CHAPTER 5

RESULTS AND DISCUSSION

5.1 INTRODUCTION

Holistic assessments used to monitor the performance of the cochlear implant device itself, and the performance of the child with the device, provide important information for intervention and also highlights the importance of effective and efficient assessment protocols which are used within cochlear implant programmes.

The results are discussed whilst focusing on the main aim of the study, which is to determine the clinical relevance of the assessment protocol compiled by the Pretoria Cochlear Implant Programme. The results were addressed through the realisation of five sub-aims. The purpose of the first sub-aim was to establish what type of results are obtained from the different assessment areas within the protocol, to determine if over- or under-evaluation is occurring. The second sub-aim was to critically evaluate and describe the type of information gained from the proposed assessment protocol. The third sub-aim was to determine the duration for administering and interpreting the assessment protocol. The fourth sub-aim was to determine the cultural and language barriers affecting the administration and interpretation and the protocol, and the final sub-aim was to determine the overall value of the assessment protocol in an inclusive educational setting.

The purpose of this chapter is to present the results of this study according to the five sub-aims in order to address the main aim of the study. The results are presented and discussed by integrating the current body of knowledge, and extracting the significance of the results obtained. The results for each sub-aim will be presented, followed by an interpretation and discussion alongside current literature. In the final section of this chapter, recommended changes for the protocol and a summary of the results, as obtained from the administration of the assessment protocol in realisation of the main aim, will be supplied.

5.2 SUB-AIM ONE: EVALUATION OF THE DIFFERENT ASSESSMENT AREAS WITHIN THE ASSESSMENT PROTOCOL

The assessment results and various results obtained from the individual assessments included in the protocol were used to determine if over- or under evaluation is occurring.

Table 5.1 summarizes the areas assessed and individual assessments used.

Table 5.1 Areas assessed and individual assessments

Assessment Areas					
Auditory Abilities	**Language Abilities**	**Speech Abilities**	**General Development**	**Parent-Child Interaction**	**Questionnaires**
• Aided audiogram (125-8000Hz) • Speech discrimination • Speech in noise • Tympanometry • Checklist: Developmental Assessment Schema (DAS) (Auditory communication)	• Checklist: DAS (Expressive and receptive language) • Checklist: Rossetti Infant-Toddler Language Scale (receptive and expressive language) • Checklist: Profile of Actual Linguistic Skills (PALS) • Standardised test: Reynell Developmental Language Scales III Verbal comprehension	• Checklist: Speech Intelligibility Rating (SIR) • Checklist: Voice Skills Assessment (VSA) • Checklist: Profile of Actual Linguistic Skills (PALS)	• Checklist: DAS (gross and fine motor, personal-social, self help and perceptual-cognitive) • Checklist: Rossetti-Infant-Toddler Scale (gross and fine motor, play and gestures) • Checklist: Preschool literacy assessment	• Checklist: Mother Infant Communi-cation Screening (MICS) (video analysis) • Checklist: Caregiver-Child Interaction (video analysis)	• Background information (parents) • Meaningful Auditory Integration Scale (MAIS) (parents and teachers) • Meaningful Use of Speech (MUSS) (parents and teachers)

From the above table it is clear that all the vital areas of assessment are covered in the proposed assessment protocol, as discussed in detail in chapter 1. Literature regarding assessment in children with cochlear implants suggests that the following areas are essential and should be included in all assessment protocols: general development, parent-child interaction, general socialization, emerging literacy skills, auditory ability (including pure-tone audiometry, listening skills, auditory attention span and memory, phonological awareness, speech perception and speech discrimination), language skills (including receptive and expressive skills), speech production (including speech repertoire, intelligibility and voice use), and everyday communication skills (Mahshie, 2006:82; Dyar, 2003).

The Pretoria cochlear implant assessment protocol included the DAS (General Development) and Rossetti Infant-Toddler Language Scale in order to assess general development. These checklists were appropriate to obtain a general overview of subjects' development as personal-social, perceptual-cognitive, self-help, fine motor, gross motor, expressive language, receptive language, play and use of gesture development are included (Anderson, Nelson & Fowler, 1978; Rossetti, 1990). Literacy skills were assessed by completing the Preschool Literacy Assessment (Edmiaston, 1988).

Contextual factors play an important role in communication development and therefore should be considered in any assessment. Factors such as joint activity routines, communication of needs and opportunities for choice making and protesting should be considered. These factors are often predictable and repetitive activities requiring active involvement, reciprocal and exchangeable roles, a mutual focus of attention, turn-taking, and communicative exchange focused on a common theme or goal. Joint activity routines allow young children to participate and communicate actively, with the necessary situational and interactive support allowing for the greatest amount of participation. Children also have needs to communicate, as well as to reject, protest or make decisions in socially acceptable ways. It is from these experiences that children learn to communicate for a wide variety of communicative functions. Therefore, for successful communicative interactions and language growth, characteristics of parent-child interaction should be documented in all assessments to help determine whether any environmental adaptations should be made as part of the intervention programme (Prizant & Wetherby, 1995:163). Parent-child interaction was assessed by completing the Mother-Infant Communication Screening (MICS)

(Raack, 1989) and the Caregiver-Child Interaction (Louw & Kritzinger, 2000). Parent-child interaction is an important aspect, as optimal interaction between parents and their children is most favourable for aural habilitation and the continuation thereof at home (Venter, 2000:90). Information regarding everyday communication skills was also obtained by way of parent-child interaction video analysis, and while observing the subjects in the classroom. Children feel most comfortable in situations known to them and while they are among familiar people. Therefore, emphasis was placed on a naturalistic setting. Observation included sampling of various developmental behaviours, and recording of these behaviours (Zsilavecz & Naude, 2000:23).

Auditory ability was thoroughly assessed and is considered an important aspect in the proposed assessment protocol. It is crucial to evaluate the extent to which a child can receive auditory information from the environment. The auditory information will indicate what type of sounds or words the child is aware of and what sounds or words can be discriminated or identified. This information also provides an indication of the stage of auditory development, which is essential for intervention planning and auditory training (Mahshie, et.al, 2006:128). An aided audiogram, speech discrimination results, Speech in Noise Test and tympanometry was included in order to determine if optimal device functioning was present and to monitor listening development (Lutman et.al, 1996:39-42). The Developmental Assessment Schema (Auditory Communication) was completed to obtain an in-depth view of the subject's listening skills, once it was confirmed that the subjects have optimal hearing levels (Allum, 1996:39). It is believed that parents and teachers know the children best, and for this reason the Meaningful Auditory Integration Scale (MAIS) was included in the protocol in order to obtain information regarding the subjects' use and reliance on the implant in natural environments, such as their homes and schools. MAIS also allowed for the subjects' listening progress to be documented (Venter, 2000:90; Lutman et.al, 1996:48).

Language skills were assessed by completing the DAS (General Development) and Rossetti-Infant-Toddler Language Scale checklists as they contain expressive and receptive language sub-sections. The Reynell Developmental Language Scales III (Verbal Comprehension) was included as a standardised or formal measure to obtain a score for receptive language, whereby future re-assessments can easily be compared in order to monitor progress. The Profile of Actual Linguistic Skills (PALS) provided a broad description of language development given by the Classification of Linguistic Performance (Dyar, 2003). The PALS examined the linguistic competence of the subjects at five interrelated levels, namely communication, receptive language, expressive language, and voice and speech ratings. These five levels were combined to give an overall classification into one of three language categories: preverbal, transitional and functional language (Lutman et.al, 1996:41).

In both the Speech Intelligibility Rating (SIR) and Voice Skills Assessment (VSA) checklists are included to assess speech and voice skills and to document the intelligibility of emerging speech and voice skills (Lutman et.al, 1996:46). The Meaningful Use of Speech (MUSS) was completed by the parents and teachers to obtain an overview of the subjects' use of speech at home and at school (Venter, 2000:90).

Overlapping occurs with the DAS (General Development) and Rossetti-Infant Toddler Language Scale, as similar areas are assessed. Valuable information is obtained from the DAS and Rossetti Infant-Toddler Language Scale. The problem is that these tests are designed for children up to the age of 60 and 36 months respectively and the subjects in this study were all between four (48 months) and seven years (94 months). The result is that the age levels obtained are beyond 60 or 36 months in some developmental areas such as gross motor skills, self-help skills, personal-social skills, play and use of gesture development; rather than obtaining the exact age level at which the subjects are functioning.

During the assessment of parent-child interaction, overlapping occurs as the MICS and Caregiver Child Interaction was completed after the video analysis. The Caregiver Child Interaction was appropriate for the age group included in the study, but the MICS is designed for infants, and the subjects used in this study were above the age of four years. The areas assessed in the MICS are Language and Synchrony, Distress, Feeding, Play/Neutral State and Rest. These areas are important when assessing parent-infant interaction (Rossetti, 1990:46), but the MICS does contain many areas of assessment (e.g. rest and feeding) that may not be appropriate for toddlers.

Although the DAS (General Development) and Rossetti-Infant Toddler Language Scale include receptive and expressive language as areas of assessment, the Reynell is a standardised measure for verbal comprehension, and serves as a crosscheck for the informal measures (i.e. checklists) used. The PALS checklist had many purposes. It substantiated the findings from the speech and language assessments and recorded samples, serving as a crosscheck. In the context of the overall intervention programme, the PALS monitors' progress towards functional spoken language, which is expected in most cochlear implant recipients (Lutman, et.al, 1996:41).

The crosscheck implies that one test result confirms another test result. This principle clearly states that clinicians need verification with a battery of tests before the information obtained can be seen as accurate (Turner, 2003:269; Herzfeld, 2000:1). No further overlapping occurs as the other areas included in the protocol cover the previously mentioned vital areas of assessment. As a vast amount of informal measures such as observation and completion of checklists are included in the protocol, and part of the assessment occurs in a natural setting (i.e. school), ample opportunity is provided to enforce the crosscheck principle.

Therefore, although some overlapping occurs in the protocol, it should not always be seen as over-evaluation, but rather to ensure that accurate information is obtained from the assessment and that the crosscheck principle is being applied. As all the vital areas of assessment are covered in the protocol, under-evaluation is not a concern.

5.3 SUB-AIM TWO: EVALUATION OF THE TYPE OF INFORMATION GAINED FROM THE ASSESSMENT PROTOCOL

The assessment results obtained for each child on all the procedures included in the protocol were used to critically evaluate and describe the type of information gained from the proposed assessment protocol.

Table 5.2 summarizes the type of information gained from the assessment areas within the protocol.

