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Cleft-Palate Speech Therapy: Telesupport as a Home Program Supplement

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Abstract

International humanitarian efforts in cleft palate care often lack follow-up support for speech deficits. Ten Spanish speaking participants in Tijuana Mexico, age 3-12, with cleft palate were randomly assigned to a home speech program or a home speech program with additional weekly telesupport. Speech production was measured before an eight-week home treatment program and after treatment to determine the effectiveness of adding telesupport to a parent-implemented articulation approach. Age was significantly related to amount of time practiced, with older participants practicing more at home, with marginally increased practice for older students provided telesupport. There were no significant differences in speech production between the two treatment groups, yet the parent report was positive. Parents in the telesupport group were more comfortable with therapy implementation. Possible reasons for lack of phonemic outcomes are explored, as well as the potential that telesupport holds for treating cleft palate speech in children with limited access to resources, such as trained speech-language pathologists.

Keywords: cleft palate, cleft lip, cleft, speech, speech therapy, articulation therapy, telepractice, telesupport, telemedicine, home-program, parent training, family-centered, humanitarian, international.

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CHAPTER 1: Introduction and Literature Review

Introduction

Cleft lip/palate is the fourth most common birth defect and the most common congenital facial anomaly, occurring worldwide in one in every 700 births (World Health Organization [WHO], 2001). Cleft occurrence rates are difficult to determine due to a variety of cleft types and severities (e.g., occluded submucous clefts which may go undetected); however, it is estimated that there are approximately 7.75-10.63 per 10,000 live births, with about 4,437 new cases each year in the United States (ASHA, n.d.). A cleft is a gap where closure that typically occurs during prenatal development does not occur or only partially occurs. Clefting of the lip has its greatest impact on cosmetic appearance, whereas clefting of the roof of the mouth (cleft palate) can have an impact on functions, such as feeding, speech, and hearing. Clefts can vary in location and severity with partial or incomplete varieties. Individuals with cleft palate are unable to seal the nasal cavity from the oral cavity, which often results in nasal regurgitation during feeding. Additionally, individuals with unrepaired cleft palate are prone to increased occurrences of pneumonia, since they are often unable to create a seal between the back of the tongue and the roof of the mouth, to keep fluids from spilling posteriorly during swallows. Cleft palate alone does not directly affect cognition; however, the rate of cleft is higher with some syndromes that have an impact on cognition.

Rates of clefting are further compounded by presence or absence of a syndrome, ethnicity, and gender. Syndromes associated with clefting are more common in those with cleft palate only (i.e., without cleft lip). Of those individuals with cleft palate only (i.e., without cleft lip), approximately 40-50% have a diagnosed accompanying syndrome, of which over 400 syndromes linked with cleft have been identified. Conversely, only 10-15% of individuals with

cleft lip (with or without accompanying cleft palate) have a cleft-related syndrome (Kummer, 2014). The rates of clefting also vary by ethnicity, with the highest rates in Asian and Native American populations and lowest rates within African American populations (ASHA, n.d.). In terms of sex differences, males are more likely to have cleft lip only, whereas females are more likely to have cleft palate, without cleft lip, which may be due to different timing of palatal closure during embryological development (Kummer, 2014).

A review of the types of clefts, etiologies, and prenatal development timeline the birth anomaly will be reviewed, as well as the effects of cleft-palate on speech and language. Speech effects are present as early as infancy and influence resonance, airflow, and articulation. These areas of speech affected by cleft will be covered in detail, as well as differentiation between structural obligatory errors and learned errors, that are common with cleft palate. Language and hearing can also be impacted by cleft, which will be examined briefly. Finally, current treatments for cleft-palate speech will be presented, as well as an overview of humanitarian efforts in cleft-palate and issues concerning ability to provide quality speech therapy in foreign efforts. Family involvement, including the use of home programs has started to be included in many humanitarian efforts, but the need for speech therapy often surpasses the help available. In this study, we will examine the addition of telesupport for speech therapy home programs as a potential solution to provide additional treatment that is needed for individuals with cleft palate who are given care during humanitarian outreach trips.

Development and Classification of Cleft Types

In order to understand the types and classification systems used for cleft palate, a foundation of the typical prenatal development is useful. At 6-7 weeks gestation, migration of cells and a zipper-like closure begins, moving anteriorly, starting at the incisive foramen, next

connecting the base of the nose and then joining lips at the philtrum. Somewhat later in development, starting at 8-9 weeks, with completion at 12 weeks, the posterior palate is zipped closed. This closure begins at the incisive foramen and moves in a posterior fashion, including the velum (soft palate) and finishing at the uvula. Classification of the type of cleft includes whether the gap is primary or secondary and also includes the severity as being complete or incomplete.

Primary clefts occur anterior to the incisive foramen, often including the alveolus and can continue to include the nostril sill and lip. Complete anterior cleft must continue posteriorly to the incisive foramen, where incomplete anterior cleft can be any portion anterior to the incisive foramen. Secondary clefts run posterior to the incisive foramen, including the hard palate and sometimes the velum. An incomplete posterior cleft may be as minor as a bifid uvula (an incomplete split of the uvula), whereas a complete posterior cleft runs anteriorly to the incisive foramen. Additionally, submucous clefts occur when the muscles are separated, but the soft tissue is intact, often masking the appearance of the cleft.

Cleft lip and palate can occur together or as isolated cases and can be unilateral, occurring on one side of the face, or bilateral, on both sides. When primary cleft lip occurs unilaterally, it most frequently occurs on the left side of the face. Cleft lip/palate is a congenital condition, with a variety of etiologies, including some genetic syndromes and teratogens such as smoking, use of phenytoin, valium, corticosteroids, lead exposure and other viruses, including rubella and influenza. Additional risk factors include maternal malnutrition, including deficiencies in vitamin B. Although low levels of folic acid were once thought to be a contributor, there is new evidence that suggests it may not be related to cleft (Kummer, 2014). Additional causes include mechanical prenatal influence that decreases space for the head and

mouth structures to move as needed during prenatal development. Obesity, older age of parents, and general malnourishment increase the risk of cleft lip and palate, along with other malformations. The cause of cleft, in most cases, is multifactorial and typically requires treatment from a team knowledgeable in many areas of development, including genetics, plastic surgery, orthodontia, dentistry, audiology and speech (Kummer, 2014). A speech-language pathologist plays an integral role on the cleft palate team, evaluating the structure and function of the palatal structures for speech production purposes pre- and post-surgery, providing services related to feeding and communication, starting with early infant intervention.

Early Effects of Cleft on Infant Speech Acquisition

Surgical repair of cleft palate usually happens around one year of age in the U.S., thus, atypical patterns of speech may develop before the structure needed for accurate speech production is present. Scherer, Williams, and Proctor-Williams (2008) found that the babies with cleft lip/palate (CL/P) displayed less complexity in their babbling at 12 months of age, most specifically lacking plosive consonants, as well as producing compensatory speech sounds (e.g., glottal stops) that are not typically produced in the English language. Even after surgical repair, the speech production patterns learned before having the structural ability to produce sounds often remain, as the brain has created muscle memory for errored production of these speech sounds. Errors in speech can be obligatory, meaning they are due to structural anomalies, or they can be compensatory, due to mislearning. It is important to distinguish between these types of errors, as speech therapy is appropriate for compensatory errors, but not for obligatory errors, which must be remediated through surgical intervention (Kummer, 2014).

Impact of Cleft on Resonance

Resonance is the shaping of the sound produced by the vocal folds and is affected by the mouth shape and velopharyngeal functioning (Kummer, 2014). Resonance can be normal, hypernasal, hyponasal, cul-de-sac, or mixed. In individuals with cleft palate, resonance can be altered due to insufficient velopharyngeal closure, allowing more air than usual to enter the nasal cavity and resonate during sounds that would typically have oral resonance. Hypernasality can be tested by listening to speech that includes non-nasal sounds. Naso-oral fistulas can also contribute to hypernasality, if large enough to allow airflow to escape into the nasal cavity. Hyponasality is when sounds are resonated more in the oral cavity, and the effects are most pronounced during the production of sounds that are typically nasal. Cul-de-sac resonance occurs when airflow is directed into the nasal cavity but then blocked, making sound muffled. Hyponasality and cul-de-sac resonance often occur with upper respiratory obstruction or mouth breathing. Because some clefts influence development of the structures of the nose, mouth breathing and abnormal nasal structures are common. Resonance is an important factor in cleft palate because structural changes that alter resonance may require physical management. This is especially true with consistent resonance changes, such as hypernasality across all speech non-nasal speech sounds. Resonance can change with the rate of speech and effort, but that does not necessarily indicate the errors are compensatory in nature. For example, an individual with velopharyngeal insufficiency may have structural deficits that makes it difficult to achieve full velopharyngeal closure. With slow, deliberate movement during speech production, the individual may be able to approximate closure, reducing nasal airflow, yet structural repair would still facilitate appropriate airflow during automatic speech. Consistent speech variations,

such as hypernasality or nasal emissions are often obligatory, whereas inconsistent errors are more likely compensatory.

Airflow with Cleft Palate

The production of many speech sounds requires precise placement of the tongue on the hard palate, as well as the use of the velopharynx to direct oral airflow through the mouth by sealing the nasal cavity. In individuals born with cleft palate, both the structures needed for tongue placement and velopharyngeal valving often compromise speech production. The structural variance results in the inability to produce many speech sounds, especially non-nasal consonants, which includes most consonants within the English and Spanish languages. Structural insufficiency often results in velopharyngeal insufficiency (VPI), or the inability to close the nasal pathway in a typical way. With typical production of non-nasal consonants, the velum is lifted to meet the contracted pharynx, in order to seal the nasopharynx and properly direct air through the oral cavity. This allows for oral pressure to build up in a closed system, which is necessary for plosives and fricatives. Without the ability to create the typically closed system, air escapes through the nasal cavity reducing the pressure needed for the production of non-nasal plosives, fricatives, and affricates. Compensation for the lack of velopharyngeal control in cleft palate often results and individuals produce speech sound errors (e.g., backing of sounds to the vocal folds) to compensate for sounds that are typically produced by air buildup in the oral cavity (Derakhshandeh, et al., 2016). Thus, obligatory airflow errors associated with resonance and compensatory articulation placement errors are highly intertwined, with articulation errors often resulting as an attempt to compensate for errors in airflow.

Common Cleft-Palate Speech Errors

The errors exhibited by individuals with cleft palate speech include both active placement errors and passive airflow errors (Al-Tamimi, Owais, Khabour & Khamaiseh, 2011). Classic cleft palate active errors are: 1) nasal fricatives, 2) glottal articulation, 3) pharyngeal fricatives, 4) backing, 5) double articulation and 6) palatal fricatives. Nasal fricatives involve constricting the nasal cavity to decrease airflow and attempt to produced fricatives that are typically produced using the tongue, palate, teeth, and lips. Nasal movement (e.g., grimacing) can often be seen alongside this production.

Glottal articulation involves using the vocal folds to stop air and then release air, as would typically be done using the tongue in the production of plosive consonants. This glottal stopping of air is the type of sound made when someone says “uh-oh” to pause in between the two syllables. Although the compensation produces a way to stop air that cannot otherwise be stopped (before palatal repair) with the tongue, the glottal stops are not typically understood by the typical listener, as they are not part of the English or Spanish languages. Additionally, oral stops vary in place of articulation and may include tongue, palate, mouth, and lips, and are therefore produced with distinguishable variation. For example, the /p/ stop consonant is different from the /t/ stop consonant because it is produced using the lips to stop air and the tongue/alveolar ridge of the hard palate, respectively. Similarly, /g/ uses the back part of the tongue against the soft palate to stop air, whereas /d/ is produced in a similarly voiced plosive manner, only differing by stopping air more anteriorly at the alveolar ridge, yet the two sounds are clearly distinguishable based on the varied location of air blockage. By compensating and stopping air using the vocal folds, a place holder is created for consonant stops, but this method does not produce precise distinctions between phonemes that are typically stopped using various

parts of the tongue and oral cavity. Production of glottal stops during speech production may make speech increasingly unintelligible (i.e., not able to be understood) by familiar and unfamiliar listeners.

