“CAN YOU UNDERSTAND ME NOW?”: THE USE OF DIRECT MAGNITUDE ESTIMATION SCALES IN TELEPRACTICE SPEECH THERAPY WITH CLIENTS WITH REPAIRED CLEFT PALATE

by

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To my parents and brother: thank you for supporting and encouraging me during this season of life. I could not have done this without any of you.

TABLE OF CONTENTS

Page

LIST OF FIGURES

Figure **Page**

LIST OF ABBREVIATIONS

ASHA – American Speech-Language-Hearing Association

ENT – Ear, Nose, and Throat doctor

DMES – Direct Magnitude Estimation Scale

SLP – Speech-Language Pathologist

VPD – Velopharyngeal Dysfunction

WHO – World Health Organization

ABSTRACT

Likert scales require respondents to select a rating based on pre-determined categories. An assumption is made that all respondents view the categories similarly. The Direct Magnitude Estimation Scale (DMES) allows respondents to create their own categories, which leads to increased sensitivity of the measured concept (Meek, Sennott-Miller, & Ferketich, 1992). With the DMES, it is not assumed that everyone shares the same definitions of categories (Meek et al., 1992). With the lack of forced categories, there is opportunity for the DMES to detect variation that may not be detected on a Likert scale (Beltyukova, Stone, & Ellis 2008).

Children who have a repaired cleft palate can be challenging to understand. Progress during speech therapy can be slow but steady. With the DMES, people are not forced into categories that might not capture the slow and steady progress of the child. By allowing the clinician working with the child with a repaired cleft palate to use the DMES, the potential exists to document the slow and steady progress more accurately.

Student clinicians provided speech therapy to children with a repaired cleft palate under the supervision of a certified bilingual speech-language pathologist. The clinicians used the DMES to rate each child's speech after each therapy session, as part of a larger study. After the clinicians rated the child, the DMES was given to the researcher who then entered the ratings onto a master DMES for each individual child. Each child had their own individual master DMES, which contained the ratings for each of their speech therapy sessions.

The clinicians documented the progress of their client's overall intelligibility as well as targeted phonemes. They documented both an increase in progress and decrease

in progress. The DMES has the potential to be used by speech-language pathologists who may not be familiar with the Likert scale or for whom the Likert scale is not culturally appropriate. For example, speech-language pathologists or professionals who live in other countries could implement the DMES to track client progress.

Keywords: telepractice, speech therapy, direct magnitude estimation scales, validity, reliability

I. LITERATURE REVIEW

Cleft Palate

According to the World Health Organization (WHO), oral clefts in any form occur in about one in every 700 live births worldwide (World Health Organization, 2001). Cleft lips and palates can cause many symptoms that result in a communication disorder. Many clients struggle with resonance and airflow, articulation, voice, dental/orthodontics, and psychosocial aspects as a result of their cleft lip/palate.

Clients struggle with resonance and airflow due to velopharyngeal dysfunction (VPD). VPD causes hypernasality, an acoustic phenomenon that occurs when there is excessive resonance in the nasal cavity during the production of vowels and vocalic consonants. Due to the coupling of the oral and nasal cavities, and nasal air emission, an aerodynamic phenomenon resulting in audible or inaudible release of air from the nasal cavity during the production of oral pressure consonants occurs. The client may sound hypernasal. Speech therapy can help with hypernasality if the hypernasality is compensatory. If the hypernasality is structural, then speech therapy will not help. If hypernasality is due to VPD, then a detailed structural evaluation is required by a speech-language pathologist (SLP) or Ear, Nose, and Throat specialist (ENT). Clients who experience loss of pressure through the velopharyngeal port also experience softer voice intensity (ASHA, n.d.b).

Clients who struggle with articulation often have obligatory errors and/or compensatory errors. Obligatory errors exist due to structural abnormalities. Obligatory errors are not likely to improve until the structural cause is managed by surgery or a prosthetic device. Compensatory errors are learned articulation errors. Compensatory

errors occur due to the anatomical inability to close the velopharyngeal port (ASHA, 2020b).