Table 5.2 Type of information gained from the assessment areas within the protocol

	Background Information	Audiograms	Developmental Assessment Schema (DAS) - Auditory Communication	Meaning Auditory Integration Scale (MAIS)	Meaningful Use of Speech Scale (MUSS)	Reynell Developmental Language Scale III
Type of information gained	• First language • Culture group • Age hearing loss diagnosed • Cause of hearing loss • Age hearing aid fitting • Age cochlear Implant received • Cochlear implant experience	• Hearing thresholds (125 – 8000 Hz) • Speech discrimination • Speech in Noise Test • Otoscopy • Tympanometry	• Awareness of sound • Sound has meaning • Auditory feedback • Discrimination skills • Localization skills • Distance and directional listening • Adding background noise • Auditory memory and sequencing (long-term and short-term)	• Reliance on auditory input • Auditory input as alerting function • Auditory input adds meaning	• Voice control • Speech sounds • Communication strategy	• Standardised assessment of verbal comprehension

	Parent-Child Interaction	Developmental Assessment Schema	Rossetti-Infant Toddler Language Scale	Preschool Literacy Assessment	Speech Intelligibility Rating (SIR)	Profile of Actual Linguistic Skills (PALS)
Type of information gained	• Appropriate tactile stimulation • Pleasure during interaction • Responds to distress • Eye contact • Smiles contingently • Varies prosodic features • Encourages conversation • Responds contingently to behaviour • Modifies interaction • Uses communi-cation to teach language	• Personal-social development • Perceptual-cognitive development • Self-help development • Fine motor development • Gross motor development • Expressive speech • Receptive speech	• Interaction attachment • Pragmatics • Gesture • Play • Language comprehension • Language expression	• Situation-Dependant print • Book handling skills • Retelling of familiar stories • Productions of children's written language	• Speech intelligibility on a scale of 1 to 6 **Voice Skills Assessment (VSA)** • Voice attributes	• Communication • Language Expression • Language Reception • Voice • Speech

As previously mentioned, all the vital areas of assessment are included in the proposed protocol, compared to assessment areas used at other cochlear implant programmes across the world (Dyar, 2003; Lutman, et.al, 1996:38-49).

The background information questionnaire provided information regarding the subjects' first language, culture group, age at which their hearing loss was identified, cause of hearing loss, age at which hearing aids were fitted and age at which they received a cochlear implant and their cochlear implant experience. Information concerning the subject's family set-up, educational setting and communication mode was also obtained. All these factors contribute to the success of cochlear implantation, future rehabilitation and possible prognostic predictions regarding the child's intervention and long-term goals (Shapiro & Waltzman, 1998:58).

The audiograms provided valuable information regarding the subject's auditory abilities. Pure tone thresholds were obtained from 125 – 8000 Hz during aided (i.e. with cochlear implant and contralateral hearing aid) conditions. The subjects responded to the tones proving that they benefit from the cochlear implantation. These pure tone results indicate how much the subjects benefit from the implant, as well as if the implant is working as it should (Lutman et.al, 1996:39-42). Richter et.al, (2002:119) demonstrated that improvement in functional gain after approximately two years of cochlear implant experience was statistically significant, corroborating preceding literature (Snik, Vermeulen, Geelen, Brokx & Van den Broek, 1997:38; Van den Borne, Snik, Hoekstra, Vermeulen, Van den Broek & Brokx, 1998:460), that a functional gain of 40 dB in the 0.25-4 kHz range is obtained – which was significantly better compared to hearing aid benefit (especially high-frequency information) before implantation.

Results, which only contain pure tone information, do not provide an indication of how a person functions in daily life. Hearing is mostly used to listen to speech, rather than to other sounds (Scott, 2002:10-26). Therefore, speech discrimination testing was included in the protocol, even though the subjects have little spoken language abilities. The subjects were able to respond verbally or point to the corresponding toy, which clearly indicates and quantifies their benefit from the cochlear implantation. Assessment of speech perception in the paediatric population is therefore important to help determine whether a child is benefiting from a cochlear implant and secondly, follow-up assessments help track performance over time. Lastly, speech perception data in combination with speech and language outcomes are essential for establishing guidelines for habilitation. Research conducted at the Nottingham Cochlear Implant Programme indicated that the proportion of young children who can successfully complete the speech discrimination assessment ranges from 20% one year after implantation to 83% three years post-implantation. Furthermore, the thresholds achieved improved over a period of three years from approximately 60 to 55 dB on average, indicating an increasing ability to utilize speech cues. It was also demonstrated that speech discrimination can be performed earlier, and thresholds decrease further and faster in children who have an established spoken language base before implantation (Lutman et.al, 1996:43).

Similarly, a study conducted in Melbourne and Sydney used speech discrimination results from one hundred children and adolescents who were categorized based on the level of ability they demonstrated in formal assessments (Dowell & Cowan, 1997:208). Their results indicated that approximately 60% of the children in the group achieved significant open-set speech recognition, and approximately 30% of the group recognized over half of the phonemes in an open-set monosyllabic word test. For these children it was reasonable to conclude that they are capable of using audition alone for interactive communication (Dowell & Cowan, 1997:208). Various research regarding speech perception concludes that children with cochlear implants reach open-set speech perception after an average of two years of implant experience. Furthermore, O'Donoghue, et.al, (2000:467) report a positive influence of cochlear implantation on speech perception. Clear improvement and statistically significant differences were shown in pre- and post-operative comparisons (Richter et.al, 2002:119).

Mondain et.al, (2002:94) demonstrated how speech perception scores improve as cochlear implant experience increases. The mean scores for open-set speech perception were 21.4% before implantation, 21.3% one month post-implantation, and then steadily increased to 53.2% after three months of cochlear implant use, 57.9% after six months of cochlear implant use, 62.1% after nine months of cochlear implant use and 83.6% after twelve months of cochlear implant use. The entire test group obtained speech recognition scores greater than 60% after twelve months of cochlear implant use. Likewise, research by Calmels et.al, (2003:4) resulted in mean scores for open-set speech perception at 8.77% three months post-implant, 16.54% twelve months post-implant, 34.33% two years post-implant, 58.56% three years post-implant, 68.42%

four years post-implant and 76.3% five years after implantation. The improvement of the performances three months and one year post-implant was not significant, but there was a significant improvement in speech perception ability between one and five years after implantation. Closed-set speech perception improved significantly between three months and one year and between one year and five years post-implantation.

The Speech in Noise Test was included to emulate a noisy classroom situation in order to determine how the subjects function in the classroom setup or noisy situations at home (Eisenberg, et.al, 2005:1). The Speech in Noise Test results also provides the clinician with information regarding the recommended use of an F.M. system within the classroom. The subjects were able to respond verbally or point to the corresponding toy, which clearly indicates and quantifies their benefit from the cochlear implantation. A preliminary study conducted by Dowell & Cowan, (1997) evaluated the speech perception of open-set words in background noise for four children. The children were assessed over a six-month period using repeated assessments. During the six-month period, each child received weekly habilitation sessions, which included perceptual training in background noise. Results showed post-training scores on open-set words to be significantly higher than pre-training scores, when testing was completed in background noise. No significant increase was evident in quiet environments, despite the training received by each child (Clark et.al, 1997:214).

Tympanometry was included in order to measure middle ear function and possible otitis media. Otitis media can result in temporary threshold shifts, and should be treated as soon as possible. A decline in thresholds can be detrimental to a cochlear implant user for learning language, as hearing abilities are temporarily not optimal. Hearing levels usually return to the optimal levels once the infection has been treated (Martin & Clark, 2000:258). Children also often complain that they are having difficulty hearing or they exhibit odd behaviours, which may mean that their MAP's need to be re-adjusted (Mertes & Chinnici, 2005:8).

The DAS (Auditory Communication) completed by the researcher during observation at school, interviews with the teachers and during video analysis provided an indication of the subjects' listening abilities and progress in the home and school environment. The categories included in the checklist include: awareness of sound, sound has meaning, auditory feedback, discrimination skills, localization skills, distance and directional listening, adding background noise and auditory memory and sequencing (short-term and long-term). Although aided sound field audiometry provides a measure of sensitivity (the ability to detect an auditory signal through the implant), there is also a need to measure the child's developing ability to listen and interpret the signal. Following implantation, the child should be able to respond to auditory stimuli within the familiar, repetitive settings that are found to promote linguistic skills (Lutman et.al, 1996:44). Furthermore, video analysis in the early stages of auditory communication assessment is a sensitive measure, which can monitor changes over short time frames, months rather than years. Video analysis has proven to be repeatable and been found to predict to a significant extent the later developments of speech perception in children with limited verbal abilities (Nikolopoulos, Archbold & Gregory, 2004:4; Tait, Lutman & Nikolopoulos, 2001:8).

It is of the utmost importance to receive input from the teachers and parents during an assessment, as they know the children best, and are able to provide information regarding how the subjects behave in their natural environments at home and school. A better understanding of the child within his/her environment must be attained. These aspects emphasize that a child may react differently in a "test situation" as the child is under pressure, and there is always the underlying urge to get the test done in as short a period of time as possible. These influences will eventually affect the end product and final findings (Shipley & McAfee, 1998:191). Therefore the MAIS and MUSS questionnaires were included in order to determine the subjects' use of speech and audition in their natural environments. Research conducted at the Nottingham Cochlear Implant Programme on thirty-six children, using the MAIS, showed a difference between parents' and teachers' scores. Lower scores were given by teachers, which probably illustrates the greater length of time taken to attach meaning to sound in the noisier environment of the classroom than at home (Lutman et.al, 1996:48). Additionally, in the early days after implantation, the MAIS may provide evidence of the use of the device when other signs of device failure are few. Parents and teachers can be encouraged to consider the way in which the child is using the cochlear implant in everyday life, and to be observant of changing behaviours. Its use may provide parents and professionals with early signs of the child not adapting to the use of the system. Similarly, the use of the MAIS over the long-term may highlight a child who is becoming an intermittent user (Nikolopoulos, et.al, 2004:9). Moreover, the aim of the MAIS and MUSS assessments is to ensure that parents' and teachers' scores are similar and these questionnaires enhance the reliability of the assessments. It is often found that parents want their children to progress well and there observations are sometimes different to those of the teachers. This can provide valuable guidelines for parent guidance concerning realistic progress expectations for their children. Mondain et.al, (2002:94) documented improvement in MAIS and MUSS scores after nine months of cochlear implant use. Seven cochlear implant users aged between four and twelve years were included in the study. The average MAIS test score was 18.1/40 before implantation and 35.1/40 after implantation. The average MUSS test score was 24.4/40 before implantation and 34.1/40 after nine months of cochlear implant use. The improvement illustrates the children's increasing ability to utilize auditory information in everyday situations.

The Reynell Developmental Language Scales III (Verbal Comprehension) was included in the protocol as a standardised measure of verbal comprehension, although informal assessment methods have become more popular for the assessment of young children (Shipley & McAfee, 1998:184). The assessment follows the development of verbal comprehension from the earliest stage of selective recognition of certain word patterns on an affective level, through gradually increasing complexity of interpretation of different parts of speech, to the stage where verbal interpretation extends to situations beyond the here and now and language becomes a true vehicle of thought. After this point, verbal comprehension becomes linked to increasingly complex processes, and to increasing vocabulary knowledge, which in turn, merges into other intellectual processes to the extent that it can no longer be assessed as a relatively separate function. The Reynell scales attempt to follow this developmental process of verbal comprehension without too much complex vocabulary used, so that the Reynell Scales test word knowledge without excessively increasing the sentence length. Furthermore, the Reynell scales can be applied to children on a developmental age level of approximately two to seven years (Edwards, et.al, 1997; Reynell, 1977:15). Therefore, this test, although standardised seems to be an appropriate measure to include in the protocol in order to be able to measure progress over time. The Reynell Developmental Language Scales III (Verbal Comprehension) could be applied to the subjects in this research study. No additional adaptations were made during the administration of the assessment. The procedures for administration were followed according to the Reynell Developmental Language Scales III resource manual. However, if the subjects struggled severely, the Verbal Comprehension B section was used, as it is less complicated than the Verbal Comprehension A. Visual cues such as lip-reading were permitted and FM systems were used during the assessment. Richter, et.al, (2002:111) evaluated the expressive and receptive language skills of 106 children with at least 2-years cochlear implant experience using the Reynell Developmental Language Scales III. Results indicated that better speech development was present in the children who were implanted at a younger age, compared to children that were implanted at a later stage. Stallings, Gao & Svirsky (2000:232) found that studies of language development in paediatric cochlear implant users could be conducted successfully using the Reynell Developmental Language Scales III in combination with other language assessments. Previous research regarding the administration of the Reynell Developmental Language Scales III (Verbal Comprehension) demonstrated a significant effect of length of device use and a significant correlation between age of implantation and length of device use on the development of receptive language abilities. The rate of growth in the receptive language scores was significantly faster for the children implanted before the age of two years, than for the children implanted at a later age (Kirk, Miyamoto, Ying, Perdew & Zuganelis, 2000:140). This suggests that children implanted prior to the age of two years are closing the gap between the receptive language age and the chronological age at a faster rate than the children implanted after the age of two years. In fact, children implanted at the age of five years or after, show very small increase in their receptive language scores over time. This does not mean that their receptive language abilities were not improving longitudinally, but rather suggests that the gap between their language age and their chronological age remained constant over time (Kirk et. al, 2000:140). Similarly, Vermeulen, Hoekstra & Van den Broek, (1999:156) demonstrated after the administration of the Reynell Developmental Language Scales III (Verbal Comprehension), that although the rate of receptive language acquisition during implant use increased, the language retardation also increased, but not at the same rate as in the period before implantation.

