THE PHONOLOGICAL ABILITIES OF CHILDREN WITH LANGUAGE IMPAIRMENT: THE NATURE OF PHONOLOGICAL DISORDER AND EFFECTIVENESS OF INTERVENTION

A Thesis Submitted for the Degree of Doctor of Philosophy to the University of Aveiro

Marisa Lobo Lousada

Supervisor: Dr. Luís Miguel Teixeira de Jesus
Co-Supervisor: Dr. Victoria Liebe Joffe

Introduction

Aims

• To describe and compare the phonological abilities of 14 pre- or early school-aged children with speech and language impairment and 14 typically developing children.
• To compare the phonological abilities of two sub-groups of children with speech and language impairment: those with normal NVIQ and those with low NVIQ.
• To explore the effectiveness of two types of intervention (articulation and phonological) in a group of 14 children with speech and language impairment, through severity measures (e.g., PCC) and intelligibility.
• To analyse if NVIQ influences the response to treatment.

Background

Method

Results and Discussion

Conclusion
Study 1: There are few studies of phonological processes in European Portuguese (EP) children (Cambim, 2002; Castro et al., 1999; Guerreiro & Frota, 2010; Mendes et al., 2009), none of which analyse the phonological processes in speech and language impaired children.

Study 2:

- There is a need to assess and compare the effectiveness of interventions that SLTs report to use in their current practice, for example, articulation versus phonological therapy (Joffe & Pring, 2003, 2008).
- Articulation therapy, minimal pair approach and phonological awareness were three of the most commonly reported approaches found to be used in clinical practice (Joffe and Pring, 2003, 2008; Baker and McLeod, 2008), but more information is required about their effectiveness.
- There are no studies investigating the approaches commonly used by SLTs in clinical practice in Portugal.

Furthermore, information on the effectiveness of phonological and articulation therapy, and the role of phonological awareness in remediating speech sound disorder is unclear:

- Phonological awareness intervention was more effective on speech production than articulation therapy (Gillon 2000).
- In contrast, Hesketh et al. (2000) did NOT find differences in speech production (PCC score) between metaphonologically and articulation interventions.
- There are other studies comparing articulation vs. phonological treatment that found phonological therapy to be more effective than traditional articulation therapy (Klein, 1996; Pamplona et al. 1999; Teutsch and Fox, 2004).

Intervention studies focusing on children’s phonology have not used intelligibility as an outcome measure. Instead, studies provide speech severity indices, such as percentage of occurrence of phonological processes and PCC score (Pascoe, et al., 2006).
### Subjects

- **14 children with speech and language impairment**
  - Subjects selection criteria included:
    - An age between 3.6 to 6.7 years
    - European Portuguese (EP) as native language
    - Greater than 1.5 SD below the mean on a standardised language test (Kay and Tavares, 2007);
    - Audition of 20dB in the frequencies 500Hz, 1000Hz and 2000Hz;
    - An absence of social or emotional problems and obvious neurological damage;
    - An absence of problems in oral structure or oral function.
  - Non-verbal ability (NVIQ) – WPPSI-R scale (Wechsler, 2003):
    - All children showed a discrepancy, of at least 1 SD, between language skills and NVIQ with language being lower;
    - 6 children had non-verbal abilities within the average range (above 85) - specific language impairment (Leonard, 1998);
    - The remaining 8 had NVIQ ranging between 85 and 62

---

### Subjects

- **The control group**
  - 14 typically developing children, **individually matched** with the speech and language disordered children on chronological age (within 4 months) and on gender.
Pre-treatment assessment

- Single-words: TFF-ALPE (Mendes et al., 2009)
- Continuous speech: Picture description task and story recall task
  - The materials used in these tasks were previously tested in a pilot study.

Annotation

- The production of the 67 words of all children were annotated (4 levels) by the PhD student.
Reliability

- In addition to the phonetic transcriptions made by PhD student, the productions of 2 children randomly selected, were annotated and transcribed by 2 trained SLTs (SLT1 and SLT2) not involved in any other part of the study and blind to its aims.

- Point-to-point reliability
  - Between the PhD student and SLT1
    - Child with speech and language impairment
      - 90.3% (pre-treatment)
      - 93.7% (post-treatment)
  - Between PhD student and SLT 2
    - Typically developing child: 96.1%

These values are comparable to those reported in other studies in disordered child phonology (Shriberg & Lof, 1991; Shriberg, Tomblin, & McSweeny, 1999) and were considered adequate for the objectives of this study.

Intervention

- The children were randomly assigned to two treatment groups:
  - 7 children - Articulation Therapy (AT) (Van Riper and Emerick, 1984),
  - 7 children - Phonological Therapy (PT) that combined phonological awareness therapy (Gillon and McNeill, 2007) and listening and discrimination activities (Lancaster, 2008).