Clients who have dental deviations and malocclusions often struggle with articulatory placement. If the front teeth are missing, producing dental sounds such as /th/ will be difficult because the tongue is placed between the top and bottom front teeth. If other teeth are missing, the production of sounds such as /s/ will be difficult because air will be escaping while the /s/ is being produced, possibly sounding like a lisp. A client with an underbite may have similar difficulties with the production of /s/ because air can escape through the lower front teeth that are extended further (ASHA, 2020b).

A cleft palate can also impact the client's psychological and social well-being. The client may have low self-confidence, feelings of depression and anxiety, and difficulties initiating and maintaining relationships. (ASHA, 2020b). While many health professionals work collaboratively on a cleft palate team, psychiatrists are not often included although a psychiatrist might be helpful (Sousa, Devare, & Ghanshani, 2009). Children with cleft anomalies are often more vulnerable to teasing based on their appearance (Turner, Thomas, Dowell, Rumsey, & Sandy, 1997). Research suggests that the cleft palate itself is not the cause of psychological and social issues; it is teasing that leads to poor psychological and social functioning (Sousa et al., 2009).

There are limitations to what an SLP can address when it comes to cleft palate. The SLP cannot surgically repair any of the affected structures. In this case, the SLP will refer the client to a cleft lip and palate team to repair the structures. After surgery, the SLP's goal is to implement normal articulatory behavior (ASHA, 2020d). The SLP also cannot provide psychological care to the client. The SLP can refer the client to a

psychiatrist who can help manage the client's psychological and social well-being. An SLP can address many of the symptoms that are secondary to a cleft palate. The SLP can assess, diagnose and treat any secondary symptoms in the areas of speech, language, resonance, or voice (ASHA, 2020a). If an SLP is not readily available for the client, then speech therapy via telepractice is a viable option.

Telepractice

According to the ASHA practice portal, "telepractice is the application of telecommunication technology to the delivery of speech-language pathology and audiology professional services at a distance by linking clinicians to client or clinician to clinician for assessment, intervention, and/or consultation" (ASHA, 2020c). Telepractice enables people from around the world and in rural areas to receive the speech therapy services they need to communicate more effectively. The ASHA code of ethics states that speech therapy delivered via telepractice must be of the same quality as face-to-face speech therapy (ASHA, 2016a). The SLP administering speech therapy via telepractice also must adhere to the scope of practice in speech-language pathology (ASHA, 2016b).

Determining if speech therapy delivered via telepractice is as effective as face-to-face therapy can be challenging. Often, it is debated as to whether speech therapy via telepractice is as effective as face-to-face speech therapy. In previous research, they suggest that speech therapy via telepractice is effective and improving as it continues to be implemented more frequently. Freckmann, Hines, and Lincoln (2017) conducted a survey of patients who had speech sound disorders. The respondents stated that they were satisfied with the use of telepractice speech therapy, even when video and audio quality were poor. SLPs stated that their conflict with telepractice was that they could not

physically manipulate their patient's articulators (Coufal, Douglas, Jakubowitz, Howell, & Reyes, 2018). While this was a concern on the clinician's end, research suggests that clients made similar progress via telepractice compared to receiving face-to-face intervention (Coufal et al., 2018). Even though the clinicians could not manipulate the articulators of the client's receiving telepractice, this did not impact the progress made by the clients.

Connectivity is also a hot topic when it comes to telepractice. In prior research, Crutchley and Campbell (2010) found that families were satisfied with the telepractice, even when connectivity failure caused the sessions to end prematurely. El Salvador is better equipped with Wi-Fi, and clients have better access to devices when compared to other Latin American countries. However, this is not the case in Guatemala where access to Wi-Fi can be challenging (Sywulka, Huang, Contractor, & Lu, n.d.).

Direct Magnitude Estimation Scales

The use of the DMES has been discussed in speech and hearing, psychophysics, business, marketing, and nursing (Beltyukova, Stone, & Ellis 2008). With the DMES, you are not assuming that everyone shares the same definitions of categories such as "moderate" (Meek, Sennott-Miller, & Ferketich, 1992). The lack of assumptions leads to increased sensitivity of the measured concept (Meek et al. 1992). When studies aimed to replicate results from the DMES, judgments had high test-retest reliability (Beltyukova et al. 2008). There is also an opportunity to detect variations that might not be captured on a Likert scale because there are no forced categories (Meek et al. 1992). The use of the DMES is easy and cost-effective (Beltyukova et al. 2008). The DMES provides the opportunity for respondents to provide a rating that is based on a

scale the individual creates. The DMES prevents people from being forced into choosing something from a pre-selected category. The DMES would be a great tool to implement in countries such as El Salvador and Guatemala because there are not any standardized-norm-referenced speech and language assessments available in the dialects of Spanish spoken in El Salvador and Guatemala. Refer to Figure 1 to see an example of the rating form.