The parent-child interaction checklist completed by the researcher during video analysis provided the following information: appropriate tactile stimulation, pleasure during interaction, response to distress, eye contact, varying prosodic features, encourages conversation, response to behaviour, modifies interaction and use of communication to teach language. This information is valuable as it can be used during parent guidance sessions in order to optimize parent-child interaction and consequently ensure ideal conditions for speech, language and auditory learning

(Venter, 2000:90). Video recorded samples allow for repeated viewing of the parent-child interaction for analysis and provide a more complete picture of the child's communication abilities (Dowell & Cowan, et.al, 1997:218).

It is important to look at a child holistically during an assessment, and assess all possible areas (Umansky & Hooper, 1998:341). Therefore, the DAS (General Development) and Rossetti Infant-Toddler Language Scale were completed by the researcher during observation of the child in classroom and play activities and during teacher interviews, to obtain an overview of the subjects' general development. The DAS (General Development) provided information regarding personal-social, perceptual cognitive, self-help, fine motor, gross motor, expressive speech and receptive speech development. The Rossetti Infant-Toddler Language Scale provided information about interaction attachment, pragmatics, and the use of gestures; play development, language comprehension and language expression. Using checklists such as these allows for easy administration as the checklists can be completed while observing the subjects in their natural environments (Shipley & McAfee, 1998:184; Gerald & Carson, 1990:61).

The Preschool Literacy Assessment provided information regarding the subjects' literacy abilities. Situation-dependant print, book handling skills, retelling of familiar stories and productions of children's written language are the areas included in the checklist (Edmiaston, 1988). This information was valuable, as the subjects' literacy skills could be compared to their hearing peers in the classroom while applying the principle of holistic assessment.

The SIR scale provided information regarding the subjects' speech intelligibility. Research conducted at the Nottingham Cochlear Implant Programme revealed that 91% of their test group had predominantly unintelligible speech to inexperienced listeners, when speech was not accompanied by gestures or contextual cues before implantation. Twelve months after implantation, 25% were at least intelligible to a listener who concentrates and lip reads. After two years of implant experience approximately 60% of the children had reached the level where they were using speech effectively as the primary means of everyday communication. The percentage had reached 91% by the three-year interval. Based on these results, it can be predicted that up to 90% of children implanted at the preschool stage will produce intelligible speech within five years of implantation (Lutman, et.al, 1996:47). Similarly, Calmels et.al, (2003:4) found that there was a significant improvement in speech intelligibility between three months and five years post-implant. After three years of cochlear implant use, more than half (71%) of the children had intelligible speech, and after five years of implant use, approximately 80% of the children achieved a maximum SIR score. The SIR has been found to be a practical clinical measure, which can be readily applied to cochlear implant users over time, irrespective of the child's age and speech abilities; and SIR has also been proven reliable between observers. Moreover, parents and non-professionals easily understand the overall pattern of development produced, and this in turn fosters realistic expectations (Nikolopoulos, et.al, 2004:10).

On the other hand, the VSA provided information regarding the subjects' voice use and voice skills (Lutman et.al, 1996:46), and looks at a range of prosodic or voice features as used by the implanted children in everyday settings, in order to highlight specific strengths and difficulties (Dyar, 1994:257). Perrin, Berger-Vachon, Topouzkhanian, Truy & Morgon, (1999:186) demonstrated that cochlear implantation tends to normalize voice aspects.

The PALS provided a broad description of language development and served as a crosscheck for the other speech and language assessments included in the protocol (Dyar, 1995). Assessment of communication, receptive language, expressive language, and voice and speech ratings provides professionals with an indication of the children's stage of linguistic development. The PALS was also used as a tool for subject selection in order to select subjects in the transitional stage of development (Lutman et.al, 1996:41). Research indicates that the PALS has been found to be a sensitive means of "profiling" changes in the spontaneous communication or linguistic skills of profoundly hearing-impaired children who have limited verbal abilities. The developmental approach of the PALS makes it an appropriate pre-cursor to norm-referenced language performance measures. It can provide global data on the linguistic status of children and identifies "gaps", which enables the clinician to plan immediate communication priorities and goals for the hearing impaired child (Nikolopoulos, et.al, 2004:6).

Therefore, it is clear that the assessment protocol can be successfully applied to children with cochlear implants in the transitional stage of linguistic development. The subjects were able to participate in all the areas of the protocol. Furthermore, the children's linguistic needs, as well as additional support needed, can be identified, and appropriate individualised intervention goals can be developed.

5.4 SUB-AIM THREE: EVALUATING THE DURATION FOR ADMINSTERING AND INTERPRETING THE ASSESSMENT PROTOCOL

The duration for administering and interpreting the assessment protocol was used to determine if the protocol is time-efficient in a clinical situation at the Pretoria Cochlear Implant Programme in particular.

Figure 5.1 describes the duration for the assessment areas included in the protocol.

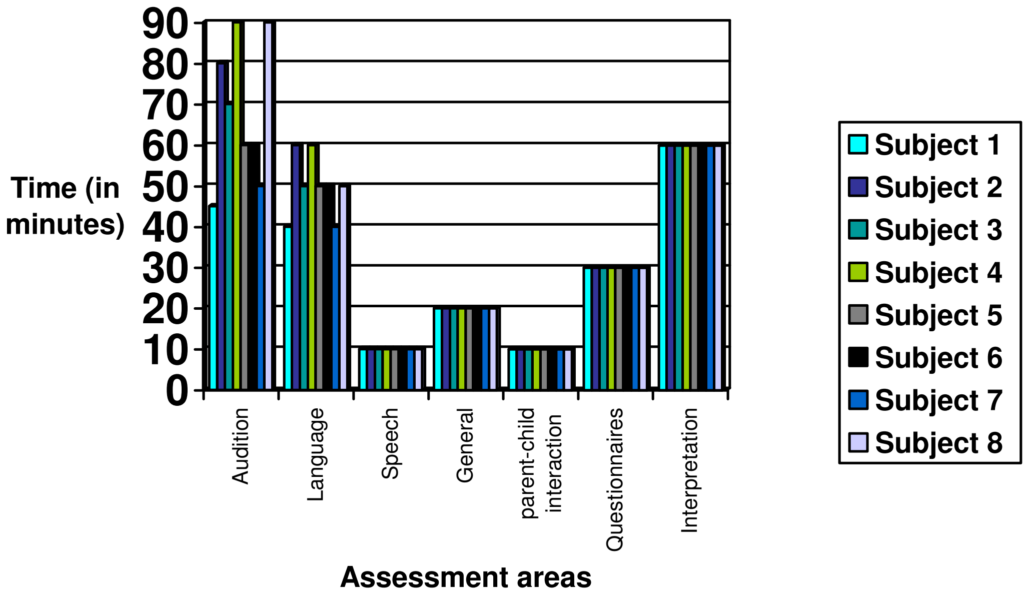

Figure 5.1 Duration (in minutes) for assessment

The duration (in minutes) for the auditory assessment took 45 minutes for subject 1, 80 minutes for subject 2, 70 minutes for subject 3, 90 minutes for subjects' 4 and 8, 60 minutes for subjects' 5 and 6, and 50 minutes for subject 7. The language assessment took 40 minutes for subject 1 and 7, 60 minutes for subjects 2 and 4, and 50 minutes for subjects' 3, 5, 6 and 8. The duration of the speech assessment took 10 minutes per subject for all eight subjects. The general development assessment took 20 minutes per subject for all eight subjects. The parent-child interaction video-analysis took 10 minutes per subject for all eight subjects. The questionnaires were completed while interviewing the teachers and parents, which took 30 minutes per subject for all eight subjects. The interpretation of the entire assessment protocol took 60 minutes per subject for all eight subjects.

From the above it is clear that the assessment of audition is the most time-consuming, followed by the interpretation of the protocol. The language assessment also takes a long time to administer, followed by the completion of questionnaires and assessment of general development. The speech assessment and parent-child interaction took the shortest time to administer.

For the administration of the entire protocol, subject 1 took 155 minutes (2.6 hours), subjects' 2 and 8 took 210 minutes (3.5 hours), subject 3 took 190 minutes (3.2 hours), subject 4 took 220 minutes (3.7 hours), subjects' 5 and 6 took 180 minutes (3 hours) and subject 7 took 160 minutes (2.7 hours).

Figure 5.2 describes the total duration taken for each subject.

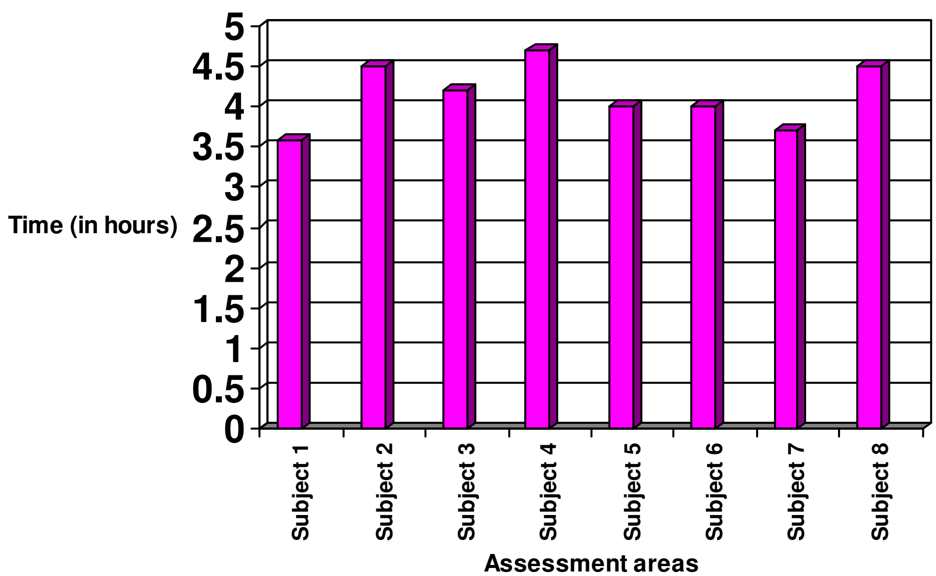

Figure 5.2 Total duration

Therefore, for the administration and interpretation of the assessment protocol, subject 1 took 215 minutes (3.58 hours), subject 2 and 8 took 270 minutes (4.5 hours), subject 3 took 250 minutes (4.2 hours), subject 4 for took 280 minutes (4.7 hours), subject 5 and 6 took 240 minutes (4 hours) and subject 7 took 220 minutes (3.7 hours).