Pharyngeal fricatives are another type of backed error where the pharynx is constricted to create turbulence that accompanies fricatives; however, the production is not the same as the constricted oral airflow produced by fricatives in typical speech (i.e., fricatives are generated through constant restricted flow of air that is built up in pressure behind a narrow opening, such as the /s/ which is produced by a controlled slow stream of air through the center of the tongue). Additionally, production in the pharynx increases the difficulty of coarticulation for speech sounds that require positioning in a more forward part of the mouth (e.g., in the Spanish word /tren/ the articulators normally move from the alveolar /t/ placement to the use of the anterior tongue for the /r/ flap, yet when the /r/ is produced further back in the pharynx it is difficult to move from anterior /t/ to posterior pharynx position; therefore, it is likely there will also be errors in production of the /t/ such as backing it to /k/). Backing involves moving sounds that are produced in the front of the mouth to places further back, for example moving sounds from the palate back to the pharynx or vocal folds.

Additional backing can sometimes be seen moving alveolar sounds to the velum (e.g., /t/ to /k/) when there is an ability to use the soft palate, but not the more anterior hard palate. Double articulation occurs when the sound is articulated both in the correct placement (e.g., /t/ is produced with the tongue and the alveolar ridge) and simultaneously at another location, such as the glottal use of the vocal folds. It can often be difficult to detect double articulation, since visually the correct placement is presented, yet double articulation alters airflow and can interfere with the flow of connected speech.

Palatal fricatives are the use of part of the tongue against the palate to produce a fricative in a non-typical manner. Often the part of the palate that does not have a hole will be used, generating a distorted fricative. Compensatory articulation errors are substituted to distinguish between phonemes and hold the place of phonemes that the individual with cleft palate is unable to produce or once was unable to produce prior to surgery. They are considered active, since action is required to produce them, despite the action often being automatic compensation.

In addition to active errors, passive errors that do not require action are present in cleft palate speech. Characteristic passive errors include: 1) absence of pressure consonants (stops, fricatives, affricates); 2) weak articulation; 3) passive nasal fricatives (/s/ produced with nasality); 4) voiceless /h/ for stops; 5) nasal realization (/b/, /d/, /g/ presented as /m/, /n/, / ŋ/) and 6) nasal emissions alongside consonants. The absence of pressure consonants often results in the omission of consonants during word production, which can make the speaker unintelligible to the unfamiliar listener, or when speaking during decontextualized conversations. Sometimes placement for consonants can be learned correctly, but difficulty directing airflow may result in weak production. Passive nasal fricatives involve production of the fricative in the correct location, but with added turbulence from air escaping through the nose. This is not an active change, but a passive distortion to the phoneme in production. Sometimes voiceless /h/ replaces stopped consonants, similar to omission, but with some slight sound from airflow restriction. Nasal realization is where a sound that is non-nasal is produced as its nasal counterpart. These sounds that are exchanged are typically produced in a similar place and manner, with their only variation being whether airflow is oral or nasal. Thus, production of a /d/ will sound like an /m/ because they are both produced by placing the tongue against the alveolar ridge and production of voice. This is a passive error because the placement and voicing are correct, just the direction

of airflow is in error, going through the nose, instead of the mouth. Nasal emission occurs when air escapes through the nasal passage during production of a phoneme, sometimes producing an audible hissing sound alongside the consonant. For example, /s/ may be produced with correct tongue placement, but air escaping through the nose can make the sound distorted. These passive errors can be due to velopharyngeal insufficiency, or the inability to seal the nasal cavity using the soft palate and pharynx, can be a result of a fistula (or hole in leading to the nasal cavity) or they can be produced because of errors in learning (velopharyngeal mislearning).

When inconsistent, the errors are usually learned and not due to structural insufficiency. If the errors are consistent, it is possible that the individual (even with a repaired palate) has structural or muscular inability to direct airflow sufficiently. Both active and passive articulation errors typically result in decreased intelligibility, which can impact social and educational interactions, influencing quality of life. Despite surgery to repair velopharyngeal function, individuals with cleft palate that exhibit compensatory articulation errors often have difficulty modifying their articulation due to muscle memory.

Effects on Language Acquisition

Speech play is often used by young babies and infants to develop language. For example, babies babble and play with sounds that get reinforced by their environment (e.g., ecstatic parents), and they learn to assign meaning to those sounds. Additionally, by repeating words and having the feedback of hearing their own sound production they continually reinforce the learning of those words and develop language. Language is not directly impacted in individuals with non-syndromic cleft palate; however, there is a growing amount of research suggesting that impacted speaking ability may, in turn, result in delays in language learning, such as decreased vocabulary repertoire and decreased expressive language use (Hardin-Jones & Chapman, 2014;

O'Gara, Logemann & Rademaker, 1994; Scherer, Williams & Proctor-Williams, 2008). Babies with cleft palate tend to have decreased phonetic inventory, reduced range of babbled words, and continue to use fewer words as they develop, most often avoiding words with the sounds that are difficult to produce (e.g., babies with cleft palate are more likely to babble “mama” because of the ease of nasal production, and less likely to babble “papa” or “dada” resulting in the development of the word “mom,” but not “dad”). It is not clear whether the children avoid using a wide range of language because they are aware that the listeners will not understand them or because they failed to learn the language due to inability to practice certain words with difficult sounds. An additional impact on language acquisition for those with cleft palate is implicated with hearing difficulties.

Structural immaturity of the cleft palate often extends to other features of the face and ear, and there is an increased risk for conductive hearing problems associated with otitis media in children with cleft palate (Scherer, Williams & Proctor-Williams, 2008). Normally, the eustachian tube that connects the middle ear to the pharynx is closed, and when pressure needs to be equalized the tensor veli palatini muscle is activated during swallowing or yawning and opens the eustachian tube. Air is pressurized, and fluid can drain from the middle ear during opening. With cleft palate, the tensor veli palatini muscle often does not function well, making it difficult to drain middle ear fluid, which can cause damage to the ossicles if left untreated. It is standard protocol to screen for hearing problems and place tubes in the tympanic membrane in children with cleft palate, since failure to drain fluid can lead to permanent hearing loss and impact language development (Vallino, Zuker & Napol, 2008). Hearing and language are concerns that should be addressed by the speech-language pathologist, in addition to the traditional focus of articulation therapy.

Articulation Therapy for Cleft

Schmidt (1975) proposed a theory of motoric learning that the brain generates sets of motor responses to act on environmental stimuli, based on prior actions that worked in those environments or similar environments, especially in behaviors that are produced by muscles effortlessly, without much thought. Principles of motor learning apply both to the acquisition of speech errors and the relearning of error-free speech, since speech production requires precise automatic movement for placing and timing of muscle movements of the articulators. Both motor learning and motor memory are required to re-learn speech production that is fast, consistent and reliable, without effort (Kummer, 2014). With cleft palate compensatory errors, the placement is typically altered (e.g., glottal stops), so a phonetic articulation approach to treatment is common. Compensatory errors are placement-based, not rule-based or phonemic; therefore, an articulation approach that targets phonetic production using the principles of motor learning is warranted, despite evidence that phonemic approaches can also help with articulatory errors (Pamplona, Ysunza & Espinosa, 1999). The initial correct acquisition of articulatory movements for speech, according to the principles of motor learning, requires the creation of mental schemas that correspond with accurate motor production. If a child has not learned the correct articulation of a sound, speech therapy can be useful in teaching this initial motor schema by providing feedback relative to placement and airflow. After initial learning has occurred, motor memory must be used to make the newly learned speech movements easy to integrate them into all areas of speech. This requires practice that is dispersed over several short, but frequent sessions (Maas, et al., 2008). Similar to learning a new instrument, instruction is typically provided during lessons to allow for motor learning, but without daily home practice, motor memory will not occur, and the individual will not progress much in learning to play the instrument. Similarly, the vocal

instrument requires both initial instruction and consistent practice for skills to be retained and for automaticity of speech production. According to Ruscello and Vallino (2014), the principles of motor learning strategies and operant reinforcement can be effective in improving cleft palate speech characteristics (CSCs) with traditional articulation therapy that is often used for other non-cleft types of speech disorders.

Motor learning is similar to operant conditioning, as they both have an external stimulus, followed by a response. Operant conditioning uses reinforcement to increase the likelihood of a specific response, or behavior, whereas motor learning uses internal and external feedback to guide the response behavior. It is important that practice includes non-errored production in order for new motor memories to be correctly formed; therefore, careful instruction during therapy sessions is important. Ruscello and Vallino (2014) suggest three stages of motor learning for application of cleft palate speech placement errors. The first stage is the Verbal-Cognitive Stage, where a new, unfamiliar behavior is introduced. In the case of cleft palate, the new behavior is the correct placement and production of a particular phoneme. During this stage, the therapist should provide models, verbal guidance, and descriptions to help the patient learn the new skill. They might also provide proprioceptive feedback by having the patient occlude nostrils to feel the correct sensation of airflow (Ruscello & Vallino, 2014). After the patient is able to produce the phoneme with maximum support, they progress to the Motor Stage. During this stage, feedback is gradually reduced, and the patient relies more on self-monitoring rather than external feedback from a therapist. The phoneme that originally was in error is practiced to make the motor movements (both placement and timing) more automatic (Ruscello & Vallino, 2014). The final stage is the Autonomous Stage, when the behavior (phoneme production) that is easily produced is generalized into everyday speech. The new skill is executed alongside other

speech sounds to move toward error-free production of the phoneme. Mental rehearsal is often used in motor learning to practice thinking of the correct movements and to imagine producing the sound correctly. Practice and repetition is key to motor learning. In order to provide sufficient practice, techniques should be modeled for parents of children in treatment incorporating the motor learning process. Family education and training are critical to ensure enough practice between therapy sessions to progress, as well as the ability to practice correctly, since incorrect practice would reinforce motor memory of errors, making speech worse (Ruscello & Vallino, 2014).

Parent/Family Involvement

Parent involvement in therapy is critical to improvement since frequent daily practice is necessary to change articulation habits. Ha (2015) implemented a parent-education intervention in young children (mean age 19.5 months). The treatment group participated in a 3-4-hour parent training session. Parents were educated about the types of errors that characterize speech produced by individuals with cleft palate. Parents listened to language samples to become familiar with hypernasality and compensatory strategies. The parents were trained in eleven communication strategies, including 1) providing face-to-face communication, 2) letting the child lead the conversation by their own interest, 3) emphasizing initial sounds in words, 4) exaggerating lip articulations, 5) slowing rate of speech, 6) repeating speech, 7) shortening the length of utterances used, 8) waiting for the child’s response, 9) listening to the child’s response, 10) responding immediately to the child’s response to communication, and 11) expanding on child’s vocalizations and modeling attempts, except in cases when compensatory strategies were used. Parents in the treatment group were observed using strategies and coached every two

weeks. They were encouraged to send video clips of their interactions while keeping in mind the checklist of communication strategies. Parents implemented the treatment for three months in their own home environment. The group with parent intervention showed increased performance on all speech and language measures, including increased accuracy of consonant production and improved intelligibility.

