Parent based language intervention for 2-year-old children with specific expressive language delay: a randomised controlled trial

A Buschmann, B Jooss, A Rupp, F Feldhusen, J Pietz, H Philippi

ABSTRACT

Objective: The aim of this randomised controlled trial was to evaluate the effectiveness of a short, highly structured parent based language intervention group programme for 2-year-old children with specific expressive language delay (SELD, without deficits in receptive language).

Methods: 61 children with SELD (mean age 24.7 months, SD 0.9) were selected between October 2003 and February 2006 during routine developmental check-ups in general paediatric practices, using a German parent-report screening questionnaire (adapted from the MacArthur Communicative Development Inventories). Standardised instruments were used to assess the language and non-verbal cognitive abilities of these children and of 36 other children with normal language development (reference group; mean age 24.6 months, SD 0.8). 58 children with SELD were sequentially randomly assigned to an intervention group (n = 29) or a 12-month waiting group (n = 29). In the intervention group, mothers participated in the 3-month Heidelberg Parent-based Language Intervention (HPLI). All children were reassessed 6 and 12 months after pretest. Assessors were blind to allocation and previous results.

Results: 47 children were included in the analysis. At the age of 3 years, 75% of the children in the intervention group showed normal expressive language abilities in contrast to 44% in the waiting group. Only 8% of the children in the intervention group versus 26% in the waiting group met the criteria for specific language impairment (t score < 35).

Conclusions: By applying the short, highly structured HPLI in children with SELD, the rate of treatment for language impairment at the age of 3 years can be significantly reduced.

With a prevalence of about 15% language delay is one of the most frequent developmental problems in 2-year-old children. Since language delay can be an indicator for several neurodevelopmental problems, it should be taken seriously and further diagnostic investigation is recommended.

There is general agreement regarding the need for intervention for children with persistent deficits in expressive language in the late preschool period and children with deficits in receptive language. But in anticipation that young children with specific expressive language delay (SELD) have a good prognosis and will normalise spontaneously, the “wait and see” strategy is widely recommended, and speech and language therapy is usually not initiated before the age of 4 years. The main reason for this approach is that language development is still quite variable in typically developing young children, and it has been shown that many children with SELD normalise, that is, their language skills at the age of 5–5 years are similar to those of their peers.

However, the picture is not entirely clear as other studies have found that at least 50% of children with SELD do not resolve their problem spontaneously. Studies that started with preschool children with follow-up into school age and adolescence, have found that a substantial proportion of children, in particular those with receptive language impairments, will not outgrow their language difficulties and are therefore at risk for cognitive, literacy, behavioural and psychiatric problems.

This unfavourable long term prognosis, combined with parental concerns, child frustration and disturbed parent–child interactions, has led to the development of early intervention models such as individual directed interventions, combined parent–child language groups or parent based group interventions. A limited number of intervention studies have been published.
Different parent based group approaches are effective and well established in North America and the UK, but they do not seem to be cheaper or less time consuming than individual directed interventions. Evaluated parent based intervention programmes are not available in German speaking countries. The purpose of this study was to examine the effectiveness of a short and highly structured parent based language intervention group programme for 2-year-old children with SELD. The main hypothesis was that 2-year-old children with SELD whose mothers participate in the intervention, will show improved expressive language abilities 6 and 12 months after pretest in comparison to children with SELD in a waiting group. The results of both clinical groups were compared to the results of a matched reference language-normal sample. Confirmation of significant intervention effects might have substantial practical implications for providing support for children with SELD.

METHOD

Study design

The randomised controlled trial (RCT), completed in the Children’s Hospital, University of Heidelberg, utilised a pretest–post-test control group design with follow-up 12 months after pretest.

Based on three frequently cited studies, a power calculation for single sided t tests was used to determine the sample size. If α was set at 0.05 and β was 0.80, 14 subjects per group were required. It was decided to aim for a sample size of 20 subjects per group.

Randomisation was carried out sequentially after pretest to achieve a balanced parallel group design stratified for gender and maternal school education because earlier studies found a correlation between maternal education and language development at the age of 3 and 4 years. Randomisation was carried out using opaque sealed envelopes. Post-test and follow-up diagnostics were carried out by different assessors who were blinded to previous results and allocation.

The study received ethical approval from the Ethics Committee of the University of Heidelberg.

Participants

Sixty one children with SELD were selected from a sample of children with language delay, identified in general paediatric practices during free routine developmental check-ups at 21–24 months of age from October 2003 to February 2006.