Table 5.3 describes the average duration (in minutes) for each assessment area and for each subject.

Table 5.3 Total and average duration (in minutes) taken for each subject and assessment area

Subject Number	Audition	Language	Speech	General Development	Parent-child Interaction	Questionnaires	Interpretation	Total Duration
1	45	40	10	20	10	30	60	215
2	80	60	10	20	10	30	60	270
3	70	50	10	20	10	30	60	250
4	90	60	10	20	10	30	60	280
5	60	50	10	20	10	30	60	240
6	60	50	10	20	10	30	60	240
7	50	40	10	20	10	30	60	220
8	90	50	10	20	10	30	60	270
Average Duration	68	50	10	20	10	30	60	248 (4.1 hours)

The average duration for the assessment areas was: 68 minutes for audition, 50 minutes for language, and 10 minutes for speech, 20 minutes for general development, 10 minutes for parent-child interaction, and 30 minutes for the completion of questionnaires and 60 minutes for interpretation of the entire protocol. Therefore, the average duration for administering the protocol was 186 minutes (3.1 hours) per subject and for interpreting the results was 60 minutes (1 hour) per subject. The average total duration per subject was 248 minutes (4.1 hours).

Limited research exists regarding how long it should take for an audiological and speech and language assessment in the paediatric cochlear implant population. The duration for administering and interpreting an assessment protocol in young children with cochlear implants is individual to each programme, and depends on their patient load, staff structure and other responsibilities within the cochlear implant programme. It must be taken into account that this was the first time the protocol was administered on the subjects, and therefore it took approximately 3 hours per subject. It is expected that when the protocol is administered on a second or third occasion, the duration time will decrease as the children will feel more comfortable with the test situation and know what is expected of them. The teachers and parents will know what type of information is expected from them, making the assessment of the children and interviews with the parents and teachers an easier and quicker task. Certain areas e.g. motor development, self-help skills, play and use of gesture development, may not be necessary to include in the second or third assessment if the previous assessment indicated that their abilities are on an appropriate age level. This would also result in the duration for the administration of the assessment protocol to decrease significantly. Repeated interpretation of the same assessment protocol will also result in the clinicians being able to interpret the information in a faster and more efficient manner.

Therefore, the administration of this protocol seems time efficient and appropriate for the Pretoria Cochlear Implant Programme, as it is expected that the duration for the administration and interpretation of the protocol will decrease at each re-assessment session.

5.5 SUB-AIM FOUR: EVALUATING THE CULTURAL AND LANGUAGE BARRIERS AFFECTING THE ADMINISTRATION AND INTERPRETATION OF THE ASSESSMENT PROTOCOL

The results obtained from the assessments included in the proposed protocol was used in order to determine if there are any cultural or linguistic barriers affecting the administration and interpretation of the protocol.

5.5.1 Background Information Questionnaire

Table 5.4 describes the background information obtained from all the subjects.

Table 5.4 Background information

Subject Number	First Language	Culture group	Chronological age	Months Experience with Cochlear Implant
1	English	Asian	7 years, 4 months	31
2	Sotho	Black	5 years, 5 months	16
3	Afrikaans	White	5 years, 0 months	21
4	English	White	5 years, 5 months	10
5	Afrikaans	White	5 years, 7 months	33
6	Afrikaans	White	4 years, 3 months	4
7	English	Asian	7 years, 3 months	45
8	Afrikaans	White	7 years, 3 months	24

The background questionnaire indicated that there were 2 Asian subjects, 1 Black subject and 5 White subjects involved in the study. The Asian subject's first language was English, the Black subject's first language was Sotho, three of the White subject's first language was Afrikaans, and the other two White subject's first language was English. In the Asian group, the one subject had 31-months cochlear implant experience, and the second Asian subject had 45-months cochlear implant experience. The Black subject had 16-months of implant use, and out of the five White subjects, they had 21-, 10-, 33-, 4- and 24-months of cochlear implant experience at the time of the study.

5.5.2 Hearing assessment

Table 5.5, 5.6 and Figure 5.3 describes the pure tone thresholds and speech discrimination results obtained for each subject.

Table 5.5 Pure tone thresholds

Subject Number	125Hz	250Hz	500Hz	1000Hz	2000Hz	3000Hz	4000Hz	6000Hz	8000Hz	Average Pure tone Thresholds
1	35 dB	40 dB	45 dB	50 dB	50 dB	40 dB	45 dB	45 dB	55 dB	45.0 dB
2	40 dB	40 dB	40 dB	50 dB	55 dB	55 dB	55 dB	60 dB	60 dB	50.6 dB
3	35 dB	35 dB	35 dB	40 dB	40 dB	40 dB	40 dB	35 dB	45 dB	38.3 dB
4	45 dB	45 dB	45 dB	35 dB	45 dB	55 dB	55 dB	55 dB	60 dB	48.9 dB
5	30 dB	30 dB	40 dB	40 dB	45 dB	50 dB	50 dB	45 dB	45 dB	41.7 dB
6	45 dB	40 dB	45 dB	40 dB	40 dB	50 dB	55 dB	50 dB	65 dB	47.8 dB
7	40 dB	35 dB	40 dB	35 dB	45 dB	40 dB	40 dB	45 dB	40 dB	40.0 dB
8	35 dB	35 dB	45 dB	40 dB	40 dB	50 dB	45 dB	50 dB	55 dB	43.9 dB

Table 5.6 Speech discrimination results, where the subjects achieved 100%

Subject Number	100% Speech Discrimination Achievement
1	60 dB
2	65 dB
3	65 dB
4	65 dB
5	60 dB
6	65 dB
7	65 dB
8	65 dB

The information described in the above tables is proposed visually in the following figure.

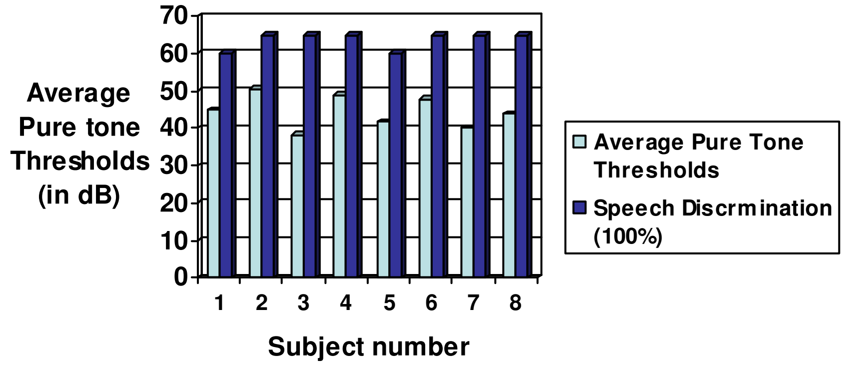

Figure 5.3 Pure tone thresholds and speech discrimination results

The audiograms indicated that the average pure tone thresholds (PTT) for subjects one, five, seven and eight were between 40-45 dB. From their background information, it is evident they have all been implanted for two years or longer. Additionally, the above-mentioned subject's first language is either English or Afrikaans, and the instructions for the hearing assessment were conducted in either one of their first languages. Furthermore, subjects one, seven and eight are all above the age of seven years and subject five is approximately five and a half years old. Therefore, these subjects are also functioning at a higher cognitive level compared to the younger subjects.

Subjects four and six achieved an average PTT between 45-50 dB. Their first language is also either English or Afrikaans, which meant that the hearing assessment was conducted in their preferred language. Their cochlear implant experience was 10- and 4-months respectively, which could contribute to their increased average PTT, as they are more than likely still adapting to their device. Their ages vary between four years three months and five years five months, indicating that they are also less cognitively mature compared to the older subjects.

Subject two had the highest average PTT, i.e. above 50 dB. From the background information questionnaire, it was evident that subject two's first language is Sotho, which meant that the hearing assessment was conducted in his/her second language rather than in his/her preferred language. The subject had only 16-months cochlear implant experience and was five and a half years old at the time of the study, which could also contribute to the increased thresholds obtained.

Subject three was the only subject with an average PTT below 40 dB. The subject was evaluated in his/her first language after 21-months of cochlear implant experience and he/she was five years old at the time of the study.

From the above-mentioned discussion, it is evident that the White and Asian subjects achieved the lowest average PTT. Possible reasons for this phenomenon could be because they were evaluated in their first language (either in English or Afrikaans) and their chronological ages were generally higher. The subject that achieved the highest average PTT was a disadvantaged Black subject in comparison to the Asian and White subjects; he/she had to be evaluated in his/her second language. Additionally, the Black subject had less implant experience compared to the Asian and some of the White subjects. For a child that may have several language influences in his/her life, it is important for the clinician to try and get an overview of what language the child knows, i.e. the child may be able to use a second language for conversational interaction; however, this does not mean that the child is able to understand or use speech well enough to participate in the classroom situation or learn new information in a timely manner (Mahshie, et.al, 2006:89). Differentiating between interpersonal and school language is an important aspect of assessing the child's abilities and will probably be achieved through intensive intervention and ongoing evaluations. It can therefore be assumed that the language barrier (Zsilavecz & Naude, 2000:21; Umansky & Hooper, 1998:341), cochlear implant experience and chronological age are contributing factors that can affect the outcome of hearing thresholds obtained in young children with cochlear implants.

All the subjects obtained 100 % speech discrimination at 60-65 dB, which did not always correlate with the pure tone thresholds obtained. Although cochlear implant experience, chronological age and language barriers may influence the speech discrimination results, it was evident that in this present study, the subjects are used to listening through an FM system for most of the day, resulting in the subjects only listening when the speech is at a comfortably loud level rather than learning to listen at all levels, no matter how loud or soft the sounds are. It is also important to mention that a large amount of conditioning was needed before the subjects were able to perform the speech discrimination assessment successfully. Additionally, it is evident that speech discrimination is not often included in the audiological assessments when hearing thresholds are monitored. Research proves that speech discrimination results rather than pure tone thresholds give a better, more reliable indication of auditory abilities (Scott, 2002:10-26).

Type A tympanograms indicating normal middle ear functioning was elicited in the Asian, Black and White subjects (Martin & Clark, 2000:156). This demonstrates that language and cultural barriers does not affect the results obtained from tympanometry, as no behavioural responses were expected from the subjects.

Table 5.7 and Figure 5.4 lists the Speech in Noise Test results obtained for each subject at a speech to noise ratio of 60:55 dB.

Table 5.7 Speech in Noise Test results

Subject Number	Speech in Noise 60:55dB Ratio
1	100%
2	60%
3	10%
4	70%
5	70%
6	80%
7	60%
8	80%

The information described in the above table is proposed visually in the following figure.

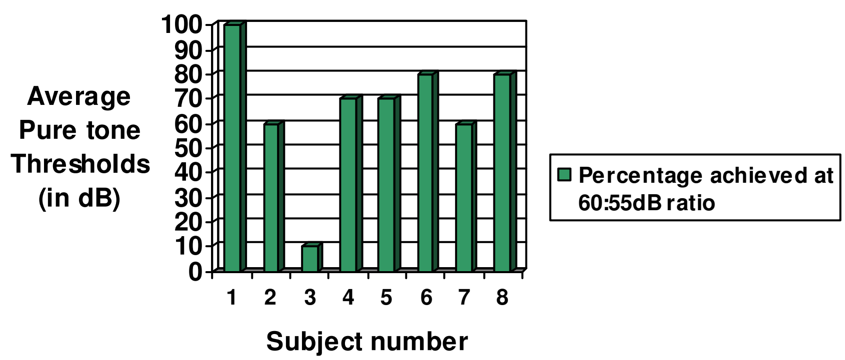

Figure 5.4 Speech in Noise Test results

Variable Speech in Noise Test results were obtained. No clear tendencies regarding culture group or language could be obtained. Five of the eight subjects obtained a Speech in Noise score of less than 80%. Only one subject achieved a score of 100%. These results emphasize that the subjects are used to listening through an FM system for most of their day, making it more difficult for them to discriminate speech in the presence of background noise. Additionally, this was the final assessment included in the hearing evaluation, and the subjects were tired and fidgety by that time.