Similarly, Pamplona, Ysunza, and Morales (2017) used home programs to involve parents in therapy. They provided audiovisual homework for forty-one children in Mexico City with compensatory articulation due to cleft palate, and compared their progress to children treated without the home assignments and parent training. The audiovisual materials included a CD with songs, audio stories and coloring books that targeted specific speech sounds that are typically difficult with compensatory articulation (e.g., /k/, /p/, /t/, /ch/, /s/). For example, one story was titled, “El **T**irano**s**aurio **q**ue **T**iene Ham**b**re.” The group with the parent involvement made more improvements over the summer than the group without parent training, suggesting that time spent training parents can be effective in maximizing reduction of CSCs in children with repaired unilateral complete clefts of the primary and secondary palate, especially when frequent speech therapy by a clinician is not available or feasible. Most home programs focus on long-term practice based on the evidence that dispersed repetition is most beneficial for speech sound improvement. Parents work with children, periodically returning for more guidance from the therapist as the child progresses and needs new techniques. Parent involvement is particularly important in areas where speech-language pathologists may not be accessible, such as in developing countries.

Complications with Humanitarian Efforts

Many charity groups that travel internationally and offer cleft palate surgical repair lack post-surgical speech therapy, although there has been a shift toward including speech treatment in outreach programs. Although the intent from these charity organizations is often benevolent, there have been many criticisms of the standards and models of providing care (Goldstein, 2000, Ruiz-Razura, Cronin, & Navarro, 2000; Silver, 2000). According to Kummer (2014), some of the primary criticisms of international outreach include the tendency to focus on surgical repair of cleft lip and palate, rather than treating the patient's needs from a more holistic perspective, which is the model followed by cleft palate team care in the United States. Mission trips focus on procedures conducted by foreign surgeons instead of training locals, which is not sustainable for long-term care. Although some organizations require licensing and experience, others provide treatment for cleft palate patients, including surgical procedures from inexperienced individuals who do not have expertise specifically in cleft palate. Some organizations have been accused of using foreign cleft-palate patients to train inexperienced professionals, at the expense of the patient. Another criticism is that services are sometimes provided in conditions that are substandard, without ideal equipment that would be expected in the United States. At worst, inexperienced treatment could result in infection or irreparable errored surgical alterations, and at best the lack of continued care could result in undetected needs for follow-up surgeries or recommended interdisciplinary services, such as speech and dentistry. It is estimated that 20-30% of patients with repaired cleft palate will need follow-up surgery for velopharyngeal insufficiency (VPI) (Kummer, 2014). Speech pathology is needed to help determine whether behavioral intervention or surgical intervention is necessary for speech differences, including VPI.

Although there are many criticisms of international outreach programs, there is also a need for these services. In many developing countries, cleft lip and palate may go unrepaired and without treatment, sometimes resulting in social isolation and difficulty communicating (Aziz, Rhee & Redai, 2009, Gupta, Bansal, Dev & Tyagi, 2010). The lack of treatment for individuals with cleft palate may be due to deficits in understanding the etiology and treatment options; this may be due to insufficient funds for treatment or cultural differences in the acceptability and attitudes toward treatment. One possible solution to the lack of cleft palate care in foreign countries is to use a team approach for treatment that includes speech services. Speech therapists who volunteer to accompany groups on mission trips would be limited by time, as most trips only extend over a few days to a week or two. In order for speech therapy to be beneficial as part of the cleft palate mission team, short-term therapy must be a viable option. Perhaps short-term intensive therapy is one option for increasing the quality of care provided on surgical trips.

Although long-term treatment of cleft palate speech is ideal, there is some evidence that improvement can be made over a short period of intense treatment and may be effective for treatment with international patients. Luyten et al. (2016) found that six hours of intensive articulation therapy over 3-4 days during a post-surgical follow up trip in Uganda was effective in improving intelligibility and reducing nasal emissions in patients with repaired cleft palate; however, three of the five patients treated were determined to still need additional therapy. Derakhshandeh et al. (2016) suggest that improvement can be made to cleft palate speech characteristics (CSCs) with short-term, intense articulation therapy. The authors found that 40 therapy sessions over 10 weeks, at home with the therapist and mother, resulted in decreased CSCs in all five children participating. Therapy specifically focused on making oral consonants (e.g., moving a glottal stop into the oral cavity); therefore, placement errors decreased, but two of

the children continued to exhibit weak consonant production or nasal emissions. When intense treatment during three-week long summer camps (4 hours a day, 5 days a week) were compared to more common articulation treatment (1-hour therapy twice a week, over a year) for CSCs in Mexico City, the improvement levels were similar, suggesting that intense short-term treatment can be as effective as infrequent long-term therapy (Pamplona et al., 2005). Overall, this research suggests that speech characteristics of children who have cleft palate speech patterns (e.g., nasal emissions, backing of consonants) may improve with intense therapy over as short a period as a few days, weeks or months; however, additional therapy may be needed over a longer period of time to become error-free and intelligible to familiar and unfamiliar listeners. In order to make treatment as intense and frequent as possible, it is ideal to include caregivers in the therapy implementation process for home practice.

Benefits of short-term, intensive therapy with caregiver implemented home programs are that treatment can be provided during international mission trips to countries where there is limited availability of SLPs trained in cleft palate evaluation and treatment (Derakhshandeh et al., 2016). These same benefits may apply to areas of the United States that lack SLPs trained in the area of cleft lip/palate and craniofacial anomalies. In addition to short-term intensive therapy, a model of family training has been proposed as a solution to the lack of cleft palate speech services in foreign countries. This model utilizes volunteers to train parents and caregivers to act as the speech therapists after the patient has recovered from surgery. Programs such as RSF-EARTHSPEAK (2012) train family members to present the sounds in error (post-surgery) in the order that they would be learned developmentally. They are guided to train the individual to start with babbling the sound, moving to more complex productions, as a child would typically learn to speak. Unfortunately, there is no empirical evidence that the training programs are effective,

and additionally, without a trained speech-language pathologist it may be difficult for family members to know whether the errors in speech are obligatory or compensatory. Home programs are ideal, in theory, but may lack follow through, especially if the patients do not see improvement, if improvement is slow, or if the trained family members feel inadequate in implementation.

Speech Therapy via Telepractice

Perhaps a more promising solution to the lack of speech therapy services for cleft palate across the nation includes the use of telepractice. The advances in modern-day technology may help bridge the gap between the need for post-surgical speech therapy and the lack of available services in remote or distant locations. Furr et al. (2011) successfully implemented telepractice speech therapy by setting up a receiving computer with internet connection in a rural area in Peru. Therapy sessions were provided through video chat with bilingual speech therapists in the U.S. treating 13 patients, age 4-24 years, who had previously received surgical repair as part of a humanitarian effort. All patients improved intelligibility and presented a reduction of hyponasality or hypernasality after several months of treatment, according to anecdotal evidence. The authors anecdotally reported that patients were universally accepting of the treatment and enthusiastic in participation, per patient report through interviews.

Another study used telepractice for treatment of 10 patients in Nicaragua, ages 3-17 years, who also received cleft palate repair through humanitarian services (Glazer et al., 2011). Services were provided monthly through video conferencing with a speech therapist in Baltimore, and the use of an interpreter. For patients who completed at least three teletherapy sessions, there was a significant improvement in whole-word and initial consonant production;

however, final consonant production did not significantly improve. Additionally, quality of life was rated significantly higher following participation in teletherapy. In addition to this evidence supporting treatment of cleft palate speech patterns through telepractice, researchers have found that evaluations of cleft palate speech through telepractice are valid and consistent with evaluations simultaneously performed by a cleft-palate trained speech-language pathologist in person (Whitehead et al., 2013). If technology can be accessed in the areas where humanitarian trips treat patients, this may hold promise for follow-up speech services.

Intervention models using home programs or telepractice therapy have evidence to support treatment of speech sound disorders, especially for patients in areas without access to trained therapists. No research has yet investigated the effects of the combination of home programs with telepractice follow-up consultation to guide family members in treating individuals with cleft palate speech errors. In the current study, the use of weekly telepractice for support in parent implementation of a home speech program is investigated for the treatment of cleft palate speech patterns in children with non-syndromic cleft palate. In this study, direct treatment targeted compensatory speech errors and included training of the family members during an initial face-to-face meeting. Subsequently, indirect treatment included biweekly follow-up telesessions to assess progress and answer therapy-related questions. Bessell et al. (2013) reviewed current evidence-based practice in the field of speech treatment for cleft palate and found a lack of unbiased quality research on cleft palate speech treatment; therefore, the current study focused on randomizing treatment to include either parent training with a home program, or parent training with a home program and weekly telesupport. It was expected that the patients with both the home program and telesupport would make more progress toward correct articulatory production of the targeted phoneme, as well as spend more time practicing

the target speech sound. According to motor learning theory, rehearsal is key to mastering automaticity, and it was anticipated that weekly telesupport for speech services would remind and encourage continued daily practice, as well as help fine-tune the accuracy of practice in order to reinforce correct motor production. The telesupport was included to provide training of family members, consult for questions about therapy techniques, as well as an informal assessment of weekly improvement. Final improvement was evaluated in-person and expected to be higher for the telesupport group due to increased practice time and support for comprehension and implementation of therapy techniques. There are many humanitarian efforts aimed to help individuals with cleft palate, and many of them are starting to include speech therapy as part of the holistic treatment, yet the need for improvement still exists. Lack of trained speech pathologists, time with patients in foreign countries, and follow through with quality home programs are barriers to patients receiving speech benefits. In this research, we hope to offer a solution to these issues, by adding telesupport to the speech therapy provided through home programs.

CHAPTER 2: Method

Design

A randomized design was selected, with participants assigned to either the TEL or TAU groups through a randomized function of Microsoft Excel. Additionally, a mixed design was utilized for outcomes, with between group measures to compare the TEL and TAU groups and within group measures to compare changes before and after treatment. All outcomes, other than the language samples, were quantitative in nature. Outcome measures were taken once at baseline and then once again after eight weeks of treatment.

Setting

The evaluations and parent training took place in a small hospital in Tijuana, Mexico that provides services for low income families through a cleft palate clinic that meets two times per month. The hospital currently does not offer speech therapy, but has services in diagnostics, surgical repair, surgical follow-up and audiology. Treatment of the home program was provided in homes of families living in Tijuana, by parents. Telesupport was also provided to participants who were located in their own home or at public location of their choice in Tijuana, with the families using their own electronic equipment and home connections to the internet (or a public connection of their choice) to receive services. The student clinician providing telesupport was located in San Diego County, CA.

Participants

Ten Spanish speaking children, ages 3-12 years (6 males, 4 females), with complete cleft palate (with or without lip) were recruited from a cleft palate clinic. Participants were not currently receiving speech therapy through the clinic, nor other outside speech services, and had not been diagnosed with a syndrome or other cognitive impairment. Participant cleft palate repair status

ranged from completely repaired, partially repaired (hard palate open) to unrepaired. All participants with cleft lip had their lip repaired. Some participants with repaired hard palates had fistulas ranging in size from small to large. The study was approved by California State University San Marcos (CSUSM) Institutional Review Board (IRB). Informed consent was obtained from the parents of all participants and assent was also obtained for children seven years or older. Participants were randomly assigned to either a treatment as usual (TAU) group or a telepractice (TEL) group. One participant from the TEL group was unreachable after initial assessment and one participant in the TAU group could not participate in post-treatment evaluation due to a fistula repair. Additionally, the youngest participants, one in the TEL group and two in the TAU group (all three years old), did not cooperate for production of the word and sentence outcome measures, so language samples were used for assessment of progress for these three participants. The TEL group consisted of two males and two females, whereas the TAU group was comprised of four males. The average age of the TEL group was 5.5 years and the TAU group was 5.25 years, excluding those who did not return for post-treatment evaluations. Further details regarding participants in each group are found in Table 1 and Table 2.