Participants were singletons born at term without pre-, peri- or postnatal complications and a German speaking family background. Exclusion criteria were chronic hearing deficits.

Figure 1 Flowchart of patient involvement in the study.
persistent middle ear effusion accompanied by a significant hearing loss of >20 dB, visual impairments, genetic syndromes, pervasive developmental disorders or other diseases with a known influence on language development, deficits in receptive language and/or in non-verbal cognitive abilities, and previous language intervention. The children were between 24 and 27 months of age at entry into the study (mean age 24.7 months, SD 0.9). None of these children had reached the critical cut-off of 50 words in their expressive vocabulary as measured by the parent-report screening questionnaire ELFRA-2.

Nine families dropped out before follow-up. Two families from the intervention group were excluded from analysis, resulting in a final sample of 47 children with SELD (fig 1).

To obtain a reference language-normal group, an advertisement was placed in a local newspaper. A total of 86 children (mean age 24.6 months, SD 0.8) were matched as closely as possible with respect to age, sex, birth order and maternal school education.

Demographic and clinical data are presented in table 1.

### Measures

During the routine paediatric check-up, parents completed the ELFRA-2 (the German version of the MacArthur Communicative Development Inventories), a reliable and easy to use parent-report screening questionnaire for the early identification of children with language delay.

At pretest, children were tested with the widely used developmental language test for 2-year-old children (SETK-2), a standardised and norm-referenced instrument to examine the language status of German speaking preschool children (reliability coefficients 0.62–0.86). Language production was measured with the subtest Encoding Semantic Information (ESI) in the same manner as with the two production subtests of the SETK-2. The other subtest measures the ability of plural forming (FF). Parents completed the ELFRA-2 questionnaire research version, which includes six additional syntactic items for better differentiation of 3-year-old children.

Results within normal limits (t score >40) in both production subtests of the SETK 3–5 indicated the child had caught up. Specific language impairment was defined by a t score of more than 1.5 SD below the mean (≤35) in at least one production subtest of the SETK 3–5.

All diagnostic sessions were recorded on videotape.

### Intervention programme

The intervention used was the Heidelberg Parent-based Language Intervention (HPLI), a highly structured and interactive programme developed for use with a group of 5–10 parents. The 5-month programme consisted of seven 2 h and one 3 h session 6 months later.

The HPLI is based on an interactive model of language intervention, which presumes that optimised parental input will provide better language learning opportunities for children. Parents are introduced to child oriented, interaction promoting and language modelling techniques. Sharing picture books is one of the main topics of the programme, since picture book sharing is an ideal time to initiate communication as well as being a prototypical situation for learning words at the age of 2.

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### Table 1 Demographic and clinical data of children in the intervention group, the waiting group and a reference language-normal group

<table>
<thead>
<tr>
<th></th>
<th>Intervention group, n = 24</th>
<th>Waiting group, n = 23</th>
<th>Fisher’s exact test*</th>
<th>LN group, n = 38</th>
</tr>
</thead>
<tbody>
<tr>
<td>Birth order, %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>First born</td>
<td>20.8 (13 males/11 females)</td>
<td>43.5 (11 males/12 females)</td>
<td>0.22 NS</td>
<td>41.7 (20 males/16 females)</td>
</tr>
<tr>
<td>Second born</td>
<td>62.5</td>
<td>39.1</td>
<td>50.0</td>
<td>50.0</td>
</tr>
<tr>
<td>Third or fourth born</td>
<td>16.7</td>
<td>17.4</td>
<td>8.3</td>
<td>8.3</td>
</tr>
<tr>
<td>Family history of SLD (1st degree), %</td>
<td>50.0</td>
<td>43.5</td>
<td>0.77 NS</td>
<td>2.8</td>
</tr>
<tr>
<td>Age of mothers at birth, mean (SD), years:months</td>
<td>32.1 (3:8)</td>
<td>33.7 (4:3)</td>
<td>31.7 (4:4)</td>
<td></td>
</tr>
<tr>
<td>Maternal school education (years in school), %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>No/low graduation (8–9)</td>
<td>12.5</td>
<td>8.7</td>
<td>11.1</td>
<td></td>
</tr>
<tr>
<td>Middle school graduation (10)</td>
<td>37.5</td>
<td>56.5</td>
<td>47.2</td>
<td></td>
</tr>
<tr>
<td>High school graduation (13)</td>
<td>50.0</td>
<td>34.8</td>
<td>41.7</td>
<td></td>
</tr>
<tr>
<td>Maternal work situation, %</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Full time employment</td>
<td>8</td>
<td>4</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>Part time employment</td>
<td>38</td>
<td>52</td>
<td>44</td>
<td></td>
</tr>
<tr>
<td>House wife</td>
<td>54</td>
<td>44</td>
<td>53</td>
<td></td>
</tr>
</tbody>
</table>

*Comparison of intervention and waiting group.