Overall, no cultural barriers seemed to affect the audiological results, however, linguistic barriers together with individual factors such as cochlear implant experience, and chronological age, mood and energy levels could impact the final outcome of the audiological results.

5.5.3 Developmental Assessment Schema (Auditory Communication)

Table 5.8 and Figure 5.5 lists the Developmental Assessment Schema (Auditory Communication) results for each subject.

Table 5.8 Developmental Assessment Schema (Auditory Communication)

Developmental Assessment Schema (Auditory Communication)	Subject Number							
	1	2	3	4	5	6	7	8
Awareness of sound	8/8	7/8	7/8	7/8	6/8	8/8	7/8	8/8
Sound has meaning	5/5	5/5	5/5	5/5	5/5	5/5	5/5	5/5
Auditory feedback	17/17	15/17	14/17	16/17	15/17	16/17	17/17	16/17
Discrimination skills	28/31	16/31	21/31	25/31	28/31	23/31	22/31	25/31
Localization skills	5/5	0/5	0/5	4/5	0/5	5/5	5/5	5/5
Distance & directional listening	7/7	5/7	5/7	7/7	7/7	7/7	7/7	7/7
Adding background noise	6/6	4/6	5/6	2/6	6/6	6/6	6/6	6/6
Auditory memory & sequencing - short-term	9/11	3/11	3/11	6/11	11/11	10/11	8/11	11/11
Auditory memory & sequencing - long-term	12/17	3/17	3/17	1/17	13/17	5/17	11/17	5/17

The information described in the above table is proposed visually in the following figure.

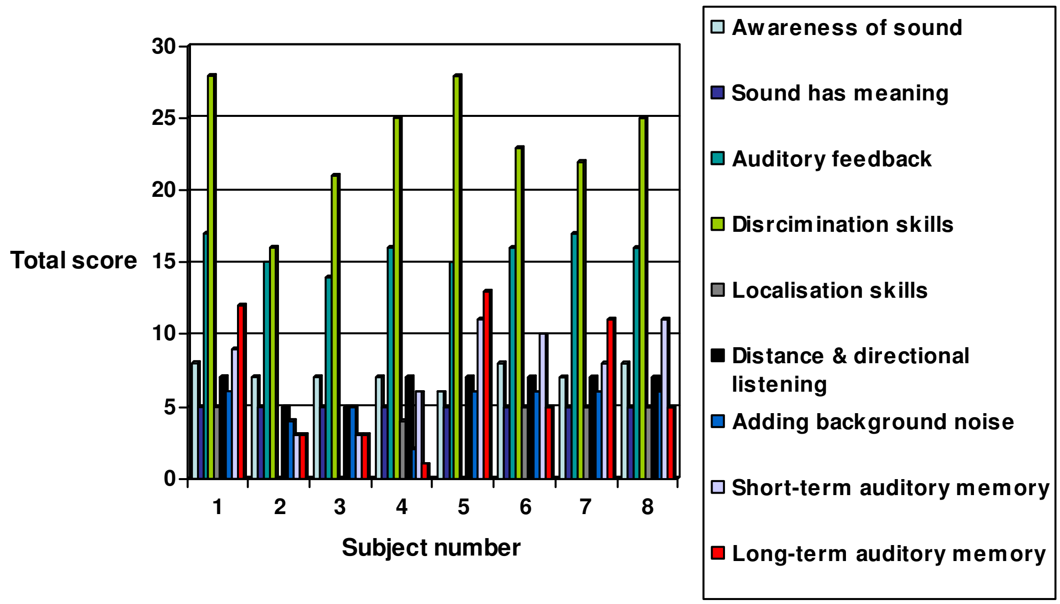

Figure 5.5 Developmental Assessment Schema (Auditory Communication)

The DAS (Auditory Communication) includes nine sub-sections. In the awareness of sound, sound has meaning, auditory feedback and distance and directional listening categories, no significant differences in the subject's scores were found. In the discrimination skills category, subject two obtained the lowest score, while the other subjects received scores above 20. Possible reasons for this phenomenon could be that subject two only had 16-months' cochlear implant experience at the time of the study and he/she was expected to process the auditory information in his/her second language, which is more difficult than processing information in his/her first language (Owens, 1999:107).

In the localization skills category, subject two, three and five achieved scores of zero. No tendency between these subjects is evident as cochlear implant experience varies between 16 and 33 months. The heterogeneity amongst the hearing impaired population is highlighted, and it is obvious that children do not function in a uniform fashion (Estabrooks, 1998:79). Subject four scored the poorest in the background noise category, partly due to the fact that he/she only had 10-months' cochlear implant experience at the time of the study.

In the auditory short-term memory and sequencing category, subject two and three had the poorest scores. Cochlear implant experience of less than two years could be a contributing factor for the lower scores as well as second language barriers for subject two, as he/she is expected to process the auditory information in his/her second language. Similarly, in the auditory long-term memory and sequencing category, subjects two, three, four and six achieved the poorest scores. Cochlear implant experience of less than one or two years may have influenced these results.

Overall, in the DAS (Auditory Communication) scale, culture or language did not affect the administration of the scale, as the scale was completed while observing the subjects in their natural environments at school and during teacher interviews. However, language barriers may influence the results obtained, as second language learners may have more difficulties processing auditory information in their second language as apposed to their first language (Owens, 1999:107). Therefore, the clinicians administering and interpreting the scale need to be aware of and sensitive to second language learners, to ensure that no biased assessments occur. In this study, the largest contributing factor to discrepancies in scores amongst the subjects was cochlear implant experience.

5.5.4 Meaning Auditory Integration Scale (MAIS)

Table 5.9 and Figure 5.6 list the MAIS results obtained from each subject.

Table 5.9 Meaningful Auditory Integration Scale (MAIS)

Subject Number	Parent Response	Teacher Response
1	39/40	28/40
2	36/40	27/40
3	31/40	32/40
4	14/40	22/40
5	35/40	32/40
6	26/40	31/40
7	37/40	28/40
8	34/40	30/40

The information described in the above table is proposed visually in the following figure.

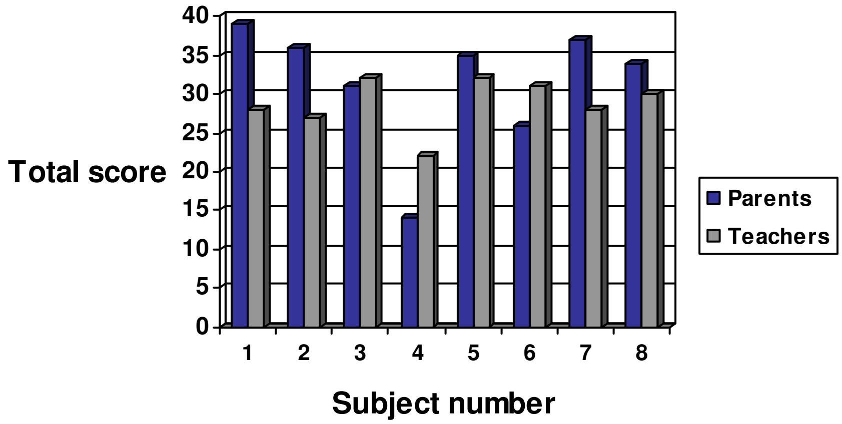

Figure 5.6 Meaningful Auditory Integration Scale

The MAIS (parent response) indicated that higher scores were given for five of the subjects compared to the responses from teachers. Research demonstrates that teachers usually give lower scores. The reason for this may be that a greater length of time is required to attach meaning to sound in the noisier classroom situation (Lutman, et.al, 1996:48). In this study, however, the subjects function in an ideal listening environment where they are exposed to FM systems for most of the day. Therefore, the poorer scores reported by the teachers are most likely not due to the noisier classroom situation, but rather due to the more realistic scores given by teachers as apposed to parents, as parents want their children to succeed and are more "lenient" when scoring.

Subjects one, five and seven, who have more than 35-months of cochlear implant experience obtained the highest scores (above 35) from the parent response. However, subject 2 who had only been implanted for 16-months at the time of the study also obtained a score of 36 from the parent response. Subjects three and eight who had 21-24 months of implant experience, received scores from 31-34. Subjects four and six who have the shortest implant experience (less than ten months) received the lowest scores from the parent response.

From the teacher response, subjects three, five, six and eight received the highest scores between 30 and 32. Subjects three, five and eight had between 21- and 33-months cochlear implant experience, however, subject six had only 4-months implant experience at the time of the study.

Subjects one, two and seven received scores between 27 and 28 and had 16-45 months of cochlear implant experience.

No significant tendencies can be obtained from the parent and teacher responses, as variable scores were obtained, and cochlear implant experience does not seem to cause significant differences between the scores. The heterogeneity of the subjects is highlighted once again (Estabrooks, 1998:79).

Cultural barriers did not seem to have an effect on the administration and interpretation of the MAIS. Language may possibly affect the outcome of the scale, as the MAIS is currently only available in English. Parents and teachers with Afrikaans, Sotho or Sign Language as their first language were therefore expected to complete an English questionnaire. The clinician should be sensitive to language differences and ensure that the parents and teachers have a complete understanding of the questions included in the MAIS.

5.5.5 Meaning Use of Speech (MUSS)

Table 5.10 and Figure 5.7 list the MUSS results obtained from each subject.

Table 5.10 Meaningful Use of Speech (MUSS)

Subject Number	Parent Response	Teacher Response
1	31/40	24/40
2	28/40	22/40
3	34/40	25/40
4	8/40	23/40
5	32/40	30/40
6	32/40	27/40
7	27/40	23/40
8	24/40	22/40

The information described in the above table is proposed visually in the following figure.

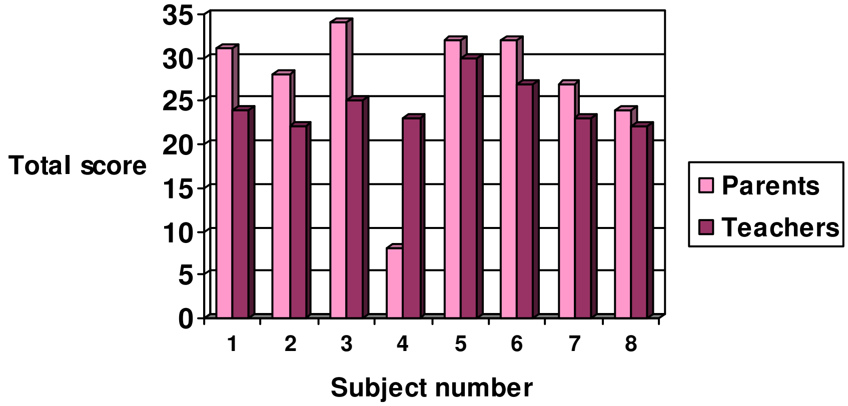

Figure 5.7 Meaningful Use of Speech Scale

For seven of the subjects, the MUSS (parent response) scores were poorer than the teacher response scores. This may demonstrate that it is more difficult for teachers to adapt too many hearing-impaired children's use of language, while it is easier for parents to understand their own child's use of language.

