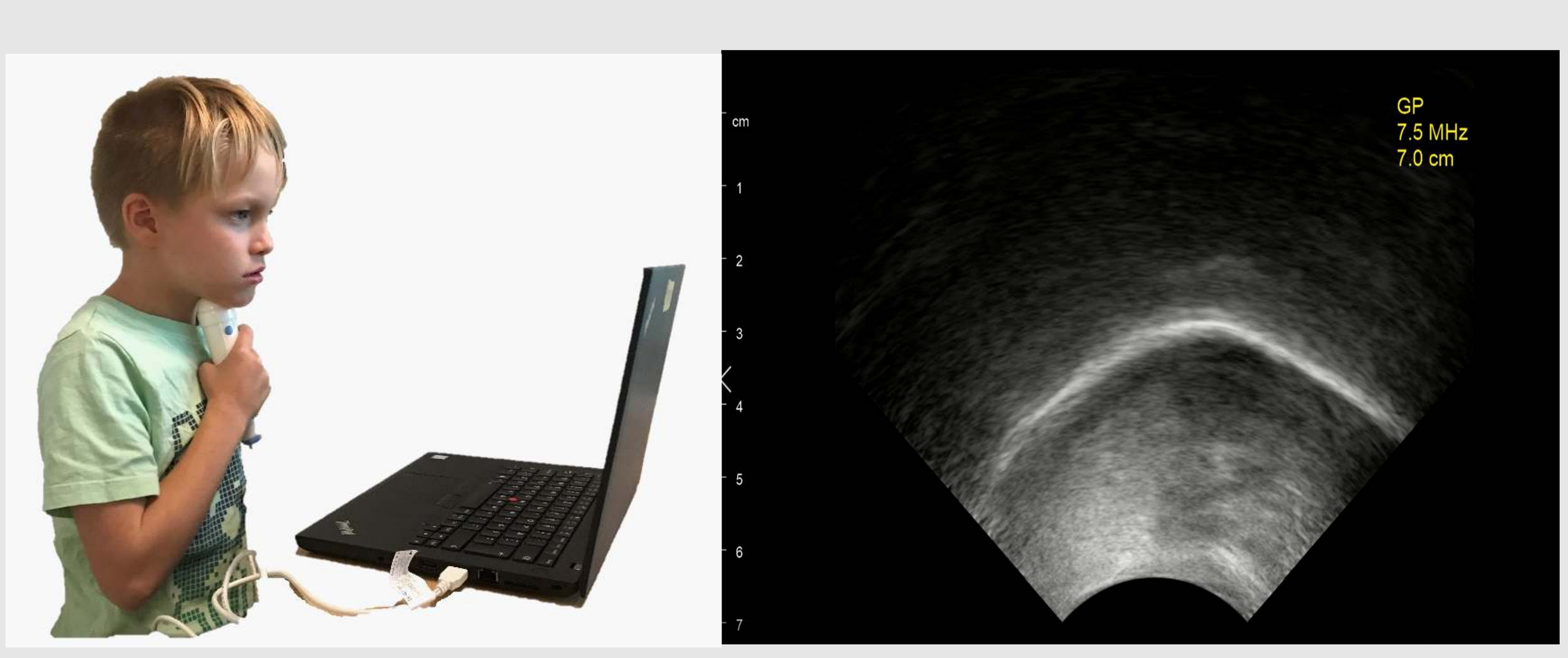