- 25 weekly sessions of 45 minutes divided in 3 blocks.
- Both groups were treated by the same SLT.
- One phonological rule or phoneme was chosen for each block according to:
  - The frequency of use of phonological processes (Hodson and Paden, 1991);
  - The effect on intelligibility;
  - Stimulability of speech sounds;
  - The sequence of normal development (Dodd and Bradford, 2000).
• Qualitative Assessment
  – A questionnaire was developed to evaluate the effectiveness of each intervention from the perspective of the children’s parents

• Post-treatment assessment
  – After 25 sessions, the children were assessed with the same materials by the PhD student.
  – The effectiveness of the two treatments was compared

• Outcome measures
  – Percent of consonants correct (PCC) score
  – Percentage of phonological processes (PPP)
  – Phonetic inventory
  – Generalisation probe
  – Intelligibility

• Intelligibility
  – Speakers: 14 children
  – Listeners: 21 unfamiliar listeners
  – **Single words:**
    • Each listener hears words of 2 children of *pre- and post-treatment assessments.*
    • Judges listened to the words once only and transcribed the words.
    • Analysis: The percentage of words correctly identified was calculated for each child and for each assessment moment.
  – **Continuous speech:**
    • Each listener hears samples of 2 children of *pre and post-treatment assessments.*
    • The listeners were asked to hear the samples and then to classify them using a rating scale.
    • Analysis: The classifications of speech intelligibility were obtained for each child and for each assessment moment.
  – The inter-rater reliability was analysed
Results and Discussion – Study 1

• The results showed severe difficulties in speech production of children with speech and language impairments, evident by a low PCC score and a higher percentage of occurrence of typical phonological processes.

• Children with speech and language impairment also used phonological processes that are considered unusual in normally developing children (atypical processes).

• Children with low NVIQ and children with normal NVIQ did not perform significantly different in their speech production.

Results and Discussion – Study 2

• PCC
  – Results showed significant differences in the PT group (p = 0.018) and in the AT group (p = 0.018) pre- to post-treatment.

  – A significant difference in PCC change scores between groups was found (p = 0.015), with the children receiving PT showing a more significant improvement than the AT group.

  *Both intervention approaches were effective.*

  *The phonological approach was found to be more effective than the articulation approach.*
Results and Discussion – Study 2

• Percentages of phonological processes (PPP) and phonetic inventory
  – PT group – A decrease in PPP after the intervention, especially in target phonological processes
  – AT group: the results showed that for 3 children one or two target sounds were added to the phonetic inventory after the therapy and other non-target sounds were also added. None of the target sounds was added for the remaining children.

• Generalisation probe
  – PT group: 71.4% of the children after block 1 and 57.1% of the children after blocks 2 and 3 made substantial and potentially long standing changes as they generalised to untreated words.
  – AT group: only 14.3% of the children after block 1 and 28.6% of the children after blocks 2 and 3 presented substantial levels of generalisation (> 50%).

Introduction
Background
Method
Results and Discussion
Conclusion

Results and Discussion – Study 2

• Parental opinion
  – Every parent reported that the intervention had contributed to their child’s improvement, and that the therapy helped them to better understand their children.

• Influence of NVIQ on response to treatment
  – The results did not show significant differences in response to treatment as a function of differences in NVIQ. However, we need to be cautious about this finding due to the small sample size in each group.
Results and Discussion – Study 2

• Intelligibility
  – Reliability analysis showed a high agreement between the listeners that listened to the same children.

  – Single words
    • A significant difference was shown in the PT group (paired t (6) = 4.409, p = 0.005) pre- to post-treatment. Results showed no significant difference in the AT group (paired t (6) = 1.763, p = 0.128).

  – Continuous speech
    • A significant difference was shown in the PT group (paired t (6) = 5.281, p = 0.002) pre- to post-treatment. Results also showed no significant difference in the AT group (paired t (6) = 1.918, p = 0.104).

Conclusions

• Study 1
  – Children with speech and language impairment showed severe difficulties in speech production when compared to typically developing children.
  – Children with low NVIQ and children with normal NVIQ did not perform significantly different in their speech production.

• Study 2
  – Articulation and phonological therapies are both effective in enhancing children’s speech production. However, the PT was found to be more effective than AT.
  – PT promotes a significant improvement in children’s intelligibility after the treatment. Results showed no significant difference in speech intelligibility in the AT group pre- to post-treatment.
  – The results obtained in this study did not show significant differences in response to treatment as a function of differences in NVIQ.
Limitations and future work

• Limitations
  – Some instruments (e.g., child case history form) were not validated in this work
  – Small sample
  – Lack of a control treatment group
  – The post-intervention tester was not blind to group membership

• Future work
  – Validate and distribute the activities (in EP) from the phonological awareness intervention (Gillon and McNeill, 2007) through ACSA website http://acsa.web.ua.pt
  – Distribute amongst SLTs the pictures created for the picture description task
  – Validation of the child case history form
  – Increase the sample
  – Distribute software scripts used to calculate automatically the PCC and the PPP based on SAMPA phonetic transcriptions

Publications resulting from this project

• Publications resulting from this project

• Oral presentations resulting from this project

• Registered (Trademark and Copyright) health assessment tool resulting from this project
Acknowledgments

• To my supervisors Dr. Luís Jesus and Dr. Victoria Joffe for their supervision, support and encouragement over these years.
• To FCT and DGES (PROTEC grant – Ref. SFRH/BD/49852/2009).
• To University of Aveiro (ERASMUS program – Ref. 3.64.92/7775).
• To IEETA for the space and for the funding to participate in the ASHA conference.
• To all the children who took part in this study.
• To my colleagues, friends and specially my family.