Research Question

The purpose of this study is to determine if the DMES capture progress during telepractice speech therapy sessions. The research question is, "Do ratings on the Direct Magnitude Estimation Scales (DMES) accurately capture the progress of Spanish-speaking clients with repaired cleft palate during speech therapy via telepractice?"

II. METHOD

Participants

Six graduate student clinicians in a bilingual concentration communication disorders program conducted speech therapy sessions with clients with repaired cleft lip/palate. The graduate student clinicians and clients were part of a larger study focusing on effective speech therapy techniques for working with clients via telepratice (Resendiz & Gonzales, in preparation). The telepractice sessions they provided were a part of their normal coursework. The six clinicians ranged in age from 21 to 24 years and were all female. The participants presented with different ranges of Spanish and English proficiency.

The clinicians were enrolled in courses that addressed competencies as mandated by the following ASHA Standards: Basic Human Communication (III-B), Articulation &

Phonology (III-C), Assessment of Individuals with Articulation & Phonological Disorders (IV-D), and Cultural Aspects (III-B) (CAA, 2019). Clinicians conducted two to five telepractice sessions, depending on the availability of the clients, over the length of the course. The sessions were part of regular coursework.

Clients

The clients ranged in age from seven to fifteen years old and had a cleft palate repair. Each client's cleft palate ranged in severity and number of repairs/surgeries needed to correct the abnormality. All the clients lived in El Salvador or Guatemala and were receiving speech therapy via telepractice. The clients each had different goals ranging in the areas of pragmatics, articulation, and nasal air emission. Each client received between two to five speech therapy sessions via telepractice addressing their individual goals. All the clients articulated multiple phonemes in error. The clinician may have chosen to work on all the phoneme errors during one session or just target one specific phoneme. This did not mean that one client was more intelligible than the other. Refer to Table 1 to see client information.

Client 1 was a 7-year-old male from Guatemala. He was our most unintelligible client. Client 1 was also the only client participating in telepractice from Guatemala. The clinicians made comments about having trouble with connectivity. This was consistent with the previous research about access to Wi-Fi and devices in Guatemala. This client produced a total of five phonemes in error. While the client had a few phonemes in error in initial and medial position of words, he mainly had phoneme errors in final position of words. Even though the client had five phonemes in error, the clinicians were only targeting four phonemes during his sessions. The client's target phonemes were /g/, /s/,

/r/, and /d/. Client 1 participated in five telepractice sessions from February to March.

Client 2 was a ten-year-old male from El Salvador. This client produced a total of nineteen phonemes in error. While the client had multiple phoneme errors in initial, medial, and final position, he produced the most errors in medial position of words. Even though the client had multiple phonemes in error, the clinicians were only targeting one phoneme during the sessions. The client's target phoneme was /t/ in initial position. Client 2 participated in four telepractice sessions from February to March.

Client 3 was a 15-year-old female from El Salvador. She was our most intelligible client. Client 3 produced a total of four phonemes in error. The client mainly produced these errors in medial position of words. Although the client only produced four phonemes in error, she also requested to target /r/. The client had numerous missing teeth, making it difficult to produce certain sounds. Client 3 has been receiving speech therapy via telepractice for many years and has developed many self-awareness skills. The client has learned over the year to distinguish when she is misarticulating a sound. With this learned skill, Client 3 can explain her communication needs to her clinicians. The client's target phonemes were /s/, /f/, /m/, /v/, and /r/. Client 3 participated in four telepractice sessions from February to March.