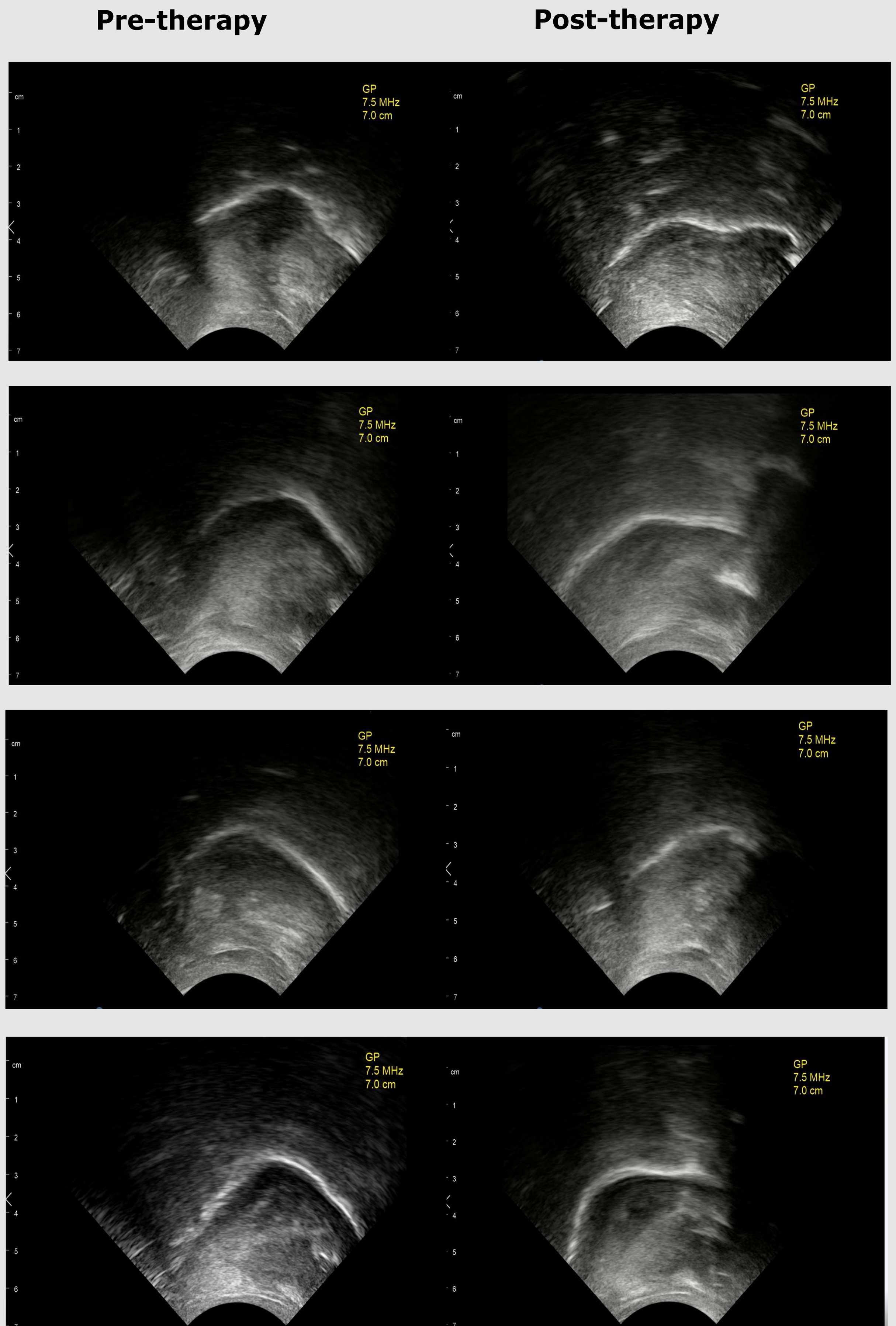