In the parent response questionnaire, subject one, three, five and six obtained the highest scores (above 30). Their implant experience varied from 4-33 months. Subject two, seven and eight received scores from 24-28 after 16-45 months of cochlear implant experience. Subject four received the lowest parent response score after only 10-months of implant experience at the time of the study.

From the teacher response questionnaire, subject five received the highest score (30) after 33-months of cochlear implant experience. The remaining seven subjects received scores between 22-27 and they had variable cochlear implant experience that ranged between 4-45 months.

As with the MAIS, no clear tendencies could be obtained between the subjects' scores due to the discrepancies between the variable scores obtained and the months of cochlear implant experience. It is evident that hearing-impaired children do not function in a uniform manner (Estabrooks, 1998:79). Furthermore, cultural barriers did not affect the administration and interpretation of the MUSS. However, as with the MAIS, language barriers may influence the outcome of the questionnaire, as parents and teachers are often expected to complete the MUSS in their second language, as the MUSS is currently only available in English. The clinician needs to take note of this aspect and ensure that the parents and teachers fully understand the contents of the MUSS.

5.5.6 Rossetti Infant-Toddler Language Scale

Table 5.11 and Figure 5.8 lists the Rossetti Infant-Toddler Language Scale results obtained for each subject.

Table 5.11 Rossetti Infant-Toddler Language Scale

Subject Number	Gesture (In months)	Play (In months)	Language Comprehension (In months)	Language Expression (In months)
1	>24-27 months	>33-36 months	>33-36 months	>33-36 months
2	>24-27 months	>33-36 months	33-36 months	30-33 months
3	>24-27 months	>33-36 months	30-33 months	27-30 months
4	>24-27 months	>33-36 months	33-36 months	24-27 months
5	>24-27 months	>33-36 months	>33-36 months	>33-36 months
6	>24-27 months	>33-36 months	33-36 months	30-33 months
7	>24-27 months	>33-36 months	>33-36 months	30-33 months
8	>24-27 months	>33-36 months	>33-36 months	30-33 months

The information described in the above table is proposed visually in the following figure.

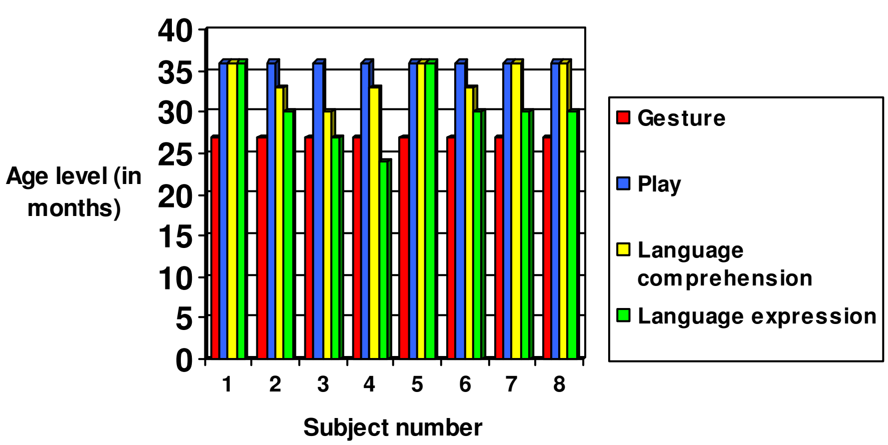

Figure 5.8 Rossetti Infant-Toddler Language Scale

The Rossetti Infant-Toddler Language Scale consists of the following categories: Interaction attachment, pragmatics, use of gestures, play development, language comprehension and language expression. However, the age levels of the subjects in this study were above the age level for the interaction attachment and pragmatics assessment. In the gesture and play category, all the subjects functioned above a 24-27 month and 33-36 month level respectively. For the language comprehension category, subjects one, four, seven and eight function above a 33-36 month level. These subjects have 24-45 months of cochlear implant experience and their chronological ages are above seven years, except for subject five who was approximately five-and-a-half years old at the time of the study.

Subjects two, four and six's receptive language was on a 33-36 month age level. They had the shortest cochlear implant experience (i.e. 4-16 months), and their chronological ages varied between four and five-and-a-half years of age. Subject three's receptive language was on the lowest level (30-33 months) after 21-months of cochlear implant experience. Subject three was five years old at the time of the study.

For the language expression category, subject one and five function above a 33-36 month age level after 31-33 months of implant experience and their chronological ages varied between five-and-a-half and seven years of age. Subjects two, six, seven and eight's expressive language was on a 30-33 month age level. Their implant experience varied between 4 and 45 months, and their chronological ages were between four and seven years of age. Subject three's expressive language was at a 27-30 month age level; although he/she had 21 months implant experience and this subject was five years old at the time of the study. On the other hand, subject four's expressive language was at a 24-27 month age level, even though he/she was only implanted for 10-months at the time of the study and was approximately five-and-a-half years old.

Research illustrates that implanted children's receptive language is usually at a higher level than their expressive language (Kirk et.al, 2003:140). From this study it was evident that the children with longer cochlear implant experience seemed to have better expressive and receptive language abilities, compared to children with shorter implant experience. Some exceptions to this generalization were present, e.g. subject three, which again highlights the heterogeneity of the hearing impaired population (Estabrooks, 1998:79). Furthermore, it is expected for the "gap" between the receptive language, expressive language and chronological age to close at a faster rate for children implanted before the age of two years, and this rate decreases when children are implanted between the ages of two and four years. For children implanted after the age of five, the "gap" would remain constant over time as language abilities improve (Kirk et.al, 2003:140).

Cultural barriers did not affect the administration and interpretation of the Rossetti Infant-Toddler Language Scale, as the scale was completed during observation of the subjects in their natural environments at school and during interviews with the teachers. However, it must be kept in mind that cultural barriers may affect the interaction attachment category, as different cultures have various views regarding communicating with their children, e.g. certain African cultures follow the principle that 'children must be seen and not heard', which may influence the results obtained from the scale. The clinician should be sensitive to all cultural differences, and keep them in mind when interpreting the information obtained and especially when providing guidelines for communication development. Although language barriers did not directly affect the administration of the scale, the clinician needs to keep the second language learners in mind and make the necessary adaptations when administering and interpreting the scale. It is also important for the clinician to distinguish between specific language disorders or early stages of second language acquisition (Owens, 1999:107).

5.5.7 Developmental Assessment Schema (General Development)

Table 5.12 and Figure 5.9 lists the general developmental age of the subjects as determined by the DAS (General Development)

Table 5.12 Developmental Assessment Schema (General Development)

DAS (General Development) (In months)	Subject Number							
	1	2	3	4	5	6	7	8
Personal-social	>60	60	57-60	60	60	60	>60	57-60
Perceptual cognitive	60	51	42-45	51-54	57-60	45-48	54-57	54-57
Self-help	>60	60	60	60	60	60	>60	>60
Gross motor	>60	60	60	60	60	51	>60	>60
Fine motor	>60	60	48-51	60	60	57-60	>60	>60
Expressive speech	60	30-33	30-33	27-30	36-39	30-33	45-48	30-33
Receptive speech	57-60	48-51	51-54	57-60	57-60	45-48	51-54	51-54

The information described in the above table is proposed visually in the following figure.

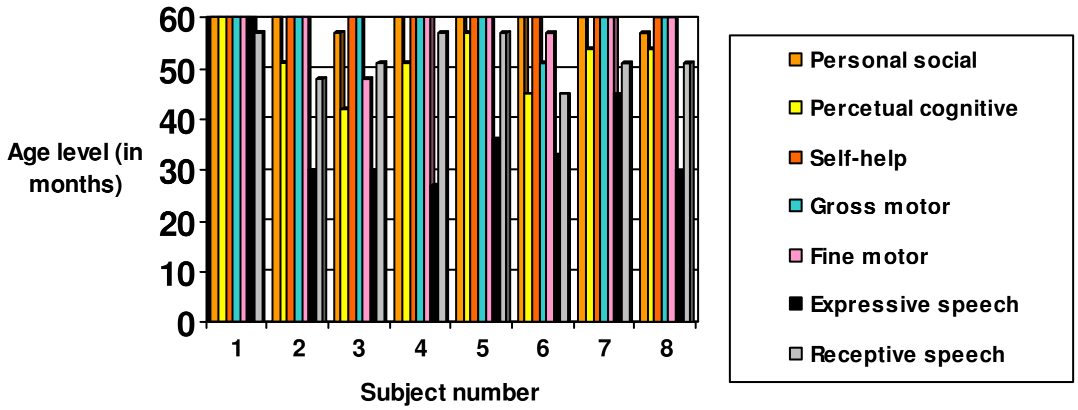

Figure 5.9 Developmental Assessment Schema (General Development)

The DAS (general development) assesses the following five developmental categories: personal-social, perceptual-cognitive, self-help, gross motor, fine motor, expressive speech and receptive speech.

In the personal-social category, subject one and seven functioned above a 60-month age level, which is appropriate for their chronological age. Similarly, subject two, four, five and six functioned at a 60-month age level, which is also appropriate for their age. Subject three and eight functioned at a 57-60 month age level, which is below the average for their chronological age. Cochlear implant experience should not directly influence personal-social skills, but could be a contributing factor.

In the perceptual-cognitive category, subject one functioned at a 60-month age level and subject five at a 57-60 month age level. Subject seven and eight functioned at a 54-57 month age level and subject two and four functioned at a 51-54 month age level. Subject six who had the shortest cochlear implant experience functioned at a 45-48 month age level. The heterogeneity of the hearing impaired population is evident in subject three who functioned at a 42-45 month age level, although he/she had 21-months cochlear implant experience at the time of the study. It is evident that the older subjects with longer cochlear implant experience function at a higher cognitive level, compared to the younger subjects with shorter implant experience. However, the individuality of the subjects is clear (Estabrooks, 1998:79).

In the self-help, gross-motor and fine motor categories, all the subjects functioned at levels appropriate for their chronological age, except for subject three who had a moderate delay in his/her fine motor skills. This information provides the clinician with a holistic overview of the subjects' general development, whereby appropriate referrals can be made if necessary.

As in the Rossetti Infant-Toddler Language Scale, it is evident that the receptive language age levels are higher than the expressive language age levels. Subject one, whose chronological age was seven years and four months, had a receptive language level of 60-months, and his/her expressive language was at a 57-60 month age level, this after 31-months implant experience. Subject two's receptive language was at a 48-51 month age level and his/her expressive language was at a 30-33 month age level, after 16-months of implant experience. The child's chronological age was five years and five months. Subject three was five years old and his/her receptive language was at a 51-54 month age level and the expressive language was at a 30-33 month age level, after 21-months implant experience. Subject four's receptive language was at a 57-60 month age level and his/her expressive language was at a 27-30 month age level, after 10-months of cochlear implant use; the child's chronological age was five years and five months. Subject five was five years and seven months old and this subject's receptive language was at a 57-60 month age level and his/her expressive language was at a 36-39 month age level, after 33-months of cochlear implant experience. Subject six's receptive language was at a 45-48 month age level, whilst his/her chronological age was four years and three months; his/her expressive language was at a 30-33 month age level, after only 4-months of cochlear implant use. Subject seven's receptive language was at a 51-54 month age level and his/her expressive language was at a 45-48 month age level, after 45-months of implant experience and the child's chronological age was seven years and three months. Subject eight's receptive language was at a 51-54 month age level and his/her expressive language was at a 30-33 month age level, after 24-months of implant use and his/her chronological age was seven years and three months.