Clients	Age	Gender	Home country	Goals
Client #1	**7 yrs.**	**Male**	**Guatemala**	**/g/, /s/, /r/, /d/**
Client #2	**10 yrs.**	**Male**	**El Salvador**	**/t/**
Client #3	**15 yrs.**	**Female**	**El Salvador**	**/f/, /m/, /s/, /v/, /r/**

Table 1: Client Information

Procedure

The clinicians were asked to implement the DMES during each of their telepractice sessions. Figure 1 shows a copy of the DMES. The DMES provides the opportunity for respondents to provide a rating that is based on a scale the individual created. For example, a person may complete a DMES and provide a rating of 64 for a pre-test and a rating of 86 for a post-test. A different person may complete a DMES and provide a rating of 3 for a pre-test and a rating of 8 for a post-test. Both clinicians observed improvement. However, the actual numbers that they used were different. This prevents respondents from being forced into categories, such as Likert scale

categories. For some people, a rating of 5 on a Likert scale may mean something totally different than for another person.

The clinicians conducted telepractice sessions with Salvadoran and Guatemalan clients who had repaired cleft palates. They were asked to conduct the telepractice sessions in pairs. They were instructed to use the DMES to rate the intelligibility of their client's productions of target phonemes and overall intelligibility (see Figure 1).

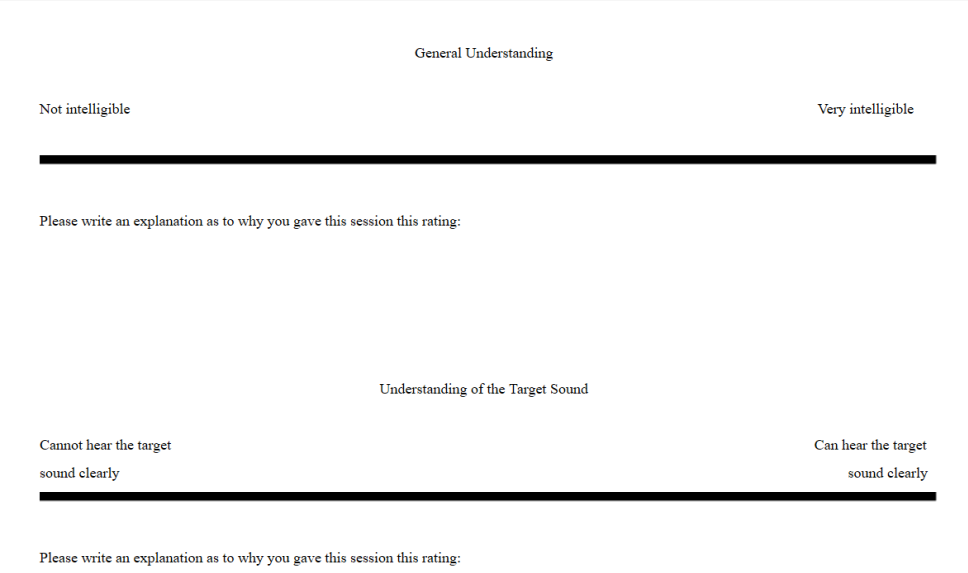

Figure 1: Sample of Rating Scale

Target phonemes were the sounds that the individual clients were attempting to improve as part of their goals. Overall intelligibility was the ease with which the client was understood in conversation when talking with the clinicians. At the end of each session, the clinicians independently rated the client's overall intelligibility of speech and the client's accuracy producing the target phoneme. The clinicians were also given

the opportunity to explain their ratings on the DMES below their rating. After they completed their ratings, clinicians turned in their DMES to the researcher and did not have access to the scale afterward. This minimized the chances of the clinicians referring to the previous DMES ratings, reducing clinician bias to rate the client higher as the sessions progressed.

The ratings of the two clinicians who conducted therapy together were entered onto a master DMES for the client. On the master DMES, the ratings of each clinician for each session were documented. The DMES ratings were then evaluated to determine similarities between the two clinician ratings over the two months of speech therapy. Each clinician's response was compared to their previous ratings during earlier telepractice sessions. For agreement purposes, the responses between the paired clinicians were compared for similarities in terms of changes in client progress on the overall intelligibility of speech and articulation of targeted phonemes. Refer to Figure 2 for an example of the master DMES. One clinician was assigned the color of blue and their ratings from sessions 1, 2, 3, 4, and 5 were documented in blue. The second clinician was assigned the color of red and their ratings from sessions 1, 2, 3, 4 and 5 were documented in red.

