Running title: Prelinguistic communication skills and autonomy

Communication Skills and Communicative Autonomy of Prelinguistic Deaf and Hard-of-Hearing Children: Application of a Video Feedback Intervention

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Abstract

Background and Aim: Evidence on the efficacy of parenting interventions to support communication development in deaf and hard-of-hearing children is emerging. In previous research, we showed that parental participation in a video feedback-based intervention enhanced parental self-esteem, and emotional availability to their deaf and hard-of-hearing children. This paper investigates the impact of the intervention on development of the children's prelingual communication skills and autonomy. Evidence on the efficacy of parenting interventions to support communication development is warranted.

Methods: Sixteen hearing parents with a prelingual deaf and hard-of-hearing child (*M*age= 2.05 years, SD= 1.77) were recruited by self-selection from paediatric audiological services, and randomly stratified into Intervention First, and Waiting-List Groups. Families completed three sessions of Video Interaction Guidance in their homes. Designed for maximal inclusion, the sample comprised of children with complex developmental and social needs. Primary inclusion criterion was child's prelingual status (<50 signed/spoken words), which was established using speech and language therapy reports. Child communicative autonomy was assessed from a 20-minute free play video-recording using a gold standard measure for deaf and hard-of-hearing children (Tait) before and after the intervention.

Results: Mann-Whitney U test indicated no significant difference between the two groups. The groups were collated and Wilcoxon Signed Rank test with Time (Pre/Post intervention) as a repeating variable was run. A significant increase was shown child's communicative autonomy (Z -3.517, p< .0001, d=0.62), and decrease in child's no-responses (Z -3.111, p< .005, d=0.55) were seen. There was no significant difference in the overall number of turn-taking between the parent and child. Indicating differences in the quality of the parent-child interactions, not the quantity.

Conclusion: This study adds to the emerging evidence for parenting interventions with deaf and hard-of-hearing children. We hypothesise that the video feedback intervention with its focus on emotional availability, created space for the child to show increased communicative autonomy during parent-child interactions. Communicative autonomy is a long-term predictor of communication and linguistic development in deaf and hard-of-hearing children, and its conceptual underpinning makes it a good early measure of relational agency. Results can inform wider interventions that focus on quantity of the parent-child communication.

Keywords: video feedback, pre-linguistic, communication, autonomy, video-interaction-guidance, deaf

Introduction

Parent-child interactions provide a window into understanding the quality of parent-child relationships (Topping, Dekhinet, & Zeedyk, 2013), and provide a pathway for the development of communication skills in the child (Bornstein, 2000). Emotionally attuned interactions marked with genuine warmth, sensitivity, and appropriate connectedness are essential for overall child development (Landry, Smith, & Swank, 2006; Nelson, Zeanah, & Fox, 2019). This includes the development of early brain systems (Piazza, Hasenfratz, Hasson, & Lew-Williams, 2020), social competence (Rispoli, McGoey, Koziol, & Schreiber, 2013; Sheffield Morris, Silk, Steinberg, Myers, & Robinson, 2007), language (Topping et al., 2013), and cognition (Landry et al., 2006; Landry, Smith, Swank , & Miller-Loncar, 2003) in the short and long-term (Nelson et al., 2019). A parent who responds to her child's verbal and non-verbal communication cues in an attuned manner scaffolds the child's communicative autonomy. Communicative autonomy occurs when an individual can communicate their own intentions and motivations in a self-preferred manner (von Tetzchner & Grove, 2003). In the context of parent-child communication, communicative autonomy is created when the parent makes space for and responds to the child's initiatives. The child can build upon these parental responses and create a reciprocal meaning making environment (Troutman, 2015). However, there are several conditions where this communicative reciprocity can be challenged, which when left unattended can adversely affect the quality of the developing parent-child relationship (Easterbrooks, Bureau, & Lyons-Ruth, 2012). Research into the impact of a child's disability on the parent-child relationship indicates that it is the complex interplay between the parent or caregiver's psychological health and the nature of the child's disability that affects the parent-child relationship rather than the child's disability per se (Howe, 2006; Spiker, Boyce, & Boyce, 2002). Parent training programmes focused on improving the relational quality between the parent and child can help mitigate risks associated with unhelpful parent-child communication (Letourneau et al., 2001).

Circumstances where a hearing parent has a child with congenital deafness provides a pertinent milieu to study the mismatch between communication demands resulting from the child's hearing status (Barker et al., 2009). Universal Hearing Screening has significantly reduced the average age at which children with hearing impairment are diagnosed (Bamford, Uus, & Davis, 2005). Still disparities remain in the timely access of the intervention of choice, e.g. cochlear implant(s) for a number of families in many parts of the world including the US and UK owing to a number of ecological factors such as hearing loss characteristics, parental demographics and provider barriers (Bush, Kaufman, & McNulty, 2017; Hanvey, Ambler, Maggs, & Wilson, 2016). There is variability in the development of oral language even after two to three years of cochlear implantation even when child's age and implant use are accounted for (Niparko et al., 2010; Svirsky, Robbins, Kirk, Pisoni, & Miyamoto, 2000). Indicating that some children could be falling through the system and missing out on adequate support. The interaction of hearing parents with their deaf and hard-of-hearing children is known to be marked with more structuring and dominant interactions that are lower in sensitivity, responsiveness, and affect matching by the parent (Lam & Kitamura, 2010, 2012; Meadows-Orland, 1997; Pipp-Siegel, Blair, Deas, Pressman, & Yoshinaga-Itano, 1998), pointing towards an authoritarian parenting style (Knutson, Johnson, & Sullivan, 2004) . Hearing parents are known to have fewer successful moments of interactions with their deaf and hard-of-hearing child (Beatrijs, Kristiane, & Mieke, 2019). Delays in communication (Barker et al., 2009), language (Moeller et al., 2007), and social competence (Hoffman, Quittner, & Cejas, 2014) in deaf and hard-of-hearing children further compounds the behavioural shortcomings on the parent's part.