LN, language-normal; NS, not significant; SLD, speech and language disorder.
The intervention started when the children were about 25 months old. To achieve comparability only mothers took part; about seven mothers took part in each group. All sessions took place at the Children’s Hospital, University of Heidelberg and were conducted by the first author who had developed the HPLI.

Statistical analysis
Statistical analysis was performed using SAS (v 8.01). Frequency differences between groups were tested for using the χ² or Fisher’s exact test. Pretest comparisons were made using analysis of variance (ANOVA) followed by two sided t tests. A series of ANOVAs, single sided t tests, calculation of effect sizes (Cohen’s d) and repeated measurements MANOVAs (using the non-verbal MDI as a covariate) were administered to test for treatment effects. All hypotheses were directional, so the one tailed probability level was set at 0.05.

RESULTS
The results are presented in three sections below: (1) pretest, (2) post-test and (3) follow-up comparisons of the intervention group, waiting group, and reference language-normal group.

Pretest comparisons
The three groups differ significantly on all language scores and on general mental abilities (ANOVA, table 2). The intervention and waiting groups did not differ significantly on any of the demographic data (table 1) or on any language score (table 2). Language comprehension was age appropriate in both clinical groups. The language-normal group differ significantly from the intervention and waiting groups on all language scores (table 2) and on the variable family history of speech and language disorder (SLD) (χ² test, p<0.001).

Post-test comparisons
At post-test all three groups showed an improvement in parent reported language scores. The language-normal group scored significantly higher compared with the clinical groups on all language scores (table 3). Children in the intervention group demonstrated greater gains than children in the waiting group in parent reported vocabulary, morphology, syntax as well as in both production subtests of the SETK-2, with medium to very large effect sizes (table 3). Regarding mean t scores, both clinical groups showed improvement in the subtest word production. However, in the subtest sentence production, only the intervention group improved their mean t score (tables 2 and 3).

Follow-up comparisons
Between groups
Twelve months after pretesting all three groups showed a further increase in parent reported language scores. The language-normal group scored significantly higher compared with the clinical groups on all language scores. Significant group differences between the intervention and waiting groups were found for parent reported vocabulary and morphology as well as for the subtest Encoding Semantic Information (ESI) (table 3).

Figure 2 shows the means and the 95% confidence intervals for language production test scores at pretest, post-test and follow-up for the intervention and waiting groups. The two production subtests of the SETK-2 were combined at pretest and post-test. At follow-up the subtest Encoding Semantic Information (ESI) was used for analysis. A repeated measurements MANOVA (without the non-verbal MDI as covariate) showed a significant main effect for group (F(1, 97) = 8.23, p = 0.006) as well as a significant interaction between group and tests (F(2, 59) = 3.80, p = 0.026), but not a significant test effect (F(2, 59) = 2.26, p = 0.11) for language production at follow-up. For the subtest Plural Forming (PF), a group effect

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Table 2: Pretest comparisons on language and cognitive abilities

<table>
<thead>
<tr>
<th></th>
<th>Intervention group, n = 24</th>
<th>Waiting group, n = 23</th>
<th>LN group, n = 36</th>
<th>ANOVA</th>
<th>Comparison of intervention and waiting groups</th>
<th>Comparison of intervention and LN groups</th>
<th>Comparison of waiting and LN groups</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>Mean (SD)</td>
<td>F value</td>
<td>t Score</td>
<td>p Value</td>
<td>t Score</td>
</tr>
<tr>
<td>Age in months</td>
<td>25.0 (0.9)</td>
<td>25.0 (0.9)</td>
<td>25.0 (0.9)</td>
<td>1.3</td>
<td>0.277</td>
<td>0.001</td>
<td>0.9</td>
</tr>
<tr>
<td>Vocabulary</td>
<td>50.0 (7.9)</td>
<td>50.0 (7.9)</td>
<td>50.0 (7.9)</td>
<td>4.6</td>
<td>0.015</td>
<td>0.001</td>
<td>1.9</td>
</tr>
<tr>
<td>Sentences</td>
<td>37.2 (3.9)</td>
<td>37.2 (3.9)</td>
<td>37.2 (3.9)</td>
<td>113.9</td>
<td>0.001</td>
<td>0.001</td>
<td>16.6</td>
</tr>
</tbody>
</table>