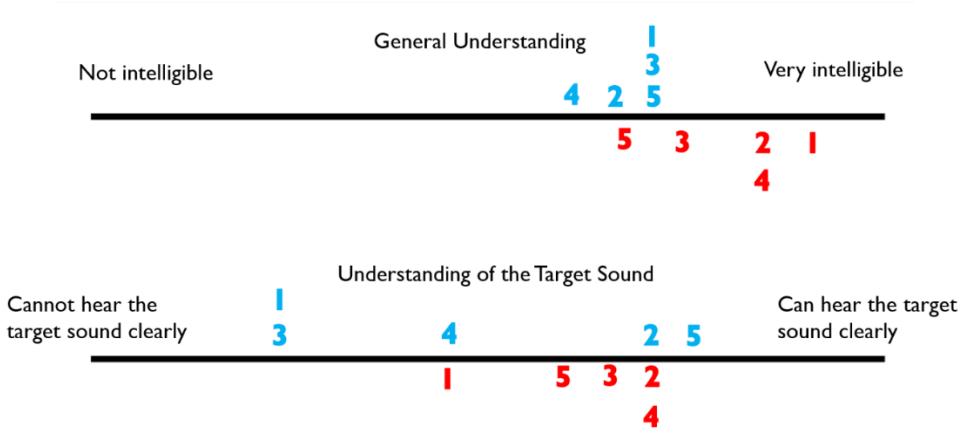

Figure 2: Sample of master DMES

III. RESULTS

The master DMES ratings for each of the sessions were compared between sessions and between the two-paired clinicians to determine progress. A comparison of each client's first session ratings (pre-test) and last session ratings (post-test) was made for each clinician.

Ratings from the master DMES for each client were evaluated to determine if there were differences in ratings from pre-test to post-test for each of the clinicians. Ratings from the master DMES were also used to determine if the changes from pre- to post-test were similar for each of the two clinicians for each client. The current study was concerned with the amount of change, rather than the starting and ending point on the DMES.

To answer the research question regarding whether the DMES could be used to document the progress of Spanish-speaking clients with a repaired cleft palate receiving speech therapy via telepractice, the pre- and post-test ratings of each client and the clinician ratings were compared. We also used the master DMES to determine if the two clinicians concurred with each other regarding the progress demonstrated by each client.

Client 1

Client 1 was a seven-year-old male from Guatemala who was working on the target phonemes /g/, /s/, /r/, and /d/. The clinicians mentioned in their comments that the internet connectivity during the sessions was not consistent. Since the client is from Guatemala, likely, the Wi-Fi connectivity on the client's end was not consistent. Even though both clinicians did not document progress for general understanding, they were in consensus as to how the client was performing during the last session. For the target phoneme, both clinicians documented progress from the first session to the last session. See Figure 3 for a visual of Client 1's progress.

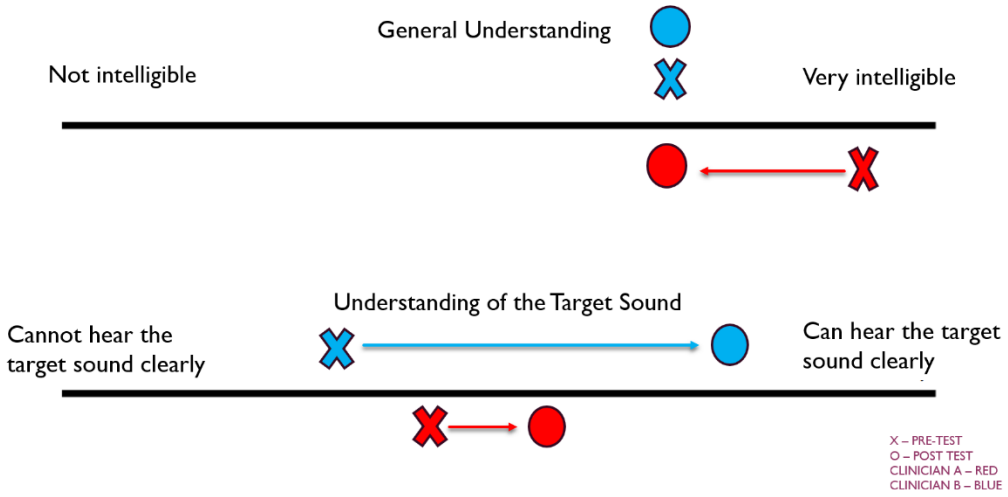

Figure 3: Client 1's progress

Client 2

Client 2 was a ten-year-old male from El Salvador who was working on the target phoneme /t/. For general understanding of Client 2, both clinicians documented progress even though they differed in the amount of change. Interestingly, the clinician coded as pink, who documented the most progress for overall intelligibility, rated the client lower at pre-test and higher at post-test when compared to the clinician coded as yellow, who