Exposure to a language rich environment is essential for a deaf and hard-of-hearing child. Hence, evidence has successfully focused on promoting family focused interventions (Yoshinaga-Itano, 2014). These interventions have focused on targeting 'quantities' of a child's speech and language outcomes such as speech perception, vocabulary size, and expressive and receptive language output (Svirsky et al., 2000), and on promoting higher 'quantities' of parent language use such as conversational turns, and mean length of utterances (Ambrose, VanDam, & Moeller, 2014). Such quantitative indicators of improvement are receiving continued attention and are supported by developments such as the Language Environment Analysis system (LENA) (Ganek & Eriks-Brophy, 2016) in the typical development, developmental disabilities, and childhood deafness literature. LENA is a digital language processor designed to capture and analyse extensive amounts of verbal data and produce core language metrics such as the quantity of adult and child words, and number of conversational turns (Ganek & Eriks-Brophy, 2016). A recent study by Christakis et al. (2019) reported on a clinic based multimodal intervention that used LENA. Their study used a combination of brief instructional videos presented via a smartphone app, advice from physician(s), and brief coaching based on the LENA counts to test whether an intervention improved home language environment and language development. The intervention consisted of short actionable tips and feedback to promote behavioral change in 61 parents of typically developing children aged 2 to 12 months in a pediatric clinic in a pre-post and follow up design. Results at follow-up indicated significant improvements in adult word counts, parent-child conversational turns, but no improvements in child vocalisations (Christakis et al., 2019). In another study, Nilsen et al. (2016) examined the influence of para-linguistic factors and mother-child communication where the child had ADHD. Their results found that child's level of ADHD impacted on the mother's para-linguistics factors including the pitch level and amplitude of the mother's voice (Nilsen, Rints, Ethier, & Moroz, 2016). It is important to understand how the style of parent communication and timing of speech input shapes communication between hearing parents of deaf or hard-of-hearing children. There is evidence that parallel talk or commenting, sensitivity of responding, and being child lead support language outcomes in deaf/hard-of-hearing children (Cruz, Quittner, Marker, DesJardin, & Team, 2013; DesJardin et al., 2014), and are usually suggested as a means of supporting communication. In a qualitative research study, Decker et al. (2016) interviewed 12 hearing parents of children with hearing loss to explore the nature of information that parents receive to help with management of their child's hearing. The key theme that emerged was for parents' to "keep talking" to their deaf and hard-of hearing child, and to focus on sound and the child's hearing. This advice to "keep talking'' is common and an essential piece of advice in early interventions for deaf and hard-of-hearing children. However, if analysis of parent-child conversation is limited to "word counts", the bi-directional reciprocity and characteristics of attuned parent-child interaction (Beebe et al., 2010; Jaffe et al., 2001) is largely overlooked. Both the "quantitative" and "qualitative" indicators are essential as measures for communication development, and provide ways of scaffolding communication and language development respectively. However, there is a danger that a focus only on the "quantitative" factors can miss the underlying fundamental relational and dialogic context of communication development. This relational and dialogic context is critical for language development in both children with and without hearing loss. Evidence suggests that early interventions and a focus on maternal sensitivity where parents' learn to attune to the child can enhance language outcomes in deaf and hard-of-hearing children (Ching & Dillon, 2013; Quittner et al., 2013). Thus, it can be postulated that using relational principles of attending to and tuning into to the deaf and hard-of-hearing child can potentially result in communicative advantages for the child. However, a gap remains in

understanding precisely how interventions impact on the quality of vocal communication between a hearing parent and their deaf and hard-of-hearing child (Cruz et al., 2013).

Tait and colleagues (Tait, Nikolopoulos, Lutman, Wilson, & Wells, 2001) developed a video coding framework to measure early communication development in deaf and hard-of-hearing children. This measure examines quantity and quality of turn-taking between the parent-child, and classifies the child's role in these turns as autonomous or not. The concept of communicative autonomy as used in this study is shaped and moulded by the Tait measure. Past evidence using the Tait measures indicated that the level of communicative autonomy shown by deaf and hard-of-hearing children prior to cochlear implantation was related to performance on speech perception tasks post implantation (Tait, Lutman, & Nikolopoulos, 2001; Tait & Lutman, 1997; Tait, Nikolopoulos, Lutman, Wilson, & Wells, 2001; Tait, Nikolopoulos, Wells, & White, 2007). Another study that used the Tait coding framework as an outcome measure after cochlear implantation showed a quick increase in turn-taking and a slow increase in autonomy 12 months post implantation (Chen, Chen, Jiang, Zheng, & Gong, 2011). Other research in children with cochlear implants found a positive but weak relationship between prelinguistic communication and language development (Kane, Schopmeyer, Mellon, Wang, & Niparko, 2004). These studies indicate that communicative autonomy can serve an important function in the development of speech and language skills, and a way of measuring early communicative development in deaf and hard-of-hearing children. However, these studies did not explore the quality of maternal sensitivity, or communicative space making within the parent-child interaction.

Communicative autonomy indicates self-determination on the person's part to operate and relate to others from either an instrumental ('*I-It'*) or mutual ('*I-You'*) perspective (Zank & Braiterman, 2014). Buber's relational ontology of dialogue explains that the fundamental need of individuals is to relate to others and it is this relational need that defines our existence (Zank & Braiterman, 2014). A highly autonomous individual will act in accordance to their authentic interests or values, and shape the relational dynamics by creating and maintaining the interactional space (Ryan & Deci, 2000). Parenting practices that promote autonomous child behaviour and experiences, socially reinforce optimal communicative experiences for the child, and provide a foundation for 'relational agency' in the child. Relational agency occurs when individuals actively participate and contribute to their life circumstances within the context of their family and social life (De Mol, Reijmers, Verhofstadt, & Kuczynski, 2018). One can argue that in family communication parent-child interaction is the space where relational agency is developed, as relationships are constructed in daily communications (Relational Dialectics Theory) (Baxter, 2011), and mediated by intersubjectivity (Trevarthen, 1979). In the childhood deafness literature the Tait video analysis provides an opportunity to investigate communicative autonomy given its focus on *prelinguistic development* (Tait, Nikolopoulos, Wells, & White, 2007), and postulate it's theoretical relevance to relational agency. The Tait measure is thus used as a primary outcome measure in the present study. An investigation into the number and nature of turn-taking episodes provides an opportunity to examine the *quantity* and the *quality* of interaction.