Table 1

TEL Participant Information

ID	Age	Sex	Cleft Type	SP repaired	HP repaired	Fistula
A	9	F	CP (+Bi lip)	+3 mo	+ 9 mo	+
B	6	M	CP (-lip)	+ 11 mo	+ 11 mo	-
C	4	F	CP (-lip)	+ 1 yr	+ 1 yr	-
D	3	M	CP (+L lip)	-	-	HP/SP open
E*	6	F	CP (+R lip)	+ unknown	+ unknown	+

* Participant E had initial evaluation but no further participation

Table 2

TAU Participant Information

ID	Age	Sex	Cleft Type	SP repaired	HP repaired	Fistula
F	4	M	CP (+R lip)	+ 1 yr, 4 mo	+ 1 yr, 4 mo	-
G	11	M	CP (+L lip)	+ 1 yr	+ 1 yr	+
H	3	M	CP (+Bi lip)	+ unknown	-	HP open
I	3	M	CP (+Bi lip)	+ unknown	-	HP open
J*	10	F	CP (+Bi lip)	+ 1 yr	+ 1 yr	+

* Participant J had initial evaluation but no further participation due to fistula repair

An evaluation of speech sound production was performed for all ten participants during their initial visit. Of the ten initial participants, the three youngest, Participant D, H and I were mostly non-verbal and did not cooperate in completion of several outcome measures, so only language samples and parent report were obtained for these three participants. Five of the seven fully assessed participants returned for post-treatment evaluations, which consisted of the same assessments conducted during the pre-treatment initial assessment. For the remaining seven participants, articulation of phonemes at the syllable, word, and sentence level was assessed, as well as in connected conversational speech during initial assessment.

Materials

Intake.

Solicitud de Participación.

Parents filled out a ten-page intake form (Appendix D), designed for a previous study at CSUSM, with questions about participant demographics, cleft medical diagnoses and repair dates, hearing history, developmental milestone dates, and areas of speech, language and communication concerns.

Baseline and outcome measures.

Target and probe words.

A list of ten target words and ten probe words were generated, including the targeted phoneme in initial word position; nasal phonemes were excluded from all words. The majority of the words were selected from the Leaders Project (n.d.) games targeting specific phonemes, with additional words added from the website "Palabras Con" (n.d.) if enough words on the game board did not meet the criteria (e.g., "**d**ame" was excluded due to nasal /m/ and "**d**ecir" has no nasal phonemes, so it was included lists). The treatment and probe word lists can be found in Appendix B.

La Medida Española de Articulación (La MEDA; Mason, Smith & Hinshaw, 1976).

La MEDA (Mason, Smith & Hinshaw, 1976) is a Spanish articulation screener that has fifty-four visual images for the speaker to verbally identify. The images include all of the consonants in the Spanish language, in different word positions (e.g., initial, medial, final) that the phonemes naturally occur (e.g., **d**inero, **d**e**d**o, se**d; s**illa, ca**s**a, do**s**). The screener also includes words with blends (e.g., **cl**ase, **bl**anca, **fl**or) and vowels (e.g., **o**s**o, e**lot**e**). The screener was used with participants to identify the phonemes each participant produced in error at the word level, along with the compensatory productions made by each participant.

Evaluación de Los Sonidos (Leaders Project, n.d.).

The *Evaluación de Los Sonidos* (Leaders Project, n.d.) was used to assess consonant production at the syllable and sentence level. This form includes sentences that have words with the consonant assessed in word initial position (e.g., **S**iempre **s**ale el **s**ol; **T**ío **T**ony **t**omo **t**é). Participants were asked to repeat the sentences, or if literate, read the sentences.

Language sample.

An audio recorded sample of connected speech was obtained through conversation about school, friends, holidays and pets for verbal participants and through play for younger

participants who were mostly non-verbal. Labeling of pictures on La MEDA was also included in the language sample, if the participant was able to produce words.

VPI Effect on Life Outcomes (VELO; Skirko, et al., 2013)

Parents filled out the *VPI Effect on Life Outcomes* (VELO; Skirko, et al., 2013) quality of life survey pre and post-treatment to assess changes that might accompany improvements in speech. This instrument examines changes in quality of life with articulation treatment (Skirko, et al., 2013). The quality of life measurement is specific to VPI-related issues, but also includes health issues that can change with therapy. The 26-item parent version of the questionnaire includes the following subscales: Speech Limitations (e.g., *The sounds of speech are different compared to other children*); Swallowing Problems (e.g., *Liquid leaves my child´s nose while eating/drinking*), Situation Difficulty (e.g., *My child´s speech is difficult for friends to understand*); Emotional Impact (e.g., *People make fun of my child due to his/her speech*); Perceptions by Others (e.g., *Other people ignore my child because of his/her speech*); and Caregiver Impact (e.g., *I worry about the way that my child speaks*). The response format is a 5-point Likert-type scale (i.e. 0=never a problem to 4=always a problem). The highest possible score of 100 indicates the greatest impact of cleft palate/VPI on quality of life.

Post-treatment parent survey of improvement and connectivity.

A Likert-type survey was created, assessing the parent reported amount of practice, perceived improvement in speech and perceived understanding of therapy. These questions were given to all participants after the eight weeks of home practice. The TEL group was also given additional connectivity questions, similar to those utilized by Whitehead et al. (2013) about their experience connecting during the telesessions and satisfaction with participation in teletherapy. Survey questions for both groups can be found in Appendix C.

Treatment materials.

Treatment materials included a binder with the following: *Acevedo Spoke* for syllable practice, the treatment word list (same as used for assessment) with 10 words that included targeted phoneme in initial position alongside a photo (all words were chosen to be free of nasal consonants), a gameboard with words (accompanied by photos) that included the targeted phoneme in initial, medial and final positions, a book with the targeted phoneme. The treatment binder also included materials for training use of the home program, including phoneme specific stimulation instructions/tips, a hierarchy of therapy, specific steps for therapy using the *Acevedo Spoke* and word lists, an instruction sheet for use of the game and book. Data sheets (Appendix E), were also included, with an option for recording whether the participant practiced each day, the type of practice (e.g., book, game, wordlist), the phoneme practiced and +/- for recording rates of correct/incorrect production. The *Acevedo Spoke*, games, books stimulation handout and hierarchy were obtained from the Leaders Project (n.d.). Home packets also included sticker packs for positive reinforcement of practice and chipper chat chips and a wand. Instructions for parents on how to proceed with the *Acevedo Spoke* was also included and can be found in Appendix A.

Procedure

Participants were evaluated using *La MEDA*, *Evaluación de Los Sonidos*, and a short language sample to determine their speech needs. Based on performance and phonemes in error, stimulation of targeted sounds was attempted. If the child was stimulable, then the treatement and probe words were read to be included as part of the outcome information. Therapy materials for targeted phobeme(s) were presented to participants during initial meeting, immediately following the evaluation and stimulability check. One or two of the phonemes /p/,/b/, /d/, /t/, /k/,

/g/ and /s/ were included in the packets for treatment and targeted based on each patient´s performance during the evaluation. Decisions for which phoneme to target were made following the typical developmental acquisition order, which usually occurs with stops from front of mouth (e.g., /p/, /b/) to back (e.g., /k/, /g/), followed by fricatives (e.g., /s/, /z/). Additional considerations were the frequency of the errors, such that if an error was made occasionally (i.e., less than 1%) the next phoneme in development was chosen as the target. Treatment was initiated during the initial visit as long as the participant was stimulable for the target sound, and parents were educated on how to proceed with the materials at home. During initial training, the student clinician modeled use of the magnetic chips for focus, entertainment, and reinforcement during demo therapy. Each participant was giving a metalic token after each production of the target phoneme, which they placed on the arms of the *Acevedo Spoke*. When the spoke was full of chips, the child was handed the magnet wand to collect the chips, which was a desired action by all children. The instruction sheet for the steps of therapy with the *Acevedo Spoke* was reviewed with the parent to increase parent understanding and any questions were answered. Parents were asked to demo their therapy so that the student clinician could provide feedback to implement during home practice.

Telepractice support.

Two treatment groups for cleft-palate speech patterns were formed by random assignment: Group 1=treatment as usual (TAU), Group 2=telepractice group (TEL). The groups were similar in initial treatment, receiving a home program and parent training for implementation to work on specific phonemes over eight weeks at home. The only difference between the treatment of the two groups was that the TEL group received additional weekly support through telepractice, with a 15-minute video or phone conversation between graduate

student clinician and parent/participant, whereas the TAU received the home program without weekly follow-up.

During the initial meeting a short in-person therapy session was conducted as a model for parents of both groups. Parents were provided the therapy materials and guidance for home implementation of treatment of a specific targeted sound(s). Both the treatment as usual (TAU) and telepractice group (TEL) were asked to practice two times a day, for 5-10 minutes each practice session, over 8 weeks. The TEL group also received weekly follow ups via Zoom or phone calls, approximately 15 minutes each, to provide further support in answering questions and deciding how to modify therapy based on progress. Parents in the TEL group were asked to demonstrate their home therapy practice of the phoneme being targeted, using the materials provided (e.g., book with sound, *Acevedo Spoke*, word list, games). Parents were educated during each meeting and given feedback regarding their application of home therapy. Follow-up also included a component of accountability, asking the parents and children participating how often they had practiced over the previous week. Data sheets were provided to confirm the amount of practice; however, they were not returned by the majority of participants.

Measuring outcomes.

Two in-person evaluation and therapy training sessions took place for both groups before and after the 8 weeks of treatment, in order to assess the child's speech sound production, provide a home therapy program specific to the child's needs, and evaluate progress on phoneme specific goals. These in-person meetings were approximately one hour and included recording the child's production of sounds, as well as assessing speech production of targeted phonemes. During the initial evaluation and post-treatment evaluation participants were asked to read or repeat the list of treatment words with their targeted phoneme. These were the same ten words

included in the treatment packet. Additionally, ten probe words were used as an assessment of word-level targeted phoneme generalization, both pre and post-treatment. As additional measures of target phoneme improvement, words with the targeted phoneme from *La Meda* and the sentences from the Leaders Project assessment were also assessed before and after eight weeks of home practice.

Analysis

All statistical analyses were conducted with IBM SPSS Statistics software (Version 24). Non-parametric measures were used due to small sample sizes and non-normal data distributions. Wilcoxon Signed Rank Tests were run for all within group comparisons pre and post-treatment and Mann Whitney U was used for comparisons between the TEL and TAU groups. Additionally, Spearman´s ρ was used for a non-parametric correlation of age and number of times practices and Pearson's partial r was calculated for correlation of treatment and number of times practice, while controlling for age.

CHAPTER 3: Results

Power Analysis

A power analysis, assuming at least a medium effect size, revealed that the current sample sizes would yield a power no greater than β=0.07 for Mann Whitney U tests and β=0.08 for Wilcoxon Signed Rank Tests. Ideal sample sizes for Wilcoxon Signed Rank Test to detect a medium effect size is n=35 and for Mann Whitney U is n=67 per group. Although the non-parametric tests used to analyze data are robust to violations of assumptions of normality and homogeneity of variance, the results are reliant on sufficient sample size to draw inferences. Thus, all null inferential results reported should be interpreted with caution, given the reduced ability to statistically detect changes and differences between groups.

Inter-rater reliability

The primary investigator and two additional graduate students each individually rated accuracy of targeted phonemes for *La MEDA*, treatment words, probe words, and sentence level words for all participant data, both pre- and post-treatment. Chronbach's alpha indicated acceptable internal consistency in rating of phoneme production (650 items, α= 0.73) suggesting reliable ratings for participant accuracy.

Word Level Production of Targeted Phonemes

It was hypothesized that improvement in phoneme production would occur, with increased phoneme accuracy post-treatment compared to pre-treatment production. This difference was expected to be greater for the telesupport (TEL) group than for the treatment as usual (TAU) group; however, improvement was expected in both groups. Three lists of words were assessed at the initial meeting and post participation, including a list of treatment words, probe words and phoneme specific words from *La MEDA*.