Notes:
1. Raw score; *SETK-2, for description of this language test see Buschmann et al; t score normative means are 50 (SD 10). A standard score normative means are 100 (SD 15).
2. ANOVA over all three groups; **two sided t test adjusted for multiple testing using Bonferroni corrections.
needed individual therapy, so the expected cost was £15 652.

therapy for the six children. In the waiting group 13 children
the HPLI and the expected cost for additional individual directed
£13 704 for the whole intervention group, including the cost of
child. As six children in the intervention group needed
language ((1) p = 0.21; (2) p = 0.67).

up compared to children with persistent impaired expressive
exact test) or between children in the waiting group who caught
"caught up" in comparison to those who showed continuing
impairment (t score

no significant difference regarding gender (1) or maternal
school education (2) between intervention group children who
"caught up" in comparison to those who showed continuing
impaired expressive language ((1) p = 0.17, (2) p = 0.29, Fisher’s
exact test) or between children in the waiting group who caught
up compared to children with persistent impaired expressive
language ((1) p = 0.21; (2) p = 0.67).

Cost effectiveness
The HPLI costs £270 per child. In Germany the cost of one
individual directed therapy session is £28. Because individual
therapy for children with specific language impairment takes an
average of 43 sessions, the labour costs amount to £1204 per
child. As six children in the intervention group needed individual
directed therapy, the labour costs amounted to £15 704 for the whole intervention group, including the cost of
the HPLI and the expected cost for additional individual directed
therapy for the six children. In the waiting group 13 children
needed individual therapy, so the expected cost was £15 652.

DISCUSSION
In this RCT we examined the effectiveness of the HPLI in a
group of 2-year-old children with SELD. The results support
previous evidence that early parent based language intervention
is effective in the short term. During the 6- and 12-month
intervals, children in the intervention group made develop-
mental gains in vocabulary and grammatical abilities over and
above the maturational changes seen in the waiting group.
However, the most important result was that the percentage of
children who showed standardised scores within normal limits
in expressive language and therefore had caught up with their
peers at the age of 3, was 75% in the intervention group in
contrast to 44% in the waiting group. Thus, the percentage of
children who needed to start additional individual directed
language therapy was significantly lower in the intervention
group compared to the waiting group. These differences are
suggested to be the result of participating in a highly structured
and short parent based language intervention. These findings
support previous evidence that the interactive style of mothers
may be optimised to provide a superior language learning
environment and accelerate the language development of late-
talking toddlers.

Since the subjects showed only expressive language delay, the
results cannot be generalised to children with additional deficits
in receptive language or to children with concurrent cognitive
deficits. In addition, despite impressive improvement due to our
intervention, the expressive language abilities of the interven-
tion group remained significantly lower compared to the
language-normal group.

The importance of the HPLI as an effective prevention
programme is underscored by the fact that there is only little
evidence for the effectiveness of individual therapy implemen-
ted in preschool children. Compared to the established Hanen
Parent Programme (HPP), the HPLI offers a more structured
approach, takes a shorter time and is less expensive and time
consuming. It is carried out without home visits by a single
HPLI-trained therapist.

The results of our study have important clinical implications
for providing support for children with SELD. Currently, parent
report screening questionnaires such as the MacArthur
Communicative Development Inventories are seldom used in
German speaking countries to identify children with language
delay, even though they can be easily used in general paediatric
practice. One reason for their low acceptance could be that
currently there are no guidelines on how to most appropriately
provide support for children with language delay. While the
wait and see approach is widely used, it cannot be recom-
manded on the basis of our results for the following reasons.
First, the heterogeneity of children with language delay makes
further diagnostic work-up necessary. Second, the persistence
of language impairments in a substantial number of children
together with related educational, social-emotional and beha-
vioural problems clearly indicates the need for early language
intervention that helps children develop normal linguistic
functioning as quickly as possible. One possible approach is a
parent based intervention with the advantage that parents are
perceived to be competent partners in the facilitation of
language development. According to our results, the HPLI also
seems to be successful in families with low socio-economic
status.