Video feedback interventions, such as Video Interaction Guidance (VIG) can enhance the quality of parent-child relationship (Kennedy, Landor, & Todd, 2011) . VIG is a strengths based effective intervention, which builds positive relationships through filming, micro-analysis of and feeding back on positive moments in the interaction (James, 2011). Three to four sessions of VIG in dyads with and without child hearing loss is known to have a positive

impact on parent-child communication and relationship (Juffer, Bakermans-Kranenburg, & van IJzendoorn, 2005a; Lam-Cassettari, Wadnerkar Kamble, & James, 2015). Following participation in VIG, hearing children that had been adopted showed a decrease in disorganized behaviours and attachment styles (Juffer, Bakermans-Kranenburg, & van Ijzendoorn, 2005b). Similar increases in maternal sensitivity were shown by Lam-Cassettari et al., (2015) in the context of childhood hearing loss and use of VIG. Mothers also showed appropriate structuring, decreases in hostility and increase in their perceived level of self-esteem. Improvements were also shown in child responsiveness and involvement in mother-child interaction (Lam-Cassettari et al., 2015). The positive impact that maternal sensitivity and attentiveness has on social interactions with children in the context of hearing loss has also been shown in the longer-term language growth of children who are deaf and hard-of-hearing and not attending a video intervention service (Quittner et al., 2013).

Over a period of one and a half years (2010-2012) our research lab conducted the first ever trial of VIG using N=1 intervention design with 16 families, who were concurrently randomised and stratified in either a waiting-list or an intervention first group (James, Wadnerkar Kamble, & Lam-Cassettari, 2013; Lam-Cassettari et al., 2015; Wadnerkar Kamble, Lam-Cassettari, & James, 2014). The programme of research focused on increasing parental sensitivity and attention to the strengths shown in the parent-child relationship where the child was deaf and hard-of-hearing. Results showed a large effect on the Emotional Availability (EA) scales for both the waiting-list and the intervention group (Lam-Cassettari et al., 2015). Indicating that the video feedback intervention enhanced parental sensitivity and attentiveness towards their deaf and hard-of-hearing child. The only other published study that has used VIG with families of deaf and hard-of-hearing children is a non-randomized, clinical trial with case reports (dos Santos & Brazorotto, 2018). This study found post intervention improvements in parent-child interactions as measured by an observation scale looking at the use of facilitative language strategies by the parents such as being child-led, and using an expansive vocabulary. Children in the dos Santos et al. (2018) study were older than our sample. There is no indication of the child's communication or speech and language status in their paper.

It is not well understood how interventions including video feedback can shape communication skills in the prelinguistic phase in deaf and hard-of-hearing children (Terlektsi et al., 2019). Evidence is required to ascertain the influence of video feedback intervention on the deaf and hard-of-hearing children's communicative autonomy, and the development of relational agency. The current paper builds on previously published results (Lam-Cassettari et al., 2015) by looking at the quantity and the quality of child communication. This paper investigates how the intervention influences the i) communication skills of the child based on the counts of turn-taking and no-responses, i.e the quantity, and ii) the quality of parent-child interactions, i.e. the child's autonomy.
The research question for this paper was: What are the effects of the video feedback-based intervention on the prelingual deaf and hard-of-hearing child's i) communication skills (turn-taking and no-responses), and ii) communicative autonomy? This study hypothesized that the intervention will enhance the prelingual deaf and hard-of-hearing child's i) communication skills, i.e. increase turn-taking and decrease no-responses, and ii) communicative autonomy.

Material and Methods

Participants

Sixteen families with hearing parents and congenitally deaf and hard-of hearing prelingual children were recruited by self-selection from the Nottingham paediatric audiological services. Families responded to information packs provided at the audiological management services between June 2010 and July 2011. All participants were of British origin, except one who was European and non-English speaker. The researchers worked with an interpreter for all assessment and intervention visits with this family. Study inclusion criterion was the child's prelingual status as <50 signed/spoken words (Clark, 1996), which was established from reports by the Speech and Language Therapist. Owing to the heterogeneity in children who are deaf and or hard-of-hearing this study had a mix of age range (Mean age 2.03 years, SD= 1.94, Range 0,6-6,10 years) and developmental ability. There is a paucity of research with children who have complex needs along with deafness/hearing impairment (McCracken & Pettitt, 2011). Hence, this intervention study was designed to be maximally inclusive of prelingual deaf and hard-of-hearing children who had additional developmental and social conditions as shown by 37.5% of this sample having complex needs. The majority of the children were male, i.e. 69%. This concurs with a higher prevalence of males in congenitally deaf children in general (Cremers, 1994). Table 1 summarises demographic details of the children. The study achieved 100% compliance and no attrition. Participants were compensated for their travel costs to attend the laboratory assessments. Although, this study had a heterogeneous sample of children there was no statistical difference between the groups in terms of sex, level of hearing loss, type of hearing prostheses, presence of complex needs, birth order, or child age at enrolment to the study.

[INSERT TABLE 1 HERE]

Ethics

This research programme received ethical approval from the Nottingham University Hospitals Trust and the Derbyshire Research Ethics Committee, UK (NRES reference: 10/H0401/10), with continued approval to analyse and present data from the original study. Written informed consent was obtained from parents before stratification.

Procedure

Families were randomly stratified (Altman & Bland, 2005) to the intervention group (IG) or waiting-list groups (WLG) based on child's age, sex, level of hearing loss, and additional needs by a research assistant not directly involved with the data-collection. Families in the WLG group had double baseline sessions, i.e. pre intervention baseline 1 and pre intervention baseline 2, and only one post intervention session. Families in the IG group had double post intervention sessions, i.e. post intervention 1 and post intervention 2, and only one pre intervention baseline.

Data were collected by MWK and CLC before and after the intervention in a purpose-built family room at the Child and Family Research lab in the University of Nottingham over a period of one year. Data collection involved parents completing questionnaires, video recording 20 minutes of unstructured parent-child free play, and participating in semi-structured interviews. Details related to the procedure are described in Lam-Cassettari et al., (2015). Families completed three sessions of Video Interaction Guidance in their homes.

One of the authors (DMJ) who was trained in Tait analysis coded the videos following the Tait protocol after interventions were finished and all data collection was complete. The Tait coding involved viewing the 20 minutes of free play recording twice to find the most two minutes of successful sequence of communication. The selection of the two consecutive minutes from each 20 minute recording of the parent-child play session at the lab was the best section of natural play as judged by the coder (as per the Tait protocol). Criteria for selection in this study entailed the overall quality of the interaction between parent and child, the degree of active participation from the child and responsiveness of the mother to the child's initiatives. The selection was not subject to inter-rater reliability; only the coding of the turn types was. To establish inter-rater reliability of the coded segments a research assistant who was also trained in Tait analysis coded 30% of the videos, which were randomly selected from the entire sample of 48 videos. Inter-rater reliability was measured using ICC. There was very good agreement between the first and second rater as indicated by ICC's ranging from .85 - .87 across all turn types. Both DMJ and the research assistant were blind to the order of test sessions and neither were involved in the data collection.