Treatment Words

Ten words with the targeted phoneme in the initial position were presented before treatment to assess accuracy of the targeted phoneme. The same ten treatment words were given as part of the home program to practice over eight weeks and then reassessed for targeted phoneme accuracy after treatment. The number of the treatment words with the targeted phoneme produced correctly were recorded, and accuracy rates (number of correct phonemes out of 10) are provided in Table 3 and 4 below for both the telesupport (TEL) group and treatment as usual group (TAU), respectively. It should be noted that most of the participants were not ready for the word level at initial assessment, so although the words were part of the home program, the participants may have only heard the words as a form of auditory bombardment, instead of use for articulation practice. Parents were educated in the hierarchy of articulation progression from phoneme, to syllable to word level; yet most participants did not reach sufficient syllable level production by the end of the eight weeks and were not ready for word-level practice. According to a Wilcoxon Signed Rank Test for paired samples the TEL phoneme accuracy, out of ten treatment words before participation did not significantly differ from post-treatment accuracy, Z=-0.18, p=0.854. The TAU group also did not change significantly on their production of treatment word phonemes pre- and post-treatment, Z=-1.34, p=0.18.

Table 3
TEL Accuracy of Treatment Words

ID	Phoneme	Pre Tx	Post Tx	Change
A	/s/	0/10	0/10	0*
B	/g/	7/10	10/10	3
B	/k/	9/10	10/10	1
C	/d/	5/10	1/10	-4
C	/t/	10/10	9/10	-1

*decreased nasal emissions, but still present

Table 4

TAU Accuracy of Treatment Words

ID	Phoneme	Pre Tx	Post Tx	Change
F	/t/	9/10	8/10	-1
G	/k/	9/10	5/10	-3
G	/g/	10/10	10/10	0

Probe Words

A list of ten probe words with the targeted phoneme in the initial position was assessed for phoneme accuracy both before and after treatment (see Table 5). The probe words were not included in the home practice packet and were intended to measure generalization of changes in targeted phoneme production at the word level. The TEL group did not significantly change the accuracy of phonemes in probe words pre- and post-treatment, according to a Wilcoxon Signed Rank Test, Z=-0.18, p=0.854, nor did the TAU group, Z=-1.34, p=0.18.

Table 5

TEL Accuracy of Probe Words

ID	Phoneme	Pre Tx	Post Tx	Change
A	/s/	0/10	0/10	0
B	/g/	9/10	10	1
B	/k/	9/10	6/10	-3
C	/d/	2/10	0/10	-2
C	/t/	7/10	10/10	3

Table 6

TAU Accuracy of Probe Words

ID	Phoneme	Tre Tx	Post Tx	Change
F	/t/	8/10	8/10	0
G	/k/	7/10	2/10	-5
G	/g/	10/10	8/10	-2

La *MEDA* Words

The targeted phonemes were also assessed at the word level using *La MEDA*, which allowed for assessment of the phonemes in various word positions and within some blends. *La MEDA* includes fifty words, with three words targeting each phoneme; however, many of the words that assessed non-targeted phonemes also included the targeted phoneme. Therefore, all words with the targeted phoneme were identified and used to calculate both pre- and post-treatment success. Since each phoneme was represented a different number of times, the proportion correct was calculated, with the total phonemes produced without error, out of the number of times the phoneme appeared in *La MEDA*. The TEL group had a positive shift in proportion correct (M=0.15, SD=0.37), whereas the TAU had a negative shift in proportion correct (M=0.01, SD=0.22); however, this difference was not significant, p=0.352, Mann Whitney U. When the initial mean proportion correct for the TEL group (M=0.51, SD=0.41) was compared to the change in proportion correct post-treatment (M=0.65, SD=0.33), the difference was not significant, according to a Wilcoxon Signed Rank Test, Z=-1.21, p=0.225. Additionally, the slight difference in pre-treatment proportion correct for the TAU group (M=0.68, SD=0.26) compared to their post-treatment proportion correct (M=0.67, SD=0.26) was not significant, Z<.001, p>0.99. Even though the change in proportion correct on targeted phonemes in La MEDA was in the expected direction for the TEL group, the difference was not significant, nor were there significant differences between the TEL and TAU groups.

Sentence Level

The change in phoneme accuracy at the sentence level was compared between the TEL and TAU groups. It was expected that the TEL group would show greater improvement than the

TAU group; however, the difference in phoneme accuracy at the sentence level was not significant, as measured with a Mann-Whitney U test, p=0.216. The non-significant change was in the predicted direction for the TEL group (M=0.60, SD=0.89), but not for the TAU group (M=-0.33, SD=1.15) and there was more variability in the change for the TAU group.

Language Samples

The three youngest participants, Participant D, Participant H and Participant I, did not fully comply with attempt to evaluate via *La MEDA*, treatment/probe words and *Evaluación de Los Sonidos* sentence level repetition. Lack of completion of these measures may have been due to decreased compliance based on age, low language ability, lack of interest or attention span below that required for completion. Alternatively, language samples obtained before and after treatment were used in place of the formal outcome measures to compare progress. Participant D was in the TEL group and Participants H and I were in the TAU group.

The language sample for Participant D (TEL) was taken while attempting to have Participant D imitate words from La MEDA, followed by a play sample with magnetic building blocks. The initial language sample was characterized by minimal verbal output that consisted of all vowels, with a preference for non-verbal communication. Non-verbal communication included crying, shrieking, hitting, running, grabbing and reaching toward desired items. Spontaneous communication with vowels was produced, with intermittent imitation of 1-4 vowel sounds that occasionally matched the modeled vowels in a word (e.g., “ah-oh¨ for *gato*). All verbal output was produced with a high pitch. Lip movement was not present during sample for consonants, including a lack of /m/ and /n/ bilabial movement that is typically unaffected by cleft palate. Slight improvement was noted during the second language sample, with a few instances of bilabial lip movement that was not present during initial assessment, including /m/

in imitation of modeled “mama” and attempts for production of /p/ with occluded nares (repetition of “papa). Lip movement increased, but accurate production of /p/ was not obtained. The ost-treatment language sample also was comprised mostly of non-verbal communication, including pointing and grabbing, as well as grunting, crying and shrieking. The sample was characterized mostly by vowel production, with an occasional consonant after exaggerated modeling. Vocalizations continued to be high-pitched and hypernasal. The parent reported reducing practice to three times a week because of difficulty engaging Participant D. The parent reported practicing /m/ without nasal occlusion and lip movement for /p/ with nasal occlusion. Additionally, the parent reported attempting therapy through games, without success. Parent perceived some improvement, but continued with difficulty to get Participant D to cooperate with therapy practice and stated that being firm was the only way to get Participant D´s attention. There was some improvement noted between language samples, with closer consonant approximation, but the targeted phoneme /p/ was still in error.

Participant H (TAU) protested participation in the planned outcome measures, and wanted to run and play; thus, a language sample was utilized to compare progress. Participant H´s parent reported practicing often at the post-treatment follow-up, but could not recall the phonemes that were assigned to the home program during the initial assessment nor the training meeting. The parents reported practicing only with the book because of protesting with the other materials. Participant H showed some improvement post-treatment with increased lip movement, increased attempt to use verbal language and successful production of /p/ with nares occluded. Participant H´s initial language sample was characterized by a preference for non-verbal communication, including grabbing and reaching, alongside crying. Verbal production included use of consonants: /t/, /p/, /b/, /n/, /k/, and “ñ” although all consonants were used infrequently.

Most words were produced using vowels only (e.g., “aye-oh-ah” for *pelota*), although consonants were occasionally produced during imitation (e.g., “utala” for *cuchara*). Many words with multiple syllables were shortened (e.g., “nana” for *manzana*). Participant H had minimal lip movement, with difficulty imitating words with sounds that typically are able to be produced with an open palate (e.g., /m/ and /n/), although these sounds were produced spontaneously at times (e.g., “no” and “mino”). Additionally, many consonants were omitted from words (e.g., “alo” for *palo*). An attempt to initiate “ma” resulted in several errors, including production of “na” and “da” inconsistently, although Participant H produced “ma” intermittently. An attempt to occlude nares as a game for /p/ production was unsuccessful during the initial meeting. Parents were educated on how to practice this phoneme at home. During the post-treatment language sample, Participant H produced similar language patterns, such as “api” for lapiz, with a preference for reaching and screaming to communicate, yet spontaneous consonants were produced more often. Participant H independently produced several words (e.g., “no,” “ama,” “mine”) exhibiting more spontaneous lip movement than during the initial assessment. Parents reported that Participant H gets mad when they try to occlude the nares to practice, but that he does better when only one parent is present. Both parents were present during the language sample, and Participant H initially protested nasal occlusion for /p/ production, but then with coaxing participated and produced the phoneme successfully during play post-treatment. Parents reported a language spurt within the last week, with Participant H attempting to repeat more words.

Participant I (TAU) had similar initial and post-treatment language samples. Participant I preferred verbal communication that was composed of primarily vowel sounds, with one instance of “ñ” (e.g., “ñ-o” for *Indio*) and one occurrence of “n” as a sound in isolation separated

from the syllable (e.g., “n” pause “o” for *conejo*). No other consonants were present in the language sample. Multiple words were used by Participant I in sentences to answer questions and communicate ideas, but most output was unintelligible to an unfamiliar listener. Parent of Participant I understood most verbal communication, though only comprised of vowels. Participant I used up to three-syllable words during speech, but often reduced the number of syllables when imitating three-syllable words (e.g., “ee-ah” for *abeja* and “ah-ah” for *manzana* and “ee-ah” for *mariposa*). Three syllables were produced with maximum prompting (e.g., “uh-uh-ah” for *pelota* on third imitation attempt). Multiple syllables were produced during conversational speech, but the length of each word was difficult to determine due to high level of unintelligibility. Participant I omitted nasal consonants from most words produced (e.g., “ah-ah” for *mama* and “ah-oh” for *mano*). Participant I had appropriate turn-taking conversation, answering and asking questions, and changing inflection to match the type of sentence, as well as singing a song and reciting the vowels spontaneously. Nasal occlusion for stimulation of “p” was attempted, but Participant I protested. Post-treatment language sample for Participant I consisted of communication that was similar to the initial sample, with continued communication that was primarily verbal but consisted of only vowels (e.g., “ah-ah” for *mama*). When asked questions, Participant I responded with appropriate answers (e.g., When asked “What does mama drink in the morning?” responded with “ah-ay” for *café*). Participant I spontaneously produced phrases to communicate with use of words produced solely with vowels, but was mostly unintelligible due to omission of consonants. Per parent report, Participant I is able to produce /m/, but with maximal effort. Parent also reported trying to occlude nares to practice /p/, but Participant I would blow and not produce sound.

Parent Report Survey: Practice Frequency, Therapy Knowledge & Speech Improvement

It was proposed that providing weekly telesupport would increase the accountability to continue practicing speech therapy at home, resulting in increased frequency of practice. A Mann-Whitney U test was utilized to compare the number of times reported practicing over one month, between the telesupport and non-telesupport groups. The telesupport group (TEL) reported practicing an average of 20.5 times per month (SD=9.88) whereas the treatment as usual group (TAU) without telesupport reported practicing an average of 12.5 times per month (SD=11.90); however, this difference was not significant, p=0.343. There was a significant positive correlation between age of participant and number of times practiced over a month, ρ (6)=0.814, p=0.014, suggesting older participants practiced more, across both groups. Using a partial correlation to control for age resulted in a marginally significant relationship between treatment (TEL vs. TAU) and the number of times practiced over a month, r (6)=0.725, p=0.065.