Figure 1. The ultrasound device and image of the tongue in the neutral position. Mid-sagittal view, the tip of the tongue on the right.



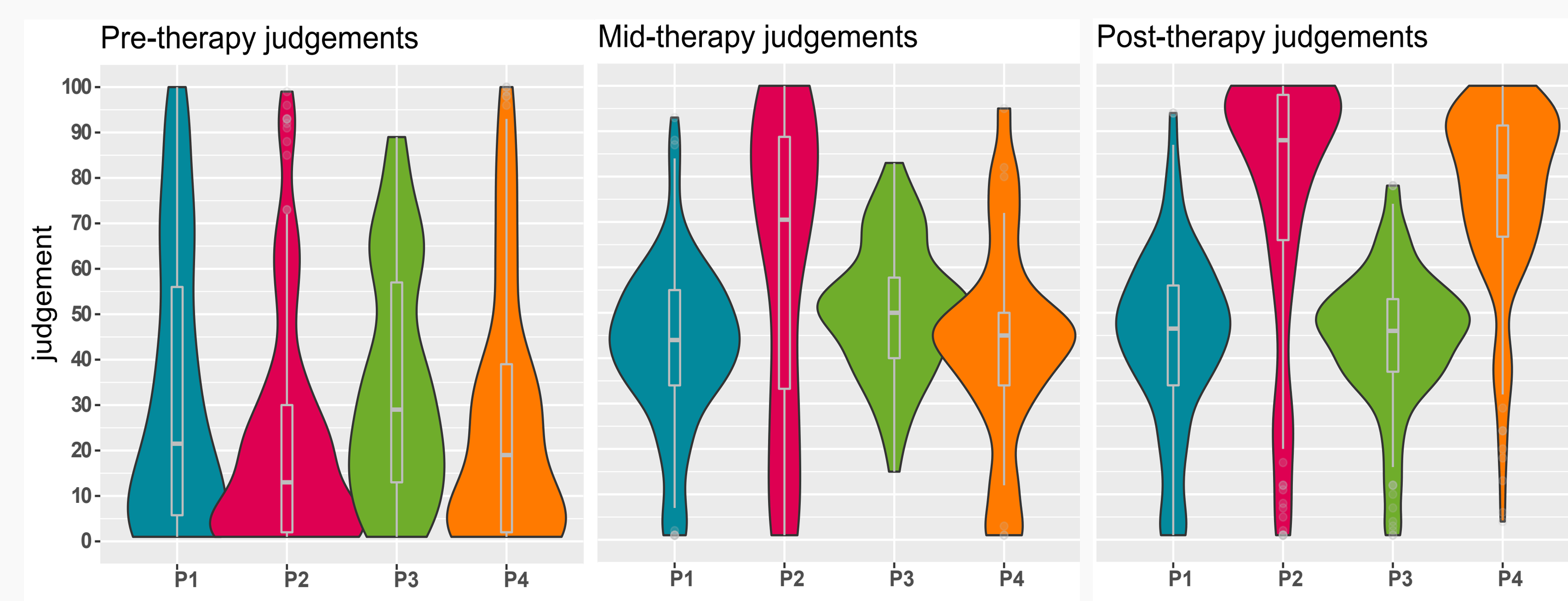


Figure 3. Results of perceptual judgement (0=other place of articulation; 100-Finnish /r/) for the 4 participants at pre-therapy with positive treatment effect apparent for P2 and P4 and individual differences in treatmnet progress.

1. We observed a positive effect of ultrasound treatment of /r/-sound for all participants. Wilcoxon signed-rank test results revealed that there was a significant difference between pre-therapy and post-therapy (*p<0.001*), as group and and as individuals. The difference was also significant between the pre-therapy and mid-therapy as well as mid- and post-therapy (p<0.001) in group and individual analysis, except between mid-therapy and post-therapy in participants 1 (*p ≈ 0.78*) and 3 (*p ≈ 0.62*).

2. Perceptual judgements of /r/-sounds were reliable. A good or excellent degree of reliability was found between the raters in the three measurements. The average measure ICC2 with 95% confidence interval was 0.83 in pre-therapy (*p<0.001*), 0,89 in mid-therapy (*p<0.001*) and 0.92 in post-therapy (*p<0.001*). Control samples (n=20) were also assessed highly similarly both times. The mean vas-scale score in the first rating was 47.1 and 47.0 in the second. Wilcoxon signed-rank test didn't either show a significant difference between the two ratings (*p ≈ 0.82*).

3. **The samples were judged quite similarly by experienced and inexperienced SLPs.** Mann-Whitney U-test showed that the difference between the groups was significant in pre-therapy judgements (*p ≈ 0.0036*). However, no significant differences were found between the groups in mid-therapy judgements (*p ≈ 0.067*) and 3 (*p ≈ 0.80*).