Outcome Measures

Dependent variable

Tait video analysis measure

The Tait video analysis procedure is an established video coding framework of pre-verbal communication in the childhood deafness literature, and has a high inter and intra rater agreement (Tait et al., 2007). Coding is performed on two minutes of purposefully selected audio-video recordings of the child to assess pre-verbal communicative behaviours. The Tait framework categorizes the child's communicative behaviours (gestures, and vocalizations) into three behavioral codes: i) turn-taking between the parent and the child (gestural, or vocal), ii) communicative autonomy, and iii) no-response (Tait et al., 2007). i) Turn-taking is coded first. Turn-taking is defined when the child makes use of the opportunity to communicate. The parent creates this opportunity for the child when they say/do something, or leave a pause for the child to respond. Turn-taking also occurs when the child interrupts the parent's communication. Turn-taking provides an indication of the *quantity* of interaction. This study coded the turns as gestural and vocal, but used a combined score of these two as a turn-taking score; ii) Communicative autonomy is coded by counting the number of turns in which the child's communication could not be directly anticipated from the parent's earlier turn. For example, a child may look away when the parent offered something, and pick up another item. Communicative autonomy results in a change of focus/direction of the interaction with the parent (Tait et al., 2001). Communicative autonomy provides an indication of the *quality* of interaction iii) No-response is coded where the child *does not* respond to the parent when there is a clear opportunity for a response from the child, for example when the parent asks the child a question (Tait et al., 2007). In this study the purposeful selection of a two minutes of coding frame was extracted from a 20 minutes free play video-recording of the parent and the child. This free-play recording was the same as that used in our previous published work (James et al., 2013; Lam-Cassettari et al., 2015; Wadnerkar Kamble et al., 2014), hence giving the same context of observation, albeit with a focus on the child's voice.

Specific details about the Tait coding framework as used in this study

The children in this study were at a very early stage of linguistic development. They did not speak or sign in sentences. Turns, whether signed or vocalised consisted of single expressions. The details for coding, interpreting and analysing was as follows:

Identification of two minutes of coding segment: Identify the section of consecutive play and the start and end points to capture two minutes.
Transcription: Using broad orthographic transcription, transcribe each of the carer's and the child's utterances and behaviours during the two-minute selection.
Identify turn types: Go through each child's turn and identify the turns and their type taken by the child. For example, in the following segment, the mother did not take any turn between the two turns by the child. Hence, this sequence of two separable events were coded as two turns- one gestural and one vocal.

CHILD A child holds hands out towards mum (Gestural Turn)
CHILD A walks towards fan and touches the fan and vocalises (Vocal Turn)

Identifying a non-response (a classified turn type) is easier than it might sound given its classification is based on its absence. It occurs when the carer gives space for a response, expects
a response and where no response is given by the child. This is exemplified as follows:

(mother's utterances are italicized):

CHILD A falls over
Mum *oh are you okay*?
CHILD A moves the chair (No response) vocalises (Vocal Turn)
Mum *oh*
CHILD A vocalises and looks at mum (Vocal Turn)
Mum *wanna pick these up*
CHILD A plays on own, pushing chair, plays on own (No Response)

The above examples show how the child's initiative and behaviour were used to determine turn types, no-response, gestural and vocal turns. The following is an example of communicative autonomy:

Mum: ah

Child: (points at new location) (gestural autonomy)

Mum (Laughs) – oh that one

In this example, the child's gesture has the result of directing the play as indicated by the mother's response.

Quasi-control measure

Vineland Adaptive Behavior Scales

The Vineland Adaptive Behavior Scales (VABS) is a validated, reliable, and standardised developmental measure, with good internal consistency and test-retest reliability (Sparrow, Balla, & Cicchetti, 2005). The VABS can be used reliably with individuals with complex communicative needs and developmental delays (de Bildt, Kraijer, Sytema, & Minderaa, 2005). VABS was administered during a detailed parental interview (of 20-60 minutes duration) to assess personal and social sufficiency of the child. The raw scores were converted to standard scores scores (M=100, SD=15). The Adaptive Behaviour Composite Score (ABC score) was used to track developmental changes in the child before and after the intervention. The VABS was administered during the pre-intervention baseline 1, and the post-intervention 1 for both the WLG, and the IG.

Intervention

Video Interaction Guidance (VIG) (James, 2011; Kennedy et al., 2011), is an evidence based and accredited intervention using guided video feedback of spontaneous parent-child interactions to increase parental responsiveness to a child's communication and behavioural cues, and promote attuned interactions between parent and child. VIG involves an initial family centric goal setting session, which is followed by three goal directed filming sessions and three shared review sessions of parent–child interaction in the family home. The shared review sessions are facilitated by a trained VIG guider (DMJ). Three short video clips (demonstrating attuned responses linked to the family's goal) are played in each of the shared review sessions and families are guided to microanalyse and reflect on the behaviours that facilitated successful communication with their child. The specific process of the intervention is described in detail in published work from our lab (Collins & James, 2013; James, 2017; James et al., 2013; Lam-Cassettari et al., 2015).

Study Design

The original protocol from the larger research programme employed double baseline for the waiting-list group (WLG) and double post-intervention sessions for the intervention first group (IG) (Figure 1). This was to chart changes without the intervention, and to capture the maintenance of any gains made during the intervention. The original protocol hypothesized that there will be no significant difference between the WLG and IG. The groups were eventually collapsed to look at differences at pre and post intervention. The current study presents a multi-stage analyses as shown below, and explains the stage by stage process leading to the collapsing of the groups (Figure 2).

[INSERT FIGURES 1 and 2 HERE]

Data analysis

Stage 1 analysis: Differences within the double post intervention sessions for the Intervention First Group (IG), and the double baseline sessions for the Waiting-list group (WLG)

Wilcoxon Signed-rank test was used to analyse differences within the double post intervention, and the double baseline sessions for the IG, and the WLG respectively. This was necessary to aid the choice of the very first pre (pre 1) and post (post 1) session for the stage 2 between group analysis.