Another focus of the weekly follow-up telesupport sessions was to provide parents with continued education regarding therapy strategies, training for in-home speech therapy, and helping to clarify questions about implementation. It was predicted that parents who received this additional support would have greater confidence in their understanding of the speech therapy process and be more confident in their abilities to provide in-home speech therapy. Parents in the telesupport group all reported the highest level of understanding how to perform therapy in the home (M=5, SD=0) which was greater than the understanding reported by those in the home program only group (M=3.75, SD=1.26); however, a Mann-Whitney U test revealed that this difference was not significant, p=0.114.

Although treatment and probe list comparisons were made, some improvements in speech at the syllable level or outside these set lists may be more easily perceived by people who interact with the patients daily. For this reason, parents were asked about their perception of their

child´s speech improvement over the eight weeks participating in the study. Parents rated the improvement of their child´s speech on a Likert-like scale, ranging from 1 = no improvement to 5=complete improvement, with a score of 3 indicating that their child showed some improvement. Parents in the TEL group reported a slightly higher, yet non-significant, average rating of speech improvement in their children (*M*=3.75, *SD*=0.98) compared to the group that did not receive weekly support (*M*=3.00, *SD*=0.0), *p*=0.343, according to a Mann-Whitney U comparison (Table 6).

Table 6

Parent Report of Practice Frequency Per Month, Therapy Knowledge and Speech Improvement by Treatment Group

		TEL				TAU	
ID	Freq	Knowledge	Improvement	ID	Freq	Knowledge	Improvement
A	30	5/5	5/5	F	5	4/5	3/5
B	25	5/5	3/5	G	30	4/5	3/5
C	20	5/5	4/5	H	5	5/5	3/5
D	7	5/5	3/5	I	10	2/5	3/5

VELO Quality of Life

Quality of life was measured with the *VELO* at the initial assessment and again using the same measure post-treatment. The ten participants initially had a wide range of *VELO* scores from 6 to 85, with higher scores indicating a larger impact of cleft palate on their overall lives. For the eight participants that returned for follow-up evaluations, the four participants in the TEL group had an average *VELO* of 40 (*SD*=36.87), and the TAU group had an average of 46 (*SD*=22.55) indicating the groups were similar in quality of life. Overall the quality of life impact scores initially rated on the *VELO* across both groups (*M*=43, *SD*=28.49) was reduced

slightly post-treatment (*M*=36.25, *SD*=19.87), yet this reduced impact on quality of life was not significant, *Z*(6)=-0.98, *p*=0.327, according to the Wilcoxon Signed Ranks Test. Although the TEL group had slightly more improvement in *VELO* scores (*M*=7.5, *SD*=15.26) compared to the TAU group (*M*=6, *SD*=22.69) the difference between the two groups was also not significant, according to a Mann Whitney U test, *p*>0.99. There was high variability in the VELO scores, and although the differences in pre- versus post-treatment and TEL versus TAU groups was in the predicted direction, none of the differences were significant (Table 7).

Table 7

VELO Score Indicating Negative Impact on Quality of Life Before and After Treatment

TEL				TAU			
ID	Pre	Post	Change	ID	Pre	Post	Change
A	14	21	-7	F	23	41	-18
B	55	50	5	G	60	24	36
C	6	3	3	H	31	33	-2
D	85	56	29	I	70	62	8
M (*SD*)	40	32.5	7.5 (15.26)		46	40	6 (22.69)

Telesupport Connectivity and Comfort Ratings

Of the four participants who participated in the telesupport group and completed a post-survey questionnaire about connectivity, three answered questions about video connectivity. All three participants reported “5” the highest level of connectivity on the Likert scale measures ranging from 0 to 5, indicating they were in total agreement that they could see, hear, and understand instructions during video sessions. Only two of the participants responded to questions about comfort and shyness during video interactions. One of the participants rated “4” out of 5 that their child was comfortable with video participation and the other participant rated

“1” out of 5 indicating they disagreed that their child was comfortable with participation. The participant who rated being uncomfortable was the youngest participant and did not want to sit still long enough to participate in the video sessions. Shyness during the video call was also rated by two participants, with the youngest participant´s parent rating a “1” disagreeing that their child had reduced shyness during the video compared to meeting in person. The second participant rated “4” out of 5 agreeing their child was less shy during video telesupport participation. The participant with the higher rating was four years old. This indicates that differences in children might affect how they respond to telesupport provided during therapy sessions. The participant with the shy child who did not enjoy participating in the telesessions rated the benefits of teletherapy “1” whereas the other two participants who responded to the questionnaire rated the benefits “4” and “5” out of five. All four participants rated the importance of speech therapy a “5,” so they understood the general importance that therapy has for children with cleft palate. Three participants stated a “5,” that they completely agree they would participate in teleservices again and the parent with the child who did not enjoy participation rated a “4,” agreeing that they would also participate again. General satisfaction for the teleservices ranged from “3” to “5” with three participants rating the highest level of satisfaction and one participant rating “3” neutral satisfaction. Even when the children protested, the parents reported still being satisfied with the telesessions and desired to continue, should they be held again. Overall connectivity, when reported was good, with participants receiving and understanding the information presented. Data for telesupport connectivity and comfort ratings are reported in Table 8.

Table 8

Video Telessuport Ratings of Connectivity and Satisfaction

ID	See	Hear	Understand	Comfort	Shyness	Benefits	Importance	Satisfaction	Participate Again?
A	*	*	*	*	*	*	5/5	5/5	5/5
B	5/5	5/5	5/5	5/5	*	5/5	5/5	5/5	5/5
C	5/5	5/5	5/5	*	4/5	4/5	5/5	5/5	4/5
D	5/5	5/5	5/5	1/5	1/5	1/5	5/5	3/5	1/5

*not reported

CHAPTER 4: Discussion and Conclusions

The aim of the study was to determine whether telesupport, in addition to a home program implemented by parents, would increase the benefits of articulation therapy for children with cleft palate speech errors who were not receiving any regular speech services. We evaluated the speech of children with cleft palate errors before participating in an eight-week home program and after participation, with half of the participants receiving weekly telesupport through video and phone calls and the other half just doing articulation therapy with parents, without additional support. We also obtained parent's perception of change in speech during this time, as well as parent report of quality of life before and after participating. Additionally, for the group that received telesupport, measures of connectivity and comfort with virtual participation were obtained.

It was hypothesized that the telesupport group (TEL) would improve the articulation of targeted phonemes correct post-treatment, with greater improvement than the treatment as usual (TAU) home program group that did not receive telesupport. There was not sufficient evidence to support improvement of articulation of targeted phoneme production for either TEL participants, nor TAU participants on any of the word or sentence outcome measurements. The direction of improvement on the words produced in the *La MEDA* and in sentences with target phonemes was in the predicted direction, with slightly more improvement for the TEL group, despite nonsignificant differences. It is possible that neither intervention method, the home program alone, nor the home program combined with telesupport, were sufficient for improvement in phoneme production at the word or sentence level. Limitations include the length of therapy. It is possible that eight weeks of treatment was not enough time to result in changes at the word and sentence level, since many of the participants were still working at the

phoneme and syllable level. According to principles of motor learning (Ruscello & Vallino, 2014) consistent practice over time is required for muscle memory to be created. It is possible that the low intensity of practice over a short period of time was not enough to generate new muscle memory. In order to detect more subtle changes, parents were asked about their perceived improvement in speech throughout the study. Parents in the TEL group reported slightly higher changes in speech improvement than the TAU group, yet the difference was not significant. Both groups rated improvement as improving a little, suggesting that the changes in speech may have been small, yet present.

The three youngest participants with mostly non-verbal communication did not cooperate with participation in the pre-selected target words, probes, or sentence level phoneme assessments; therefore, only language samples were compared for these participants. One participant, in the TEL group, showed increased lip movement post-treatment and attempted the target sound, without success at error-free production. One of the participants in the TAU group also showed increased lip movement and was able to produce the target sound with prompting and maximal cues. The third participant, in the TAU group did not show changes between the two language samples. This suggests that some slight changes in approximating the targeted sounds are likely made at this young age. It is also possible that the two young children showed changes that accompany developmental growth, not reflecting influence of the therapy programs. Additional comparisons, with fewer differences amongst participants would likely help determine the causal factor in growth.

It was also predicted that participation in the TEL group would result in increased accountability and confidence that would in turn increase time spent practicing the home program. Parents in the TEL group reported practicing nearly twice as often compared to the

TAU group, yet the difference was not statistically significant. There was a strong, significant relationship between age and time reported practicing, with older children practicing more than younger children. When age was controlled, practice time was marginally related to being in the TEL group, suggesting that when children are old enough to participate, the telesupport did likely increase accountability and time participating in the speech home program. Since there is evidence that speech is influenced very early by cleft palate, even at the infant level (Scherer, Williams, & Proctor-Williams, 2008) it is important to note that the younger children were less likely to practice with these articulation materials. Perhaps a more naturalistic, play-based therapy program could be developed for infants, toddlers, and young children similar to the Milieu method used by Kaiser, Scherer, Frey and Roberts (2017). This type of program can also be implemented at home, but geared specifically toward a younger age. Similarly, Pamplona, Ysunza, and Morales (2017) found that fun play-based materials that engaged kids, such as songs and coloring books helped improve articulation and motivation to practice. The principles of motor learning require attention and repetition (Ruscello & Vallino, 2014) so traditional articulation therapy is likely more productive with older individuals, whereas play-based treatment is most likely to benefit younger children.

Quality of life was predicted to improve for the TEL group more so than for the TAU group; however, neither group had significant changes in quality of life. Similar to previous research showing increased quality of life post-articulation treatment (Whitehead et al., 2013) both groups reported quality of life being improved, which was in the predicted direction. The improvements in quality of life were slightly greater for the TEL group than for the TAU group. Perhaps more time participating in intervention is needed before more than 6-7% change in quality of life differences would be obtained.

All parents with children in the telesupport group rated their comfort and understanding of the therapy process the highest level possible, compared to moderate ratings of understanding from the home program group without telesupport. This suggests that follow-up provides additional information needed to be confident in therapy implementation, which supports our predictions, although the difference was not statistically significant. Home programs have been effective for speech therapy implementation with young children (Ha, 2015) since parents spend more time with a child than a therapist. Implementation at home can improve outcomes, since motor learning requires consistent repetition (Ruscello & Vallino, 2014), which is often not feasible in the therapy setting. Ideally, parents must be confident in home therapy implementation, which can be ensured by telesupport from a trained clinician who is able to guide parents and answer therapy-related questions as they arise. It is possible that parents who do not understand how to implement therapy, or who are not confident in implementation, may abandon treatment or provide treatment that reinforces previously mislearned errors.

Connectivity ratings by the participants who used video were high, suggesting that they were most often able to hear, see and understand directions provided through telesupport. The older children reported enjoying participation in telesupport, whereas the younger children did not enjoy participation. There were mixed results of whether children were more or less shy with the telepractice than in person, suggesting that personality and past experience with telepractice may influence individual participation and results. Not one type of treatment works for all children, so this should be kept in mind when considering the methods of implementation. For shy children who are afraid of video calls, it is possible to provide telesupport to the parents, instead of directly to the children.