Comparison of the Rossetti Infant-Toddler Language Scale and DAS (General Development) is not always possible as the Rossetti Infant-Toddler Language Scale measures development up to

36-months, while the DAS (General Development) measures development up to 60-months. Additionally, the scales include different categories, as well as variable aspects within the categories. It may be possible to compare expressive and receptive language if the children function at, or below, a 36-month age level. According to the current study, some subjects function on a higher language level according to the DAS (General Development), and a lower language level according to the Rossetti Infant-Toddler Language Scale. This could be due to the differing aspects included in the receptive and expressive language categories, making direct comparisons difficult. The clinician should therefore focus on the information obtained from both the DAS (General Development) and Rossetti Infant-Toddler Language Scale, in order to provide appropriate intervention and make the necessary referrals, rather than directly comparing the two scales.

No significant tendencies between the subjects' chronological age, cochlear implant experience and general development could be identified. However, it is expected that the cochlear implant users with longer experience have a smaller "gap" between their chronological age and language abilities (Kirk et al, 2003:140). This phenomenon was evident in subject one and seven, but there were definite exceptions to the rule which is to be expected when working with a heterogeneous population.

Cultural barriers did not seem to affect the administration and interpretation of the DAS (General Development), but, on the other hand, language barriers can affect the administration and outcome of the results, especially within the expressive and receptive language categories. The DAS (General Development) was completed during observation of the subjects at school, during interaction with the subjects, and during interviews with the teachers. The clinician must therefore make the necessary adaptations during the application of the DAS (General Development) on second language learners to ensure that the language barriers are overcome.

5.5.8 Reynell Developmental Language Scales III (Verbal Comprehension)

Table 5.13 and Figure 5.10 list the results obtained from the Reynell Developmental Language Scales III (Verbal Comprehension).

Table 5.13 Reynell Developmental Language Scales III (Verbal Comprehension)

Reynell Developmental Language Scales III (Verbal Comprehension)	Subject Number							
	1	2	3	4	5	6	7	8
Chronological age (in years & months)	7.04	5.05	5.00	5.05	5.07	4.03	7.03	7.03
Age equivalent (in years & months)	6.07-7.00	2.02	2.08	2.00	4.03	3.02	3.06	2.11

The information described in the above table is proposed visually in the following figure.

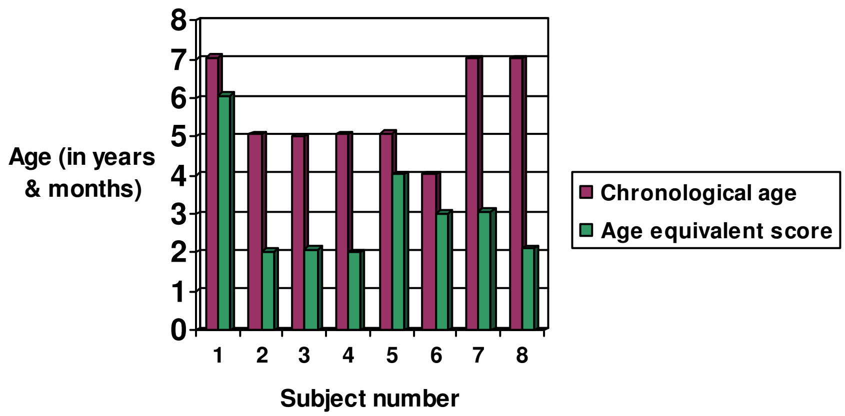

Figure 5.10 Reynell Developmental Language Scales III (Verbal Comprehension)

Subject one's chronological age was 7.04 years and his/her verbal comprehension was at a 6.07-7.00 year age level after 31-months of cochlear implant experience. Subject two's chronological age was 5.05 years and his/her verbal comprehension was at a 2.02-year- age level after 16-months implant experience. Subject three's chronological age was 5 and his/her verbal comprehension was at a 2.08-year age level after 21-months cochlear implant use. Subject four's chronological age was 5.05 years and his/her verbal comprehension was at a 2 year age level after 10 months of cochlear implant experience. Subject five's chronological was 5.07 years and his/her verbal comprehension was at a 4.03 years age level after 33-months of implant experience. Subject six's chronological age was 4.03 years and his/her verbal comprehension was at a 3.02 years age level after only 4-months of cochlear implant use. Subject seven's chronological age was 7.03 years and his/her verbal comprehension was at 3.06 years age level after 45-months of cochlear implant experience. Subject eight's chronological age was 7.03 and his/her verbal comprehension was at a 2.11 year age level after 24-months of implant experience.

Research demonstrates that in children implanted before the age of five years, the “gap” between their receptive language and chronological age will close over time with increased cochlear implant experience. In children implanted after the age of five years, the”gap” remains constant over time. (Kirk et.al, 2003:140; Vermeulen et.al, 1999:4). This phenomenon was evident in subject eight who had been implanted after the age of five years, as a large “gap” remains even though his/her language abilities are improving. It is therefore expected that the “gaps” for subjects one to seven will close over time, however, the rate at which they will close will depend on the age at implantation, i.e. the younger the age at implantation, the faster the rate of “gap” closure between the receptive language and chronological age (Kirk et.al, 2003:140; Vermeulen et.al, 1999:4).

No cultural barriers seemed to affect the administration and interpretation of the Reynell Developmental Language Scales III (Verbal Comprehension). Language barriers can definitely affect the end-result of this assessment, as standardised assessments always run the risk of being biased to second language learners. In general, second language acquisition is more difficult than first language acquisition, which for most children is fairly effortless. A language assessment must distinguish between those errors that reflect this difficulty and those that represent a language impairment (Owens, 1999:107). Therefore, the clinician needs to make the necessary adaptations when administering and interpreting the Reynell Developmental Language Scales III (Verbal Comprehension), to ensure that second language learners are accommodated.

5.5.9 Parent-Child Interaction

Table 5.14 and Figure 5.11 list the scores of the parent-child interaction analysis.

Table 5.14 Parent-child interaction

Parent-Child Interaction	Subject Number							
	1	2	3	4	5	6	7	8
Tactile stimulation	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4
Pleasure during interaction	4/4	4/4	4/4	4/4	4/4	4/4	3/4	3/4
Responds to distress	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4
Eye to eye contact	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4
Smiles contingently	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4
Varies prosodic features	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4
Encourages conversation	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4
Responds to behaviour	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4
Modifies interaction	4/4	3/4	4/4	4/4	4/4	4/4	4/4	4/4
Uses communication to teach language	4/4	4/4	4/4	4/4	4/4	4/4	4/4	4/4

The information described in the above table is proposed visually in the following figure.

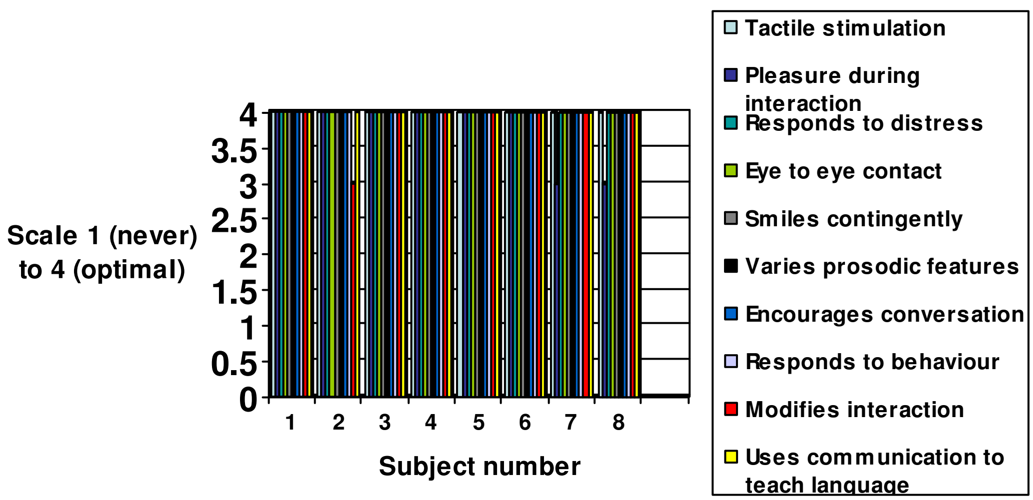

Figure 5.11 Parent-Child Interaction

The parent-child interaction assessment evaluated the following ten aspects regarding the interaction between the parents and the subjects: tactile stimulation, pleasure during interaction, response to distress, eye-to-eye contact, smiles contingently, varies prosodic features, encourages conversation, responds to behaviour, modifies interaction and uses communication to teach language.

All the subjects scored a 4 (optimum) in all the categories, except for subject seven and eight that scored a 3 for the 'pleasure during interaction' category, and subject two who scored a three for the ‘modifies interaction’ category. Linguistic or cultural barriers did not seem to affect the administration and interpretation of the parent-child interaction as all the subjects received similar scores. The parents at the school also receive compulsory parent training, contributing to the fact that the subjects received similar and mostly optimum scores for the parent-child interaction checklist.

5.5.10 Speech Intelligibility Rating (SIR)

Table 5.15 and Figure 5.12 list the SIR scores achieved by each subject.

Table 5.15 Speech Intelligibility Rating (SIR)

Speech Intelligibility Rating	Subject Number							
	1	2	3	4	5	6	7	8
Scale 1 (unintelligible) to 6 (intelligible)	4	3	3	3	3	3	4	3

The information described in the table above, is proposed visually in the following figure.

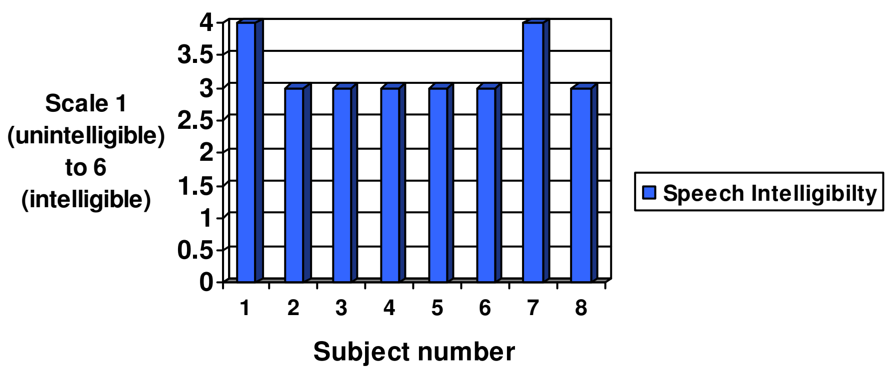

Figure 5.12 Speech Intelligibility Rating

Subjects one and seven scored a four, which indicates that their speech is intelligible to a listener who concentrates and lip-reads. The other subjects scored a three, which indicates that their speech is unintelligible, but experienced listeners can follow a known topic. Subjects one and seven had 31-45 months of cochlear implant experience, which validates their score. The other subjects had mostly shorter cochlear implant experience, and therefore scored a three. Speech abilities before implantation also contribute to the scores obtained. Linguistic barriers do not affect the outcome of this scale; however, cultural barriers may, as the Asian and Black subjects have an accent that causes their speech to be more unintelligible to a person that may not be used to the accent, regardless of the speech delay (Owens, 1999:106).

5.5.11 Voice Skills Assessment (VSA)

Table 5.16 describes the voice quality of the subjects.