Stage 2 analysis: Differences between the Intervention First Group (IG) and Waiting-list group (WLG) at pre 1, and post 1 intervention

Mann-Whitney U test was conducted to test for between group differences in the IG and the WLG at the pre 1, and at the post 1 intervention levels.

Stage 3 analysis- Differences at pre and post intervention after collapsing the two groups

The two smaller groups were collapsed to form one bigger group with Time (Pre/Post) as the repeating factor in a within subjects design. This was done to power the analysis, and is the main analysis to address the hypothesis set for this paper.

Wilcoxon Signed-rank test was used to test for pre-post intervention differences. Spearman's correlational coefficient was used to test for correlations between the Tait measures. Fisher's r-to-z transformation was performed to compare the correlations.

Additionally, case by case scores are presented for the individual families to illustrate changes in the Tait at pre and post intervention parent-child dyad level.

Results

Stage 1 analysis: Differences within the double post intervention sessions for the Intervention First Group (IG), and the double baseline sessions for the Waiting-list group (WLG)

Wilcoxon signed rank test indicated that there was no significant difference within the double post intervention sessions for the IG, and the double baseline for the WLG. This determined the choice of sessions, i.e. pre 1 and post 1, that were included in the stage 2 between group analysis. See Table 2 for the descriptive scores and statistics for the double baseline, and double post sessions.

[INSERT TABLE 2 HERE]

Stage 2 analysis: Differences between the Intervention First Group (IG) and Waiting-list group (WLG) at pre 1 and post 1 intervention

Vineland Adaptive Behaviour Scale: Mann-Whitney U test showed that there was no significant difference between the IG and the WLG at pre 1 intervention on the Adaptive Behaviour Composite score, or at post 1 intervention. See Table 3 for the descriptive scores and statistics for the Vineland Adaptive Behaviour Scale for the two groups.

[INSERT TABLE 3 HERE]

Tait video analysis: Mann-Whitney U test showed no significant difference between the IG and the WLG at pre 1 intervention for Child's Autonomy ($U = 29.50$, $p > 0.05$); Child's no-response ($U = 26.00$, $p > 0.05$); and Turn-taking ($U = 31.00$, $p > 0.05$). No significant difference between the IG and the WLG was seen at post 1 intervention for Child's Autonomy ($U = 27.50$, $p > 0.05$); Child's no-response ($U = 24.00$, $p > 0.05$); and Turn-taking ($U = 29.00$, $p > 0.05$). See Table 2 for the descriptive scores on the Tait video analysis for the

groups. These results indicated that the two smaller groups could be collapsed as one bigger group.

Stage 3 analysis: Differences at pre and post intervention after collapsing the two groups

Vineland Adaptive Behaviour Scale: A Wilcoxon signed rank test indicated that there was no significant difference between the pre and post intervention Adaptive Behaviour Composite score ($Z = -1.226$, $p>0.05$). See Table 3 for the descriptive scores on the Vineland Adaptive Behaviour Scale.

Tait video analysis: A Wilcoxon signed rank test indicated that there was a significant difference on Tait pre and post intervention scores for Child's Autonomy ($Z = -3.517$, $p< 0.0001$, $d=0.62$), and Child's no-response ($Z = -3.111$, $p<0.005$, $d=0.55$). Turn-taking showed no significant difference ($Z = -.491$, $p= 0.623$, $d=0.12$). At post intervention there was a large increase in the median scores for Child's Autonomy (Pre Mdn= 8.50; Post Mdn= 26.80), and a large decrease in Child's no-response (Pre Mdn= 27; Post Mdn= 0.00). Turn-taking increased slightly post-intervention (Pre Mdn= 61.55; Post Mdn= 64.50). See Table 4 for the descriptive scores on the Tait video analysis.

At pre intervention a significant negative correlation was seen only between Turn-taking and Child's no-response, Spearman's $r(16) = -.498$, $p = .05$, Fisher-Z= -.547. At post intervention, Child's Autonomy was seen to be negatively correlated with Turn-taking, Spearman's $r(16) = -.844$, $p < .001$, Fisher-Z= -1.23, and with Child's no-response, Spearman's $r(16) = -.632$, $p < .01$, Fisher-Z= -.745.

[INSERT TABLE 4 HERE]

Case-by-case investigation

A case-by-case investigation indicated that at post intervention all the 16 children had higher scores on Child's Autonomy, Turn-taking showed an increase in 10 cases, and 12 children had reduced no-responses. Six cases showed a decrease in Turn-taking, and one child showed an increase in no-responses (case #7 with severe developmental delays). Three children (cases #10, 11, and 16, no complex needs) had the same number of no-responses (i.e. 0) at both pre and post intervention. These three cases are part of the six cases who showed a decrease in turn-taking at post intervention. See Figures 3 for the case-by-case scores for pre and post intervention.

[INSERT FIGURE 3 HERE]

Discussion

This study set out to examine the premise that parental participation in a video feedback-based intervention will enhance the prelingual deaf and hard-of-hearing child's i) communication skills, i.e. increase turn-taking and decrease no-responses, and ii) communicative autonomy. Results partly support the hypotheses. We found a significant increase in the child's communicative autonomy, i.e an indicator of the *quality* of parent-child interaction. Gains in the child's communication skills were evidenced by the significant decrease in child's no-responses. However, the number of turn-taking between the parent and the child did not change significantly. The *quantity* of parent-child interaction did change partly after the intervention, i.e. only a minor increase in the number of turn-taking, but no-

response did decrease to a great extent. After the intervention child's communicative autonomy was negatively correlated with turn-taking, and child's no-responses. The strongest relation was seen between child's autonomy, and turn-taking. Non-significant results on the Vineland Adaptive Behavioural Scales, and between the double baseline and double post intervention sessions indicate that the children were not at an accelerated period of overall development. The general developmental changes, or the time lag between the sessions cannot explain the changes in development of the communication skills and communicative autonomy.