Cleft lip and palate are low-incidence disorders (ASHA, n.d.; Kummer, 2014) thus recruiting a large number of participants is difficult. In this study, the initial sample size was small, and then with attrition and inability to get younger participants to engage in all outcome measures, the sample size for statistical comparisons was even smaller, with three participants in the TEL group and two in the TAU group. The small sample size decreased the likelihood of detecting any differences between pre- and post-treatment or differences between the two treatment groups. Even though Luyten et al. (2016) and Derakhshandeh et al. (2016) both found that short-term articulation treatment ranging from three days to ten weeks was effective, the majority of their patients still exhibited speech deficits following short-term treatment. Pamplona et al. (2005) found that short- term, intensive treatment was as effective as a year of more dispersed treatment. The treatment with our participants was not intensive, such as an all-day camp, since parents implemented the program at home and were instructed to practice for short, more easily implemented periods of time. It is likely that eight weeks of treatment was not long enough to produce large improvements in speech production, and given a small sample size, it is highly unlikely any minor improvements would not have been detected. A larger sample size is advised for future research, with less variation amongst the sample, so that the ability to detect changes will be strengthened. In addition to the small sample, the types of cleft, repair status, and age varied greatly. This variation may have contributed to differences in the effectiveness of the treatment program, which may have masked any overall changes that occurred. Less variation amongst the sample is ideal, yet with a low- incidence disorder it is unlikely to find a homogeneous population.

According to Kummer (2014) there is a high incidence of syndromes that associate with isolated cleft palate (i.e., not accompanied by cleft lip), with prevalence of a syndrome 4-5 times

more likely than with cleft palate accompanied by cleft lip. Half of the TEL group was comprised of participants with isolated cleft palate, increasing the probability of a syndrome. Even though none of the participants had been officially diagnosed with a syndrome, there are over 400 syndromes (Kummer, 2014), so it is possible that a syndrome may have gone undiagnosed. Since the TAU group participants all had cleft palate accompanied by cleft lip, the chances that they had an accompanying syndrome is lower that the TEL group, yet still possible. Syndromes affect multiple features of development, often including cognition, which can reduce mental attention or abilities needed for successful articulation therapy. Additionally, Snyder and Scherer (2004) found that toddlers with isolated cleft palate who were syndrome-free had deficits beyond toddlers with cleft lip and palate and beyond typically developing toddlers without cleft lip or palate. These deficits were in the areas of pre-symbolic and symbolic play that correlated with delays in later developing language acquisition. Thus, it is difficult to determine whether the lack of progress in the treatment group was due to ineffectiveness of the treatment or to the type of delays associated with isolated cleft palate.

In summary, no significant differences were detected between pre and post-treatment articulation outcomes for an eight-week home program, or for the home program with weekly follow-ups through telesupport; however, parents reported some improvement in speech. Older participants in the telesupport group practiced articulation home therapy more often, so given more time, this method is likely to produce more benefits than the home program alone. Parents were also more comfortable with home therapy when they had weekly follow-ups, suggesting telepractice may be an effective way to continue training parents for speech therapy implementation. The criticisms about the lack of sufficient follow-up support for international humanitarian efforts (Goldstein, 2000, Ruiz-Razura, Cronin, & Navarro, 2000; Silver, 2000) are

not completely solved by a short-term intervention, but the results hold hope for improved long-term treatments that might become more feasible that in-person treatment, with the use of telesupport connectivity. Future research could include a longer, or more intense, implementation period, multiple baselines for comparison, and a larger sample size with less variation amongst the participant pool. Additionally, different assessment and intervention methods should be utilized for younger children compared to older children. Motivation is required to gain the attention of younger children and to result in increased practice time. Many outreach teams have started to include home programs as a method of speech intervention, but there is a lack of evidence to show whether the home programs are effective on their own. Parents may lack understanding or feel overwhelmed when presented with guidance or information for a home program treatment for a six to twelve month period. Simplification of the program presented to parents is recommended, with one step of therapy presented at a time, with an education and trainings session(s) before each step and follow-up session(s) after each step. There is still a need for quality, long-term speech therapy to address all the needs of individuals with cleft palate, which may be enhanced by modern connectivity and the use of telesupport.

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Appendix A

Instructions for use of Acevedo Spoke and Treatment Word Lists

Pasos de terapia

Sílabas (Acevedo)

1. sonido inicial con "ja":
    a. Empieze con una vocal (p.e. "ja_a, ja_a, ja_a, ja_a, ja_a,") y cuando su hijo/a pueda pronunciar, siga a la siguiente vocal (p.e. "ja_e, ja_e, ja_e, ja_e, ja_e").
    b. Despues de pronunciar cada vocal correctamente, continue practicando alternando con las vocales "ja___a, ja___e, ja___i, ja___o, ja___u"
    c. Practique las 5 vocales 10 veces cada una, dos veces al dia
    d. Cuando las 50 esten correctas (3 veces seguidas) siga a paso #2

2. sonido inicial (CV): ___a, ___e, ___i, ___o, ___u
    a. Practique las 5 sílabas 10 veces cada una, dos veces al dia
    b. Si hay más de 10 errores, regrese al paso #1
    c. Cuando las 50 esten correctas (3 veces seguidas) siga a paso #3

3. sonido final (VC): a___, e___, i___, o___, u___
    a. Practique las 5 sílabas 10 veces cada una, dos veces al dia
    b. Si hay más de 10 errores, regrese al paso #2
    Cuando las 50 esten correctas (3 veces seguidas) siga a paso #4

4. sonido medial (VCV): a___a, e___e, i___i, o___o, u___u
    a. Practique las 5 vocales 10 veces cada una, dos veces al dia
    b. Si hay más de 10 errores, regrese al paso #3
    c. Cuando las 50 esten correctas (3 veces seguidas) siga a paso #5

Palabras (De La Lista Con Fotos)

5. palabras: Siga con la **<u>lista de palabras iniciales</u>** que empiezan con el sonido ____
    a. Practique las 10 palabras 5 veces cada una, dos veces al dia
    a. Si hay más de 10 errores, regrese al paso #4
    b. Cuando las 50 esten correctas (3 veces seguidas) siga a paso #6

6. palabras: Sigua con la **<u>lista de palabras del medio</u>** que tienen el sonido ___ en medio
    a. Practique las 10 palabras 5 veces cada una, dos veces al dia
    b. Si hay más de 10 errores, regrese al paso #5
    a. Cuando las 50 esten correctas (3 veces seguidas) siga a paso #7

7. palabras: Sigua con la **<u>lista de palabras finales</u>** que terminan con el sonido ___
    a. Practique las 10 palabras 5 veces cada una, dos veces al dia
    b. Si hay más de 10 errores, regrese al paso #6
    c. Cuando las 50 esten correctas (3 veces seguidas) siga practicando con **frases y oraciones**

Appendix B
Treatment and Evaluation Word Lists
Treatment Word Lists

/b/	/p/	/t/	/d/	/k/	/g/	/s/
1. bajo	1. perro	1. tía	1. dejar	1. calle	1. garaje	1. silla
2. bola	2. palo	2. talla	2. dólar	2. caro	2. gorila	2. sol
3. búho	3. pelo	3. té	3. día	3. caja	3. gol	3. salir
4. bella	4. pie	4. tarea	4. dalia	4. qué	4. gorra	4. sello
5. barrer	5. pila	5. tirar	5. dirigir	5. koala	5. gallo	5. solo
6. burro	6. pájaro	6. tío	6. dibujo	6. calor	6. gas	6. su
7. bahía	7. pala	7. tela	7. diario	7. kilo	7. gastar	7. cielo
8. bol	8. pera	8. tú	8. dar	8. kiwi	8. gato	8. cierra
9. bailar	9. pollo	9. tapa	9. durar	9. color	9. gasa	9. sala
10. vaca	10. peor	10. taco	10. decir	10. carro	10. gozó	10. sal

Probe Word Lists

/b/	/p/	/t/	/d/	/k/	/g/	/s/
1. vaso	1. pato	1. tijeras	1. dejar	1. calle	1. garaje	1. silla
2. bolsa	2. pecho	2. taza	2. dólar	2. caro	2. gorila	2. sol
3. boca	3. parar	3. techo	3. día	3. caja	3. gol	3. salir
4. botas	4. patear	4. tierra	4. dalia	4. qué	4. gorra	4. sello
5. boda	5. pobre	5. tarde	5. dirigir	5. koala	5. gallo	5. solo
6. baya	6. paz	6. tibio	6. dibujo	6. calor	6. gas	6. su
7. bate	7. pico	7. tigre	7. diario	7. kilo	7. gastar	7. cielo
8. bosque	8. pavo	8. tecla	8. dar	8. kiwi	8. gato	8. cierra
9. beso	9. pelota	9. tercero	9. durar	9. color	9. gasa	9. sala
10. basta	10. pagar	10. tos	10. decir	10. carro	10. gozó	10. sal

Leaders Project Sentence Probes (Evaluación de los sonidos)

phoneme	sentence
/p/	El pollo picó pan
/t/	El tío Tony tomó té
/d/	Dame el dedo derecho
/k/	Carlos come queso caliente
/g/	A Gastón le gustan los gatos
/s/	Siempre sale el sol

Phoneme Specific Wordlists from La Meda

/p/ (10)	/t/ (13)	/d/ (11)	/k/ (10)	/g/ (5)	/s/ (13)
pelota platano pescado pollo palo pan plancha profesora --------- lapiz mariposa	tenedor tortuga teléfono tambor tren ---------- pelota platano gato (tortuga) llanta ratón elote frutas	dinero dedo dos dragón tenedor pescado falda (dedo) Indio grande sed	cama caja conejo cuchara casa clase cruz pescado chicle blanca	gato grande globo tortuga dragón	sed silla casa pescado manzana vaso oso clase profesora --------- lapiz dos alas cruz

Appendix C

Nombre del Paciente _____

evaluación de post- tratamiento de habla y lenguaje

1. ¿Cuantas veces ha practicado su hija/o (mas o menos) este mes pasado?_____

2. ¿Por cuanto tiempo practica cada ves normalmente? _____ minutos

3. ¿Cual sonido(s) ha practicado su hija/o el mes pasado? _____

4. Yo (mama o papa) entiendo como hacer la terapia en casa con mi hija/o.

Totalmente en desacuerdo	En desacuerdo	No estoy de acuerdo ni desacuerdo	De Acuerdo	Totalmente de acuerdo
1	2	3	4	5

5. ¿Como siente usted del habla de su hija/o?

No Mejoró		Mejoró un poco		Mejoró completamente
1	2	3	4	5

6. A mi hija/o le gustan las practicas.

Totalmente en desacuerdo	En desacuerdo	No estoy de acuerdo ni desacuerdo	De Acuerdo	Totalmente de acuerdo
1	2	3	4	5

7. ¿Ha tenido otra terapia de habla su hija/o durante los 8 semanas pasadas?: si / no
- Si su hija/o ha tenido otra terapia, cuantas veces y con quien?