The results of this RCT show that the HPLI is an effective
and cost saving approach in providing support for children with
SELD. Further follow-up investigations are necessary to
evaluate the long term effectiveness of the HPLI.
## Table 3  Post-test and follow-up comparisons on language abilities

<table>
<thead>
<tr>
<th></th>
<th>Intervention group, n = 24</th>
<th>Waiting group, n = 23</th>
<th>LN group, n = 36</th>
<th>ANOVA</th>
<th>Comparison of intervention and waiting group</th>
<th>Comparison of intervention and LN group</th>
<th>Comparison of waiting and LN group</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Post-test</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age in months</td>
<td>30.5 (0.9)</td>
<td>31.0 (1.0)</td>
<td>30.6 (0.6)</td>
<td></td>
<td>F(2,80) = 1.9</td>
<td>0.156</td>
<td>-1.5</td>
</tr>
<tr>
<td>ELFRA-2 (parent report)*</td>
<td>140.7 (57.3)</td>
<td>117 to 165</td>
<td>96.3 (64.0)</td>
<td></td>
<td>2.5</td>
<td>0.016</td>
<td>0.73</td>
</tr>
<tr>
<td>Syntax</td>
<td>22.9 (7.1)</td>
<td>20 to 26</td>
<td>13.5 (9.0)</td>
<td></td>
<td>4.0</td>
<td>&lt;0.001</td>
<td>1.0</td>
</tr>
<tr>
<td>Morphology</td>
<td>7.0 (4.2)</td>
<td>5 to 9</td>
<td>4.0 (4.1)</td>
<td></td>
<td>2.5</td>
<td>0.017</td>
<td>0.72</td>
</tr>
<tr>
<td>SETK-2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Word production</td>
<td>49.4 (10.2)</td>
<td>45 to 54</td>
<td>41.0 (12.4)</td>
<td></td>
<td>2.5</td>
<td>0.016</td>
<td>0.74</td>
</tr>
<tr>
<td>Sentence production</td>
<td>41.0 (5.3)</td>
<td>39 to 43</td>
<td>35.3 (5.8)</td>
<td></td>
<td>3.5</td>
<td>0.001</td>
<td>1.03</td>
</tr>
<tr>
<td><strong>Follow-up</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age in months</td>
<td>37.3 (1.3)</td>
<td>36 to 40</td>
<td>38.0 (1.7)</td>
<td></td>
<td>F(2,80) = 2.1</td>
<td>0.125</td>
<td>-1.6</td>
</tr>
<tr>
<td>ELFRA-2 (parent report)*</td>
<td>216.9 (36.9)</td>
<td>91 to 260</td>
<td>178.0 (65.6)</td>
<td></td>
<td>2.5</td>
<td>0.018</td>
<td>0.73</td>
</tr>
<tr>
<td>Syntax</td>
<td>43.3 (12.0)</td>
<td>21 to 59</td>
<td>34.4 (18.9)</td>
<td></td>
<td>1.9</td>
<td>0.062</td>
<td>0.67</td>
</tr>
<tr>
<td>Morphology</td>
<td>12.5 (3.3)</td>
<td>4 to 16</td>
<td>9.2 (5.7)</td>
<td></td>
<td>2.4</td>
<td>0.021</td>
<td>0.71</td>
</tr>
<tr>
<td>SETK 3–5†</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Encoding Semantic</td>
<td>51.6 (11.2)</td>
<td>32 to 81</td>
<td>43.9 (9.1)</td>
<td></td>
<td>2.6</td>
<td>0.013</td>
<td>0.75</td>
</tr>
<tr>
<td>Information, ESI</td>
<td>48.0 (9.3)</td>
<td>30 to 67</td>
<td>45.5 (10.0)</td>
<td></td>
<td>0.9</td>
<td>0.376</td>
<td>0.23</td>
</tr>
</tbody>
</table>

*Raw score; †t score normative means are 50 (SD 10); ‡95% confidence interval; ‡ANOVA over all three groups; †single sided t tests; **effect size, Cohen’s d.††

ELFRA-2, parent report screening questionnaire for early identification of children at risk; LN, language normal; SETK 3–5, [Developmental language test for 3- to 5-year-old children].
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Competing interests: None.

Ethics approval: This study was approved by the Ethics Committee of the University of Heidelberg.

We declare that we participated in the study entitled “Parent based language intervention for 2-year-old children with specific expressive language delay: a randomised controlled trial”, and that we have seen and approved the final version. We shared in designing and executing the study, analysing the results and writing the manuscript. It has been neither published nor submitted elsewhere.

REFERENCES