documented less progress. For the target phoneme, the clinicians did not give a rating for the first session because they were still in the process of identifying goals for the client. The client had multiple sounds in error, so the clinicians were trying to narrow down which phoneme(s) to target first. The comparison point for the clinicians appears to be different, based on their ratings. The DMES likely provided them both with the opportunity to report the progress of Client 2 even though they had different reference points. Refer to Figure 4 for a visual of Client 2's progress.

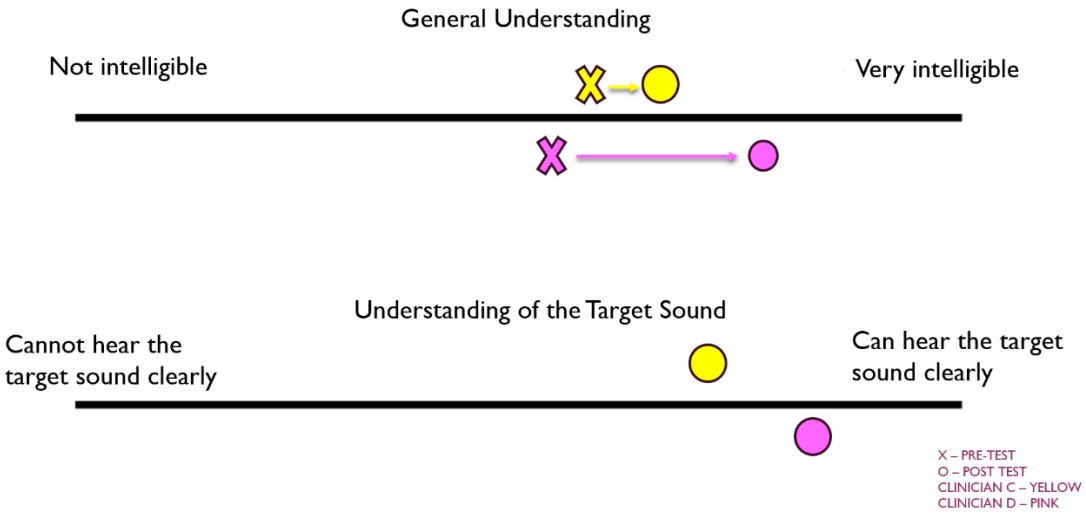

Figure 4: Client 2's progress

Client 3

Client 3 was a 15-year-old female from El Salvador who was working on the target phonemes /f/, /m/, /s/, /v/, and /r/. Client 3 was our most intelligible client. For general understanding, the clinician coded as orange documented progress while the clinician coded as green did not document progress. Since the progress was such a slight increase for the clinician coded as orange, it may have been missed using a traditional rating scale such as a Likert scale. For the target phoneme, neither student clinician

documented progress. Even though neither student clinician documented progress, they rated the target phoneme on the higher end of the scale. This could mean that the client may have started out producing the phoneme well and kept producing it well throughout the remainder of the sessions. Refer to Figure 5 for a visual of Client 3's progress.