8. ¿Si no practicaba bastante que sucedió con las practicas?

preguntas de reuniones por internet

9. ¿Cual ha usado usted durante las 8 semanas pasadas?
- reuniones por teléfono
- reuniones por internet con video
- grabaciones de practica

10. Mi hija/o esta cómoda/o con las reuniones de video.

Totalmente en desacuerdo	En desacuerdo	No estoy de acuerdo ni desacuerdo	De Acuerdo	Totalmente de acuerdo
1	2	3	4	5

11. Mi hija/o tiene menos timidez con video que tiene en persona.

Totalmente en desacuerdo	En desacuerdo	No estoy de acuerdo ni desacuerdo	De Acuerdo	Totalmente de acuerdo
1	2	3	4	5

12. Cuando tuvimos reuniones de internet con video pudimos ver.

Totalmente en desacuerdo	En desacuerdo	No estoy de acuerdo ni desacuerdo	De Acuerdo	Totalmente de acuerdo
1	2	3	4	5

13. Cuando tuvimos reuniones de internet pudimos oír.

Totalmente en desacuerdo	En desacuerdo	No estoy de acuerdo ni desacuerdo	De Acuerdo	Totalmente de acuerdo
1	2	3	4	5

14. Podía entender las instrucciones cuando tuvimos reuniones por internet.

Totalmente en desacuerdo	En desacuerdo	No estoy de acuerdo ni desacuerdo	De Acuerdo	Totalmente de acuerdo
1	2	3	4	5

15. Mi hija/o recibió beneficios de las reuniones de internet.

Totalmente en desacuerdo	En desacuerdo	No estoy de acuerdo ni desacuerdo	De Acuerdo	Totalmente de acuerdo
1	2	3	4	5

16. Participaría otra vez, si haya oportunidad.

Totalmente en desacuerdo	En desacuerdo	No estoy de acuerdo ni desacuerdo	De Acuerdo	Totalmente de acuerdo
1	2	3	4	5

17. La terapia de habla es importante para mi hija/o.

Totalmente en desacuerdo	En desacuerdo	No estoy de acuerdo ni desacuerdo	De Acuerdo	Totalmente de acuerdo
1	2	3	4	5

18. Estoy satisfecho/a con esta terapia por internet/teléfono.

Totalmente en desacuerdo	En desacuerdo	No estoy de acuerdo ni desacuerdo	De Acuerdo	Totalmente de acuerdo
1	2	3	4	5

Appendix D

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Department of Speech-Language Pathology

California State University San Marcos 333 S. Twin Oaks Valley Road San Marcos, CA 92096-0001 **Tel:** 760.750.7374 **Fax:** 760.750.3353

Solicitud de Participación

Fecha: _____

Nombre del Niño/Niña: _____

Sexo: ☐ Masculino ☐ Femenino

Fecha de Nacimiento: _____ Edad (anos: meses): _____
Grado: _____
Etnicidad: _____
Dirección de Casa: _____
Nombre de Padre/Guardián: _____
Teléfono: _____ Correo Electrónico: _____
Nombre de la persona completando esta forma: _____
Relación al niño/niña: _____

Por favor de contestar las siguientes preguntas lo más completas que se pueda.

1. Fuente de Referencia
¿Quien le recomendó esta clínica?
Nombre: _____ Teléfono: _____

Dirección: _____ Agencia: _____

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2. **Áreas de Preocupación (seleccioné todas las respuestas que apliquen)**

   ☐ Habla ☐ Lenguaje ☐ Audición
   ☐ Alimentación ☐ Comunicación Social
   ☐ Otro (por favor de especificar sus preocupaciones):_____

   _____

   ¿Actualmente está recibiendo su hijo los servicios de terapia del habla?
   ☐Sí ☐No

   Si la respuesta es sí, ¿dónde?
   _____ ¿Con quien?
   _____ ¿Que tan seguido? _____

   ¿Ha recibido su hijo el tratamiento en el pasado ? ☐ Sí ☐ No

   Si la respuesta es sí, por favor especifica el tipo de tratamiento:
   _____
   ¿Con quien?
   _____

   ¿Qué tan seguido y cuánto fue la duración de tratamiento?
   _____

3. **Información sobre el desarrollo A que edad...**

   ¿ Hizo su primer balbuceo infantil?
   _____

   ¿ Utilizó su primera palabra?
   _____

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¿Uso/Puso dos palabras juntas? _____
¿Empezó a gatear? _____
¿Empezó a caminar? _____

¿Tiene un historial de problemas de alimentación su hijo/hija?

☐Sí ☐No
¿Tiene su hijo/hija un historial de infecciones del oído? ☐ Sí ☐ No

Si la respuesta es sí, ¿a qué edad(es)? _____
Tratamiento para las infecciones del oído (medicamento; tubos de ventilación):
_____

Por favor, describa su parto (normal, complicaciones):
_____
_____
_____

¿Otros problemas de salud?
_____
Historial familiar de problemas del habla y/o lenguaje:
_____
Historial familiar de otras discapacidades: _____

¿A demostrado conocimiento de o frustración hacia su problema de habla y/o lenguaje?

☐Sí ☐No

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Si la respuesta es sí, ¿como? _____
_____

4. Información del Habla y Lenguaje

A. Habla/Articulación
¿Se habla mas de un idioma en el hogar? ☐ Sí ☐ No

Si la respuesta es sí, ¿cuales? _____

¿Qué porcentaje de las veces habla su hijo a su /su primer lenguaje? _____

¿Con quien? _____

¿Qué porcentaje de las veces habla su hijo a su / su segundo lenguaje? _____

¿Con quien? _____

¿Es difícil que otras personas entiendan a su hijo/hija? ☐ Sí ☐ No

Si respondió que si en la pregunta anterior, ¿cuál es el porcentaje del tiempo que otros miembros de la familia/personas cercanas entienden a su hijo/hija ?

_____

¿Cual es el porcentaje del tiempo qué extraños entienden a su hijo/hija? _____

Por favor explique: _____

¿Hay en particular algunos sonidos del habla que son difíciles para su hijo/hija de producir?

☐Sí ☐No

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Si la respuesta es sí, por favor liste los sonidos de mas dificultad:

_____

¿Alguna vez ha escuchado aire salir de la nariz de su hijo/hija cuando él/ella habla?

☐Sí ☐No

¿La voz de su hijo/hija suena diferente comparado a otros niños/niñas de su edad y sexo?

☐Sí ☐No

Si la respuesta es sí, como es diferente?

_____

2. Tartamudeo

   ¿Su hijo tartamudea? ☐ Sí ☐ No ¿Habla rápido? ☐ Sí ☐ No

   Otros comentarios:

   _____

3. Lenguaje

   ¿Cómo se comunica su hijo? (seleccionar todos los que apliquen)
   ☐ Gestos/Señas ☐ Una palabra ☐ Frases Cortas ☐ Oraciones

   Ejemplo de frases o oraciones que su hijo/hija use frecuentemente:

   _____

   _____

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¿Su hijo/hija entiende mas de lo que produce? ☐ Sí

¿Su hijo/hija entiende instrucciones y sigue órdenes sencillas? ☐ Sí

¿El vocabulario de su hijo/hija es pequeño para su edad? ☐ Sí

☐ No ☐ No ☐ No

¿Usted siente que el lenguaje de su hijo/hija es (seleccioné las respuestas que apliquen):

Atrasado? ☐ Sí ☐ No Inmaduro? ☐ Sí ☐ No Ausente? ☐ Sí ☐ No Las oraciones son cortas? ☐ Sí ☐ No Incompletas? ☐ Sí ☐ No

5. Información de Audición

¿Cuándo fue la última prueba de audición de su hijo/hija?

_____

¿Cuales fueron los resultados de la última prueba de audición de su hijo/hija?

_____

¿Su hijo tiene problemas de audición? ☐ Sí ☐ No

Si la respuesta es sí, el problema de audición es ☐ Leve ☐ Moderado ☐ Severo ¿Su hijo usa un aparato auditivo? ☐ Sí ☐ No

Si la respuesta es sí, que tipo de aparato auditivo usa su hijo/hija:

_____

Usa su hijo un implante coclear? ☐ Sí ☐ No

¿Cuál es el modo de comunicación de su hijo? (por ejemplo, ASL, iPad)

_____

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Si su hijo/hija está teniendo problemas con la audición, ¿le gustaría ser referido/a con un Audiólogo?
☐Sí ☐No

6. Diagnóstico Educativo y/o Médico

☐ Labio Leporino
☐ Ambos lados

☐ Completo ☐Paladar hendido

Fecha de reparación: _____ ☐ Izquierdo ☐ Derecho
☐ Incompleto

☐ Paladar duro y blando
¿Ha sido diagnosticado su hijo/hija con:

Fecha(s) de reparación: _____ ☐ Paladar blando ☐ Submucosa

☐ Retraso/Trastorno de Lenguaje ☐ Autismo ☐ Retraso/Trastorno del habla
☐ Apraxia ☐Tartamudeo ☐ Pérdida de audición
☐ Retrasos en el desarrollo
☐ Otro: _____

¿Se completó una evaluación? ☐ Sí ☐ No

Si la respuesta es sí, por quién y cuándo?
_____

Si es así, por favor de añadir una copia de la evaluación.

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Indique previas cirugías que su hijo/hija haya tenido: _____
_____

Indique todos los medicamentos que toma su hijo actualmente : _____
_____

¿Su hijo/hija tiene algún problema con su visión?

☐Sí ☐No
Si la respuesta es sí, por favor de especificar :

_____

7. En el hogar...

¿Con quien vive su hijo/hija?
☐ Padres ☐ Abuelos ☐ Guardián ☐ Familia adoptiva

Por favor liste los nombres de hermanos/hermanas y sus edades: Nombre de hermano/hermana

_____
_____
_____
_____
_____

Edad _____ _____

_____ _____ _____

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8. **Información Medica**

   ¿Está usted afiliado a un equipo de labio leporino/paladar hendido? ☐ Sí ☐ No

   Nombre: _____ Teléfono: _____
   ¿Está recibiendo tratamiento médico en este momento?

   ☐ Sí ☐ No

   Si la respuesta es sí, por favor indique que tipo de tratamiento esta recibiendo:
   _____
   _____

9. **Información sobre Educación**
   Nombre de la Escuela: _____ Teléfono:
   _____ Dirección:
   _____

10. **Nombre de la maestra/maestro:**
    _____ ¿Cómo está su hijo
    académicamente? _____
    _____

    ¿Su hijo recibe servicios especiales? ☐ Sí ☐ No

    Si la respuesta es sí, por favor especifique que tipo de servicios:
    _____
    Nombre de la terapeuta del habla y lenguaje (si es aplicable):
    _____

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10. Comentarios adicionales que desee incluir:

_____
_____
_____
_____
_____

Appendix E

Nombre:	**Meta(s):**	**Semana 1** **29/9/18 - 05/10/18**

Fecha	**Hora**	**Objectivo**
Sábado 29/09/18 **¿practicó ?** ☐ si ☐ no	**1.** ____ **2.** ____	________ ________ **Usó:** ☐ libro ☐ juego
Domingo 30/09/18 **¿practicó ?** ☐ si ☐ no	**1.** ____ **2.** ____	________ ________ __ **Usó:** ☐ libro ☐ juego
Lunes 01/10/18 **¿practicó ?** ☐ si ☐no	**1.** ____ **2.** ____	________ ________ **Usó:** ☐ libro ☐ juego

Progreso: + = correcto - = incorrecto

+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -
+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -
+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -
+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -
+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -

Total Corectos: /50

+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -
+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -
+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -
+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -
+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -

Total Corectos: /50

+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -
+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -
+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -
+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -
+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -

Total Corectos: /50

+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -
+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -
+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -
+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -
+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -

Total Corectos: /50

+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -
+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -
+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -
+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -
+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -

Total Corectos: /50

+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -
+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -
+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -
+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -
+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -

Total Corectos: /50

Fecha	**Hora**	**Objectivo**
Martes **02/10/18** **¿practicó?** ☐ si ☐ no	**1.** ____ **2.** ____	________ ________ __ **Usó:** ☐ libro ☐ juego
Miércoles **03/10/18** **¿practicó?** ☐ si ☐ no	**1.** ____ **2.** ____	________ ________ __ **Usó:** ☐ libro ☐ juego
Jueves **04/10/18** **¿practicó?** ☐ si ☐ no	**1.** ____ **2.** ____	________ ________ __ **Usó:** ☐ libro ☐ juego

Progreso: **+ = correcto** **- = incorrecto**

+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -
+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -	+ -
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Total Corectos: /50

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Total Corectos: /50

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Total Corectos: /50

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Total Corectos: /50

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Total Corectos: /50

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Total Corectos: /50

Fecha	**Hora**	**Objectivo**
Viernes 05/10/18 **¿practicó ?** ☐ si ☐ no	**1.** ____ **2.** ____	_____ _____ **Usó:** ☐ libro ☐ juego

Progreso: **+ = correcto** **- = incorrecto**

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Total Corectos: /50

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Total Corectos: /50