As demonstrated by the reduction of no-response, the deaf and hard-of-hearing children were making a lot more of their turns in relation to the space made by the parent for the child's initiative. After the intervention, the parent-child interaction resembled more of a two-way dialogic interaction rather than the parent needing to keep creating opportunities for the child to participate. The interaction space between the parent and the child was being relationally shaped so that the deaf and hard-of-hearing child was an equal participant in shaping what was to happen next and not just a participant in keeping the conversation going. This *relational negotiation* could be what resulted in the difference between the quantity and the quality of the interaction. Based on the results of the correlations the indicator of *quality*, i.e communicative autonomy was related to the indicators of quantity, i.e. turn-taking, and no-response. Illustrating that the quality of parent-child interaction might be going along with the quantity. Parent's sensitivity of responding is known to support children's language outcomes (Cruz et al., 2013; DesJardin et al., 2014). Video feedback-based intervention enhanced parental sensitivity and attentiveness (Lam-Cassettari et al., 2015), possibly leaving more space for the communicative ability and autonomy of the deaf and hard-of-hearing child to find their voice. This was true for almost all children in this study. However, one child with severe developmental delay had an increase in no-responses and a decrease in the overall number of turns. For this parent/child dyad this showed an inverse relation between turn-taking and no-responses. Interestingly, three of the cases where the children were responding to their parents turns, i.e. had zero no-responses at pre and post intervention showed a reduction in the parent-child turn taking, and an increase in autonomy after the intervention. This could support the inter-relatedness of the quality and quantity of parent-child interaction possibly mediated by parental sensitivity and attentiveness. If the parent occupies a more direct role in managing the turn-taking then this reduces the opportunity for the child to develop their autonomy in the interaction. In developmental research, the *qualities* of parents' language are important along with the *quantitative* indicators. Just counting turns or utterances does not indicate the real changes that are happening with autonomy within dialogue, i.e. relational agency. Previous studies did not explore the quality of maternal sensitivity, or space making within the parent-child interaction. Investigations with hearing children have used a standalone coding frame to account for child's use of pointing and vocalizations, and mother's attention. Such studies, which do include maternal responsivity indicate a bidirectional nature of parent-child interactions, and contributions of this interplay to subsequent language development (Wu & Gros-Louis, 2014). Scores on the Tait, a gold-standard outcome measure, are known to be predictive of later speech and language development in prelingual deaf and hard-of-hearing children with cochlear implants (Chen et al., 2011; Tait & Lutman, 1997; Tait et al., 2001). Hence, the use of video feedback with hearing parents of deaf and hard-of-hearing children can be a way to bring about communicative gains and autonomy in the child.

Throughout their development, infants are given critical opportunities to learn as they partake in parent-child interactions in which parents provide opportunities for the child to develop

their knowledge about the conversational rules, and ways of relating to others (Laible, 2004, 2006; Laible, Carlo, Torquati, & Ontai, 2004). Post the intervention the hearing parent who is more attuned and attentive to their deaf or hard-or hearing child is creating communicative opportunities such that the child is getting to exercise their 'dialogical agency'. Buber's relational ontology of dialogue can provide a framework to understand these results. Children could be relating as if they were aware of alternatives, making a transition between the *I-It* and *I-You* relations (Lawrence, 2019; Reddy, 2008) and thus beginning to exercise their 'dialogical agency'. This could have made possible by the increased sensitivity and attunement of the parents during interactions with their child. Based on the results from this study it can be postulated that the child has an increased agency post the intervention and is then influencing the parent more, and vice-versa. The role and function of communicative autonomy in human interaction is beyond simply leading or being independent. The autonomous child could to be acting with their interest and activating the parent to follow the child's lead, thus the deaf and hard-of-hearing child as the agent driving the relational agency with respect to their hearing parent (Ryan & Deci, 2000). From the perspective of Self Determination Theory (Deci & Ryan, 2012), an increased sense of autonomy serves a two-way function. It brings about a greater sense of integration within oneself, which in-turn brings about a greater sense of relatedness with external partners, such as members of the family, and society. The deaf and hard-of-hearing child could be finding ways to relate and respond better to their hearing parent as an equal and active communication partner rather than being solely reliant on the hearing prosthesis, and communicative advances made by their hearing partner. In the Tait analysis the pragmatic or communicative intent of the child overlays the modality of expression of the child's turns. The overlaying of quantity and quality of the turn-types as measured in Tait, therefore represents the development of communicative intent and autonomy as it arises with and through the modality of expression. Communicative autonomy can serve an important function in relation making, and more specifically in the development of speech and language skills. Indicating that interventions for promoting autonomy in parent-child interactions may lead to improved outcomes, and should be implemented as early as possible after the diagnosis of deafness.

The video feedback-based intervention 'Video Interaction Guidance' is central to bring about this change (James 2011, Kennedy, Landor et al. 2011). The intervention helps the parents to recognise, and respond to the child's emotional and behavioural cues, and to re-eastablish or re-aling the connection when requried, i.e. increase attuned interactions (Doria, Kennedy, Strathie, & Strathie, 2013). Attuned interactions can help to move the parent-child relationship towards intersubjectivity (Trevarthen, 1979). Intersubjectivity is when the relationship moves from the parent being a secure base for the child, to a relational pattern where both the parent and the child are sharing experiences, developing understanding and knowledge, and expectations, i.e. both the parent and the child are socially constructing their relational space (Stern, 2005), and creating relational agency (Baxter, 2011).

In the field of childhood deafness, there could be a reliance on technology, e.g. cochlear implants to bring about communicative gains. Giving access to technology does not result in same gains in all children, especially for children with complex needs (Niparko et al., 2010; Svirsky et al., 2000). Our study found that working with parents does seem to change parent's approach to the communicative context (Lam-Cassettari et al., 2015). This could be the reason the children achieved a greater communicative gain in the current study. The Tait measure advances the tools used to capture changes in early communicative development and could be used in hearing difficulties/hearing dyads. Government policies on interventions to support deaf and hard-of-hearing children emphasis on the role of parents (Terlektsi et al.,

2019). However, research has largely focused on parent's role in shaping social interactions, much to the exclusion of the child's role. Our research programme was the first to start using video feedback (Video Interaction Guidance) in working with hearing parents of deaf and hard-of-hearing children. The use of such video feedback to enhance child's communicative gains remains under used in the field of childhood deafness. By means of the intervention, parents were guided to be attuned to the child, and to give space for the child's initiative, as indicated by the increase on the scores on the emotional availability scores, i.e parental sensitivity and structuring (Lam-Cassettari et al., 2015). These parental behaviours might be supporting autonomy in the child. Based on the results one can argue that parental warmth and reciprocity during free play will lead to more autonomy in communication.