Table 5.16 Voice Skills Assessment (VSA)

Voice Skills Assessment	Subject Number							
	1	2	3	4	5	6	7	8
Normal vs. abnormal	Normal	Normal	Normal	Normal	Normal	Normal	Normal	Normal

The Voice Skills Assessment (VSA) Scale indicated normal voice qualities in all the subjects. Research illustrates that cochlear implantation tends to normalize voice qualities (Perrin et.al, 1999:7). Cultural or linguistic barriers do not seem to have an effect on the administration and interpretation of the VSA scale.

5.5.12 Preschool Literacy Assessment

Table 5.17 describes the preschool literacy skills of the subjects.

Table 5.17 Preschool Literacy Assessment

Subject Number	Level of Preschool Literacy Skills
1	Same level as hearing peers
2	Same level as hearing peers
3	Same level as hearing peers
4	Same level as hearing peers
5	Same level as hearing peers
6	Same level as hearing peers
7	Same level as hearing peers
8	Same level as hearing peers

All the subjects' preschool literacy skills were at the same level as their hearing peers in the classroom. Cultural or linguistic barriers do not seem to have an effect on the administration and interpretation of the Preschool Literacy Assessment, as the cochlear-implanted children are receiving similar preschool literacy training as their hearing peers. They also receive additional individual sessions, which reinforce and ensure understanding of the aspects covered in the lessons.

5.5.13 Profile of Actual Linguistic Skills (PALS)

Table 5.18 describes the linguistic levels of the subjects according to the PALS.

Table 5.18 PALS

Subject Number	Stage of Linguistic Development
1	Transitional language stage
2	Transitional language stage
3	Transitional language stage
4	Transitional language stage
5	Transitional language stage
6	Transitional language stage
7	Transitional language stage
8	Transitional language stage

All the subjects were within the transitional stage of linguistic development, which was a pre-requisite for subject selection for the current study. The PALS considers communication, receptive language, and expressive language, voice and speech ratings in order to “profile” the subjects. Cultural or language barriers did not have a direct influence on the administration and interpretation of the PALS, although the clinician involved should be sensitive to language barriers and should make the necessary adaptations for second language learners.

5.6 SUB-AIM FIVE: THE OVERALL VALUE OF THE ASSESSMENT PROTOCOL

The question posed in sub-aim five was whether the assessment protocol would be valuable in an inclusive educational setting. The question may be answered by critically evaluating the results of the previous four sub-aims.

The protocol includes the different assessment areas considered vital in the paediatric cochlear implant population (Mahshie, 2006:82; Dyar, 2003), and the protocol ensures that the children are looked at holistically during the assessment (Umansky & Hooper, 1998:341).

The auditory assessment determines if the device is functioning and monitors listening skills and development. The DAS (General Development) and Rossetti Infant-Toddler Language Scale evaluate general development, and they provide a general overview of development in the paediatric population.

The MICS and Caregiver Child Interaction Scale were completed during the video analysis. Valuable information regarding the interaction between the parents and subjects was obtained, and the results can be used during parent guidance sessions in order to ensure that an optimal environment for speech, language and auditory development is created at home.

Informal and formal measures were used to evaluate expressive and receptive language. A clear indication of the age level at which the subjects function was obtained. The SIR and VSA document the intelligibility of emerging speech and voice skills. The Preschool Literacy Assessment gives an overview of literacy skills.

Questionnaires (MAIS and MUSS) completed by the parents and teachers were also included in the protocol as it is important to receive information from the people who know the child best, before any conclusions can be made about a child's development (Venter, 2000:90; Lutman et.al, 1996:48).

It can be concluded that the protocol can be successfully administered on young children with cochlear implants, in the transitional stage of spoken language development. The protocol also ensures that the crosscheck principle is being applied, as some overlapping occurs in the assessments included in the protocol.

All the results obtained from administering the protocol are valuable for future habilitation; long- and short-term goal setting, as well as to monitor progress in the paediatric cochlear implant population.

The duration for the administration and interpretation of the protocol has proven to be realistic within a clinical setting. Although some linguistic barriers that may affect the outcome of the results when assessing receptive and expressive language are identified, these can be overcome by being especially sensitive when assessing a child in his/her second language, and possibly by making use of an interpreter when assessing, in order to clarify difficult concepts (Owens, 1999:109). Cultural barriers did not seem to have an affect on the administration and interpretation of the protocol; however, clinicians need to be culturally sensitive in all assessments in order to ensure the validity of the results obtained.

The protocol makes use of many informal measures as well as one standardised measure for verbal comprehension, although informal measures are more popular in the paediatric population (Shipley & McAfee, 1998:184). Informal measures are easily applied in a natural setting; therefore the child can be evaluated in a setting where he/she is most comfortable (Shipley & McAfee, 1998:191). The informal and formal assessments allow easy monitoring of progress on an annual basis, and give clear guidelines for further intervention. Therefore, the use of the proposed assessment protocol in an inclusive educational setting seems feasible and valuable for use by the Pretoria Cochlear Implant Programme.

The results of this study indicate that the proposed assessment protocol is clinically appropriate for use within the Pretoria Cochlear Implant Programme. The type of areas assessed and the results obtained, are appropriate for young cochlear implant users in the transitional stage of language development. Furthermore, the duration for the administration and interpretation of the assessment protocol seems feasible and can be used within a clinical setting. Although linguistic barriers were identified, these barriers can be overcome if the clinicians involved are sensitive to language and cultural issues that may arise during assessments. From the above-mentioned aspects, it is clear that the proposed assessment protocol is relevant and valuable; and could be used efficiently within an inclusive educational setting.

5.7 RECOMMENDED CHANGES FOR THE ASSESSMENT PROTOCOL

From the results of sub-aim one, two, three, four and five, the following recommendations are made to change the assessment protocol.

Firstly, the MICS is not appropriate for children that are older than 36-months. Secondly, the DAS (General Development) is not appropriate for children older than 60-months. It is recommended that another scale should be used for describing the general development of children older than 60-months. Alternatively, the similar developmental areas should be used, but described qualitatively during assessments. Thirdly, the Rossetti Infant-Toddler Language Scale can only be used for infants up to the age of 36-months, and therefore aspects included in the scale are inappropriate for older children. Fourthly, the background questionnaire, MAIS and MUSS assessments are currently only available in English. In order to prevent misinterpretations of the content, and to accommodate parents and teachers whose first language is not English, it is recommended that these questionnaires be translated into Afrikaans and the commonly used African languages, to ensure that all the questionnaires that are used, are linguistically appropriate.

Furthermore, as a large amount of conditioning was necessary during the hearing assessments, an assistant audiologist should be used when assessing the hearing and speech perception abilities of young cochlear implant users. It is suggested that the same assistant audiologist be used during all assessments to enhance the reliability of the study. Using an assistant audiologist would also result in shorter test durations, making the hearing assessments more time efficient. Moreover, it is suggested that the Listening Progress (LiP) developed by the Nottingham Cochlear Implant Programme be used instead of the DAS (Auditory Communication). The DAS (Auditory Communication) is lengthy and takes a long time to complete and the LiP was specifically designed for children with cochlear implants (Archbold, 1994:200). Therefore, it would be more time efficient and valid for children with cochlear implants. Lastly, the assessment protocol did not include a specific assessment for pragmatics, although pragmatics can be easily assessed during observation of a child in his/her natural environment. As children mature, they gain increasingly more complex categorisation or word-associational strategies and increasingly more complex organisational word and structure systems. The most appropriate and effective way of expressing oneself depends on a number of variables that are stylistic, socio-emotional, personal and contextual. In other words, linguistic variation is the result of skills in pragmatics or language use (Owens, 1998:286). It is recommended that the Pragmatic Aspects of Language (Prutting & Kirchner, 1987:105-119) be included in the protocol, to provide a guideline for the assessment of pragmatics.

Table 5.19 summarises the new recommended assessment areas and individual assessments according to the results of this study.

Table 5.19 Recommended assessment protocol

Assessment areas					
Auditory Abilities ***Make use of an assistant audiologist**	**Language Abilities**	**Speech Abilities**	**General Development**	**Parent-Child Interaction**	**Questionnaires** **Available in English, Afrikaans and African languages*
• Aided audiogram (125-8000Hz) • Speech discrimination • Speech in Noise Test • Tympanometry • Checklist: Listening Profile (LiP)	• Checklist: DAS (Expressive and receptive language) • Checklist: Rossetti Infant-Toddler Language Scale (receptive and expressive language) • Checklist: Profile of Actual Linguistic Skills (PALS) • Checklist: Pragmatic Aspects of Language • Standardised test: Reynell Developmental Language Scales III - Verbal Comprehension	• Checklist: Speech Intelligibility Rating (SIR) • Checklist: Voice Skills Assessment (VSA) • Checklist: Profile of Actual Linguistic Skills (PALS)	• Checklist: DAS (gross and fine motor, personal-social, self help and perceptual-cognitive) **For children under the age of 60-months* • Checklist: Rossetti-Infant-Toddler Scale (gross and fine motor, play and gestures) **For children under the age of 36-months* • Qualitative assessment of general development (gross and fine motor, personal-social, self-help and perceptual-cognitive) **For children over the age of 60-months* • Checklist: Preschool literacy assessment	• Checklist: Mother Infant Communication Screening (MICS) (video analysis) **For children under the age of 36-months* • Checklist: Caregiver-Child Interaction (video analysis) **For children over the age of 36-months*	• Background information (parents) • Meaningful Auditory Integration Scale (MAIS) (parents and teachers) • Meaningful Use of Speech (MUSS) (parents and teachers)

5.8 RECOMMENDATIONS FOR THE EDUCATIONAL SETTING

Subsequent to the administration and interpretation of the assessment protocol, certain issues were highlighted. The positive aspects of the inclusive educational setting were clear. First of all, the hearing-impaired children were able to function in an inclusive setting as they share classrooms and activities with their hearing peers, and simultaneously receive the additional support services that they need. Furthermore, compulsory parent guidance offered at the school is undoubtedly beneficial to the subjects and their parents. During the parent-child interaction assessment, optimal scores were mostly obtained. Lastly, the subjects' preschool literacy skills were all at the same level as their hearing peers. This is indicative that a large amount of time is spent on book reading and literacy activities.

The concerns that emerged from this study was firstly that the subjects are used to listening in ideal circumstances only, and they experience difficulties when the circumstances change, or when the FM systems are not used. This was evident in the poor 'Speech in Noise Test' results that were obtained. Providing individual sessions or therapy while introducing background noise may assist the individuals to function better in noisy situations, as well as to listen even if the auditory signal is soft or not optimal (Clark et.al, 1997:214). In addition, it was apparent that the subjects are not used to speech discrimination assessments, even though it is strongly recommended in the literature (Scott, 2002:10-26). It is therefore suggested that the educational setting ensures that speech discrimination testing is always included as part of the hearing assessment. Furthermore, poor receptive language scores were evident in all the subjects. It is expected that the "gap" between the chronological age and language scores will close for children implanted before the age of five years (Kirk et.al, 2000:140). Hence, in order to improve the children's language abilities, it is suggested that individual sessions should focus on auditory highlighting of certain sounds or concepts that are below average for their age to enhance their general language abilities and to increase the rate at which their receptive and expressive language develop.

5.9 SUMMARY

In this chapter the results obtained in the current study were discussed according to the five specified sub-aims. These sub-aims were selected in an attempt to answer the main aim of the study. Each sub-aim provided results that were discussed and integrated with current literature to ascertain the validity thereof. A summary of the results was compiled from the findings in each sub-aim, and supplied at the end of the chapter. Recommendations for adaptations to the current protocol followed. The results provided the current study with some clinical implications for further research and applications in the clinical setting.