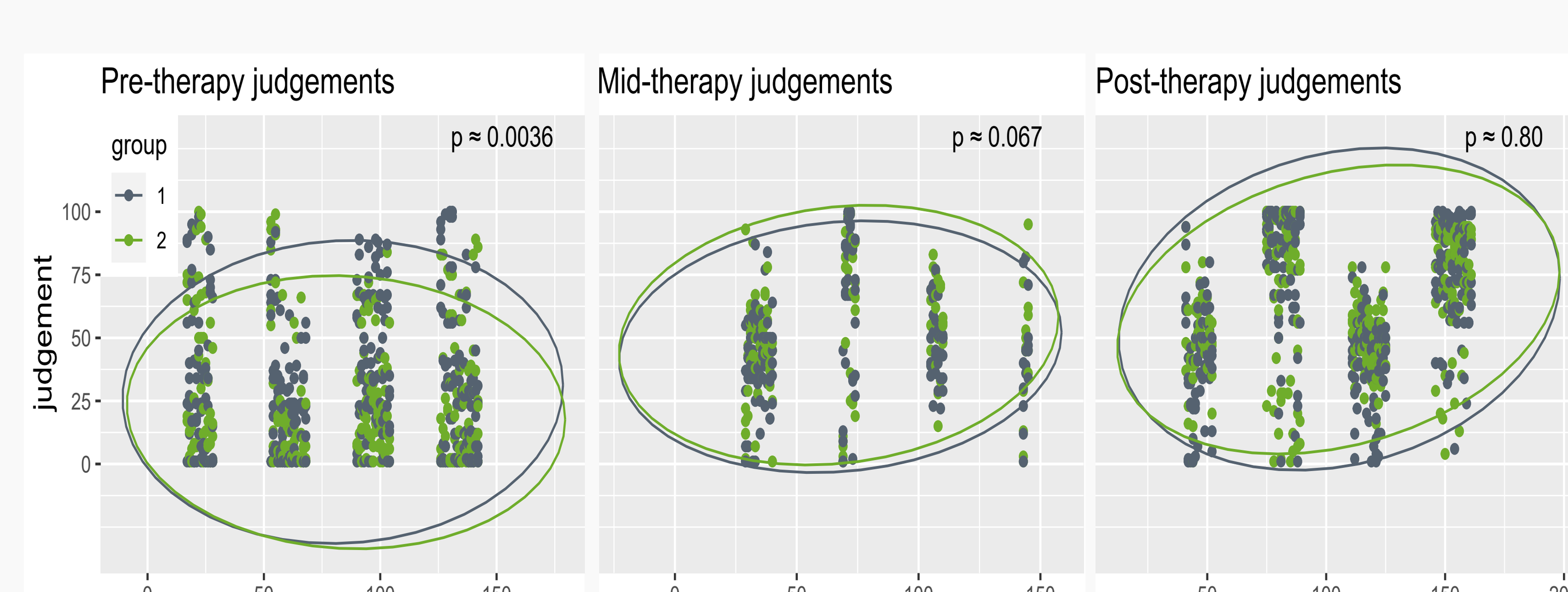


Figure 4. Perceptual judgements of experienced and inexperienced SLPs had a small but statistically significant difference in pre-therapy judgements.
There was no statistically significant difference between the groups in mid- and post-therapy judgements. Group 1= students, group 2= experienced SLPs.

Conclusions

- Preliminary evidence suggests that ultrasound biofeedback has potential to be used in treating SSDs in Finnish speaking children.
- The positive effect of treatment was observed in perceptual judgements in all participants.
- The amount of experience as an SLP may not have an effect on auditory perceptual judgements, but more data is needed.
- Next, acoustic analysis and objective measurements of the tongue movements should be included. More research with a larger sample size is needed.

References

Cleland, J., Scobbie, J. M. & Wrenc, A. (2015). Using ultrasound visual biofeedback to treat persistent primary speech sound disorders. Clinical Linguistics & Phonetics, 29(8-10), 575-597.
Preston, J. L., Brick, N. & Landi, N. (2013). Ultrasound biofeedback treatment for persisting childhood apraxia of speech. American Journal of Speech and Language Pathology, 22(4), 627-643.