Limitations

Generalisability of these results are limited by the sample size, large standard deviations, and lack of a pure control group such as hearing children. Mediator analysis using child's age and parental sensitivity measure such as emotional availability was not possible due to the sample size in this study. Future studies could include inter-rater reliability on the selection of the clips for coding. A bigger longitudinal study that follows the deaf and hard-of-hearing children for 24-36 months post the intervention will help provide definite results on the impact of the video feedback-based intervention, and communicative autonomy on later language development. However, the current results suggest that improving communication through situated relationally-based interventions could be an important factor to bring about changes at the parent and the child level. The increased autonomy could be predictive of later mastery of language irrespective of the modality of expression. A relational perspective should be integral to the early intervention strategies for prelingual deaf and hard-of-hearing children.

Conclusion

This paper is important, as it highlights the importance of investigating the quality of parent-child interactions to consider communicative gains in the deaf and hard-of hearing children using video-feedback based intervention, using an inclusive sample with complex needs. The development of communicative autonomy during the prelinguistic period is known to be predictive of later speech and language development in deaf children. It is the quality of the space that the parent makes for the child's initiative that can shape the communicative environment. Thus, emotional availability of the parent is fundamentally important. The role of dialogue and participation in dialogue plays a central role as the antecedents of language development. It is the deaf and hard-of-hearing child's active involvement with meaning making and participation in dialogue with the parent that creates relational agency.

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Table 1. Demographic details of the deaf and hard-of-hearing children (N=16)

Demographic	**Details**
Sex	11 male, 5 female children; 15 mothers and 1 father
Age: M(SD)	2.3 (1.94)
Age Range	0,6 - 6,10 years
Level of hearing impairment	14 profound, 2 moderate-severe
Type of hearing prosthesis, and length	9 with Cochlear Implants (0-12 months of use); 7 with bilateral hearing aids
Complex needs	10 with no complex needs, 6 with complex needs (37.5% of the sample had complex needs)
Details of complex needs	1× Autism, 1× severe ADHD, 1× severe learning disability, 2× preterm and associated delay, 1× cytomegalovirus/global developmental delay
Birth order	6 × first born, 8 × second born, 2 × third born

Table 2. Mean (SD) for scores from the Tait video analysis for the three behavioural codes from the original protocol, for the Intervention First group (IG, n=9) and for the Waiting List group (WLG, n=7) for double baseline pre and double post intervention sessions.

	Waiting List group			Intervention First group		
	Pre intervention baseline 1	Pre intervention baseline 2	Post intervention 1	Pre intervention baseline 1	Post intervention 1	Post intervention 2
Turn-taking	60.30 (17.69)	60.22 (14.62)	64.10 (17.02)	59.68 (20.63)	61.62 (16.06)	60.78 (14.88)
Child's Autonomy	9.22 (5.38)	15.91 (8.15)	26.53 (12.40)	14.51 (14.44)	33.06 (19.40)	32.61 (14.35)
Child's No-response	25.47 (15.56)	24.57 (13.59)	6.85 (12.22)	20.76 (16.20)	1.74 (3.48)	1.96 (3.05)

No significant difference within the Post 1 and Post 2 sessions for the intervention first group (Autonomy, Z = -.943 , p>0.05; Turn-taking, Z = -.944, p>0.05; Child's no-response, Z = -.730 p>0.05), and the Pre 1 and Pre 2 sessions for the waiting list group (Autonomy, Z = -1.85 p>0.05; Turn-taking, Z = -.169 p>0.05; Child's no-response, Z = -.210 p>0.05).

Table 3. Mean (SD) for the pre and post intervention Adaptive Behaviour Composite Score (ABC score) Vineland Adaptive Behaviour Scale for the Intervention First group (IG, n=9), Waiting List group (WLG, n=7), and for the two groups as collapse (N=16)

	Pre intervention	Post intervention
IG	67.11 (23.12)	67.89 (29.40)
WLG	71.71 (5.31)	81.57 (14.25)
Collapse groups	69.13 (17.38)	73.88 (24.32)

No significant difference between the IG and the WLG at pre 1 intervention (U = 29.50, p > 0.05), and the post 1 intervention either (U = 26.00, p > 0.05).

Table 4. Mean (SD) for scores from the Tait video analysis for the three behavioural codes of Turn-taking between the Parent and the Child, Child's Communicative Autonomy, and Child's No-response, for the pre and post intervention sessions (N=16)

	Pre intervention	Post intervention
Turn-taking	59.95 (18.77)	62.70 (15.97)
Child's Autonomy	12.20 (11.41)	30.21 (16.54)
Child's No-response	22.82 (15.58)	3.98 (8.55)