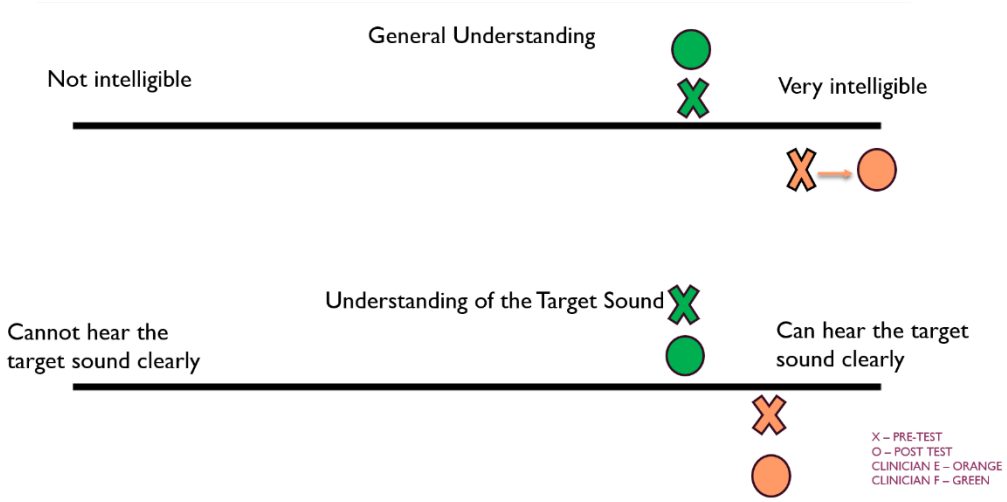

Figure 5: Client 3's progress

IV.DISCUSSION

The DMES has the potential to be used as a measure of determining progress with clients participating in speech therapy via telepractice. The DMES captured both an increase or decrease in client progress when comparing pre- and post-tests. According to the results, the DMES has the potential to be a valuable tool for documenting the progress of the clients receiving speech therapy via telepractice. Biases and different ideas about the meaning of terms such as mild, severe, and high, often appear to be reduced with the use of the DMES. Our study appears to concur with the findings from Beltyukova, Stone, and Ellis (2008), who used the DMES to measure speech intelligibility. The results from Beltyukova, Stone, and Ellis (2008) and the current study suggest promise for implementing the DMES in the field of speech-language pathology.

Clinician bias is a topic worthy of discussion when considering the accuracy with which clinicians are documenting progress during telepractice. Little evidence of clinician bias was previously documented when students observing the sessions used the DMES to rate the performance of a client. Students watched pre-recorded telepractice sessions in a randomized order. They rated the client's progress using the DMES. Although the DMES users were not the clinicians, similar client progress was documented by the students (Womble, Resendiz, Galemore, & Saucedo, 2019). In the current study, the two clinicians administering therapy to the same client gave different ratings on the DMES, suggesting no clinician bias. There was also a clinician who documented regression, again suggesting there was minimal pressure to document progress if it did not occur.

When implementing the DMES in future research, we want to be sure to give very explicit instructions since there is so much flexibility given to the respondent. We would also like to encourage the respondent to write explanations of their ratings because these explanations can provide valuable qualitative information.

Limitations

The limitations of the study include having to limit our telepractice sessions due to COVID-19. Our data might have had different outcomes if we were able to conduct more ratings regarding the telepractice sessions. Another limitation of the study was a small sample size of six clinicians and three clients. Another limitation was not having information as to the clinicians' Spanish or English proficiency. Administering the Language Use Questionnaire in the future will provide us with more detailed information

about the language proficiency of the clinicians and how it may impact the DMES ratings (Kiran, Peña, Bedore, & Sheng, 2010).

Future Research

The DMES ratings have the potential to be used with a more diverse group of participants with a range of communication disorders, including speech sound and language disorders. The results of the current study are promising for the delivery of speech therapy via telepractice locally, nationally, and internationally. The DMES can be used by professionals in other countries who work with this population but do not receive specialized training in speech-language pathology. We would also like to implement the DMES with family members and pose the question of whether the DMES generalizes into everyday use.

In future research, we would like to implement the Language Use Questionnaire to assess the clinician's language background. Language background does appear to play a role in how the clinician perceives the client (Womble et al., 2019). The language background of the clinician affects what the clinician perceives and notices during the therapy session. For example, students with more experience with Spanish focused on specific productions by the client, while students with less experience with Spanish focused on whether the client was working at the word level or sentence level (Womble et al., 2019). When assessing the progress of clients in future research, we need to consider the role that language background of the clinician has on intelligibility ratings.

In summary, the results of this study suggest that the DMES show significant promise for use in determining progress, regression, or maintenance of therapeutic goals.

The DMES appears to be very user friendly and can be used by individuals without extensive training with data collection.

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