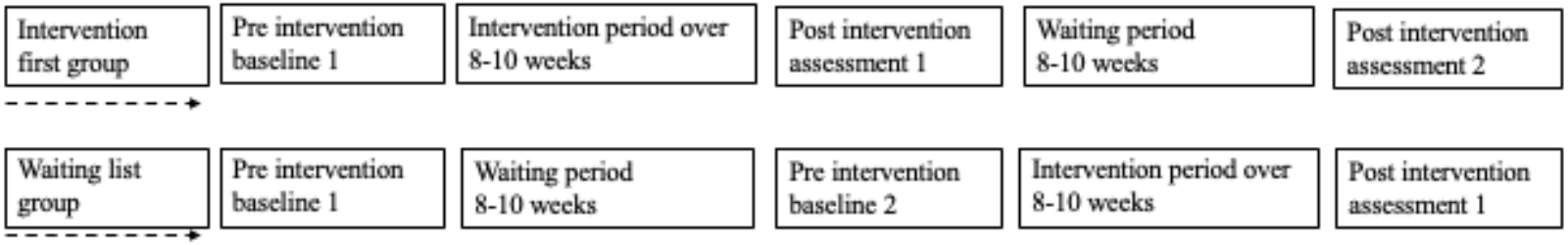


Figure 1. Study design

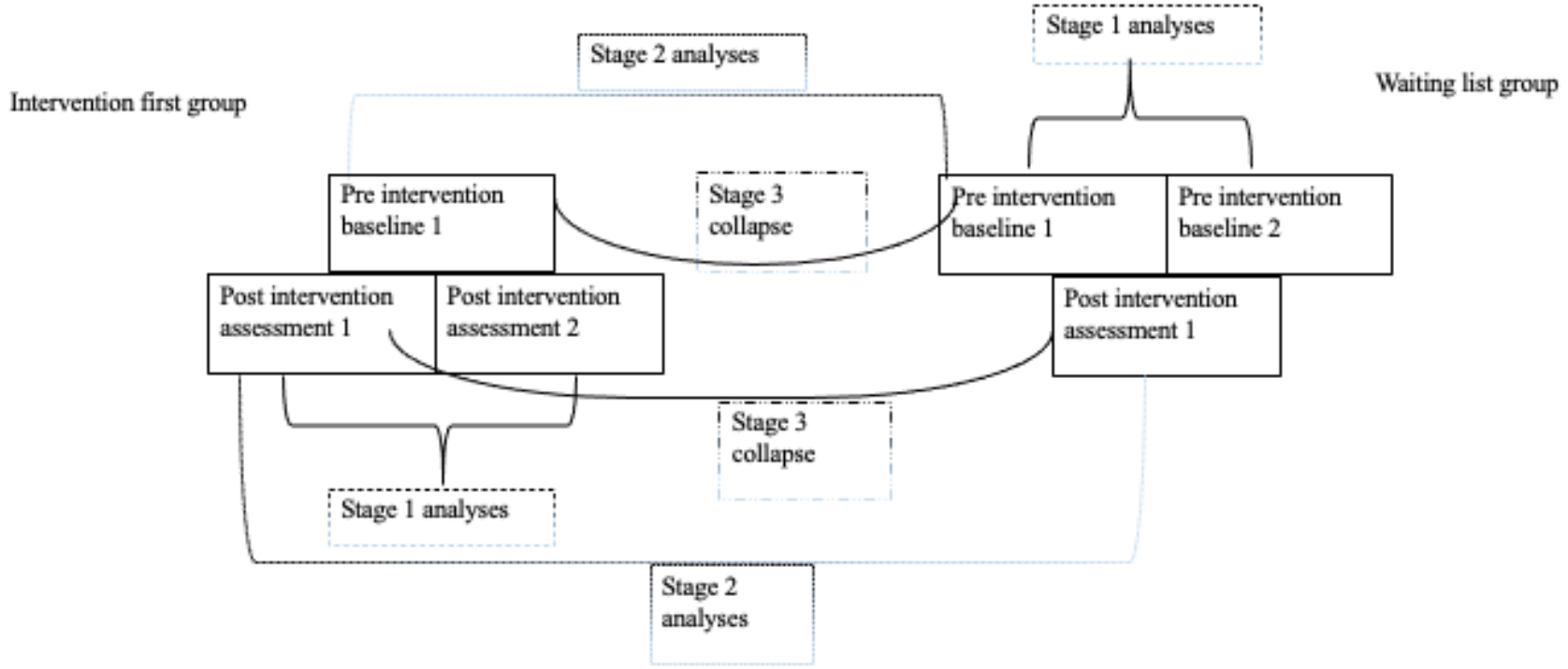
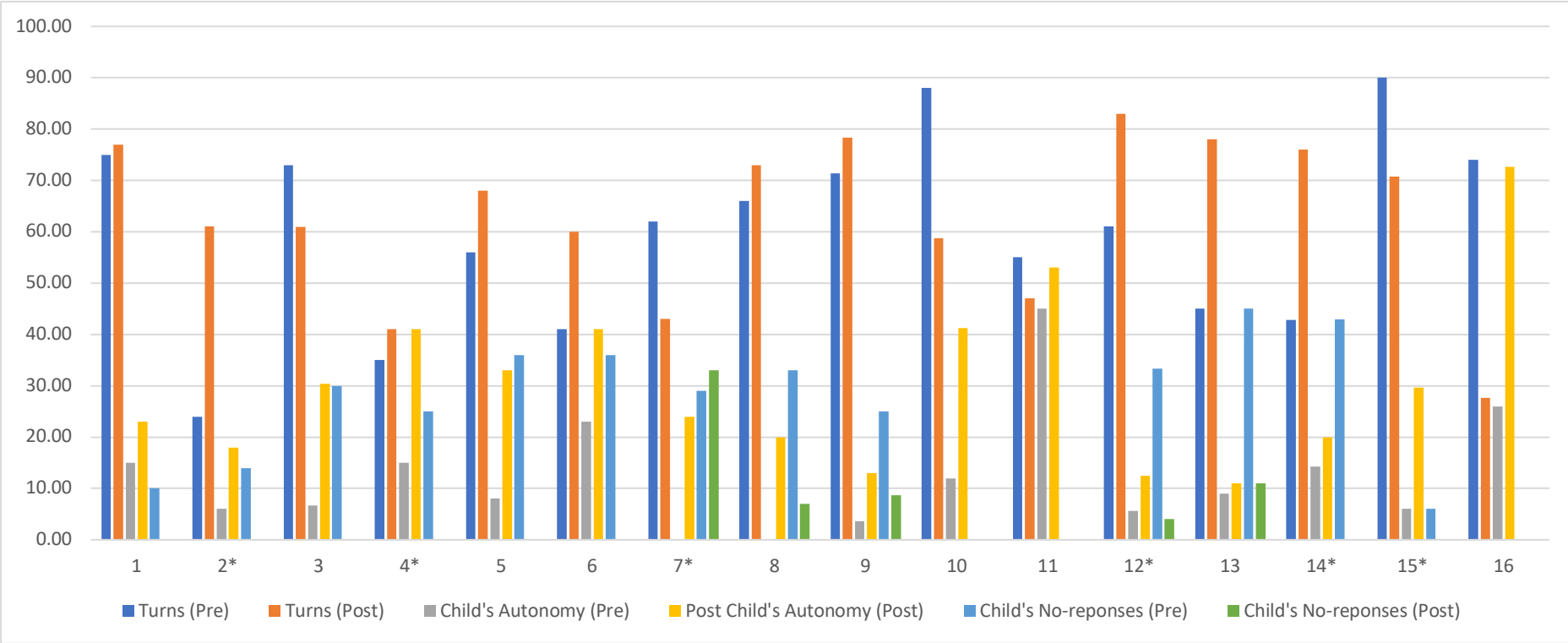


Figure 2. Illustration of the stage by stage process leading to the collapsing of the groups



**Children with complex needs.*

Figure 3. Case by case scores at pre and post intervention on the Tait video analysis.