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## Review Article

## Speech pathology telepractice intervention during the COVID-19 pandemic for Spanish-speaking children with cleft palate: A systematic review

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## ABSTRACT

**Background:** Due to the lockdown and quarantines caused by the COVID-19 pandemic, the need to study and use telepractice for providing speech pathology interventions for children with cleft palate has arisen.**Objective:** To carry out a systematic review of the use of telepractice during the COVID-19 pandemic for providing speech pathology interventions for Spanish-speaking children with cleft palate.**Methods:** In July and August 2020, the authors searched the electronic databases Medline, LILACS, SciELO, and the Cochrane Library using the following keywords in English (MeSH): Cleft palate combined with Early intervention, Speech therapy, Rehabilitation of speech and language disorders, Speech production measurement, Speech articulation tests and Telemedicine. Original articles were selected and analyzed, complemented by an analysis of flowcharts and recommendations by the GES Clinical Guide of Cleft Lip and Palate of Chile's Government and the authors' expert opinions.**Results:** A total of 2680 articles were retrieved, of which 23 were critically analyzed and used to adapt the early stimulation, evaluation, and treatment of children with CP to speech therapy telepractice at the Gantz Foundation, a Hospital in Santiago de Chile. **Limitations:** Only three researchers carried out a quick review, which limited the depth of individual analysis of the studies included. Also, the suggestions and material presented should be evaluated in future investigations.**Conclusion:** This systematic review provides useful guidelines for providing speech pathology interventions through telepractice for children with cleft palate. Audiovisual materials seem to be extremely useful for families receiving the interventions. The use of interactive videos for Spanish-speaking children and educational videos for parents is manifest.

## 1. Introduction

In Chile, approximately 400 children are born each year with cleft lip and palate (CLP), one of the most common congenital malformations in our country [1]. Depending on the type of cleft, various life functions can be affected, including diet, social and psychological aspects, hearing, speech, language, and voice [2,3].

During the first years, children with cleft palate (CP) have difficulties with oral expression, speech, and voice [4–12]. The literature describes these difficulties due to the negative impact on children's communicative, linguistic, cognitive, school, and social development [13–16].

One of the major speech and language difficulties presented by

children with cleft palate is compensatory articulation disorders (CAD). CAD affects the linguistic system and creates a different motor engram for speech sounds, severely impacting speech intelligibility [17,18]. In this regard, the evidence has shown that early surgical intervention, followed by adequate speech and language stimulation, considerably decreases the generation of CAD and, therefore, the deterioration of other aspects of development, language, or communication [19–21].

Once the baby undergoes palate surgery, intensive stimulation of oral language phonemes begins, especially those of high intraoral pressure; the sounds/p/,/t/,/k/,/s/,/f/and/ch/. Previously, the speech therapist explains in detail to the parents the velopharyngeal sphincter's operation during speech and the importance of adequate stimulation

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and monitoring of these sounds. This moment will mark the way forward in each case [22]. If the results are satisfactory in terms of anatomy and function, it is common for babies to begin producing high-pressure phonemes 2–3 months after the palate closure [23].

A speech therapist should accompany children who present delayed acquisition of speech sounds or compensatory articulation. In these cases, children receive face-to-face speech and language therapy by a qualified therapist [2]. However, as a result of the COVID-19 virus, declared a pandemic by the World Health Organization (WHO), the Chilean government has issued lockdown and quarantine orders nationwide. The inability to attend medical appointments in person has promoted technological resources for remote screening, assessment, intervention, and health education in speech and language disorders.

The telepractice (TP) of speech and language emerges as a possibility to carry out interventions implemented by speech therapists and reinforced by parents and caregivers [24,25], through synchronous methodologies (live online connection between the therapist and the user), asynchronous (delayed, with the therapist sharing online material, predetermined to the user) and hybrid and with direct (clinician-patient) and indirect (clinician-parents) interactions [25].

A previous literature review reported that the advancement of information and communication technologies provides more favorable conditions for providing distance care. However, speech therapists must adapt to this new modality of care [25]. Therefore, the purpose of this article was to provide preliminary suggestions and audiovisual material for speech and language TP in Spanish-speaking children with CP through a systematic literature review.

## 2. Material and method

### 2.1. Search strategy

For this study, the reviewers conducted a review to collect and synthesize research results systematically and orderly. The development of this was based on the question: what considerations and audiovisual material to use in speech therapy telepractice for children with a repaired cleft palate? According to the PRISMA statement checklist (preferred reporting items for systematic reviews and meta-analysis) [26].

During July and August 2020, speech therapists from the Fundación Gantz, a Hospital in Santiago de Chile, with more than 30 years of experience in the interdisciplinary rehabilitation of CLP, developed preliminary suggestions and audiovisual material for speech and language speech therapy TP in children with CP who speak Spanish. The authors work on a systematic review of the literature by analyzing the flowcharts and recommendations of the GES Clinical Guide for Cleft Lip and Palate of the Government of Chile [2] and the authors' expert opinion.

The authors used the following databases: Medical Literature Analysis and Retrieval System Online (Medline), Literatura Latino-Americana e do Caribe em Ciências da Saúde (LILACS), Scientific

**Table 1**  
Studies found in the databases with combinations of keywords.

Keywords	Electronic databases			
	Medline	LILACS	SciELO	Cochrane
Cleft palate AND Early intervention	218	0	5	27
Cleft palate AND Speech therapy	1085	16	20	47
Cleft palate AND Rehabilitation of speech and language disorders	593	0	0	4
Cleft palate AND Speech production measurement	338	7	3	21
Cleft palate AND Speech articulation tests	265	4	0	13
Cleft palate AND Telemedicine	14	0	0	0
<b>Total</b>	<b>2513</b>	<b>27</b>	<b>28</b>	<b>112</b>

Electronic Library Online (SciELO), and Cochrane Library. We used six combinations of keywords in English (Table 1) available in Medical Subject Headings (MeSH) for the articles' search. Besides, a cross-reference analysis.

### 2.2. Criteria for data selection and analysis

Studies with cross-sectional, retrospective, or prospective observational research methodologies were included, which reported early stimulation, evaluation, or treatment of speech and language in children with cleft palate, both in face-to-face sessions and by TP. Reviews selected studies without a publication deadline, in English, Spanish, and Portuguese, and full access to the text. Literature reviews, dissertations, presentations at conferences, theses, books, chapters, and case studies were excluded (Fig. 1).

For selecting the studies, a careful reading of the titles and abstracts of the publications located by the search strategy was performed. Then, the selected articles were read, which allowed us to answer the question of this research. Two reviewers independently screened all retrieved articles on the title and abstract and subsequently on full text. In case of any disagreement, there was a discussion based on the inclusion and exclusion criteria. When necessary, a third reviewer was consulted.

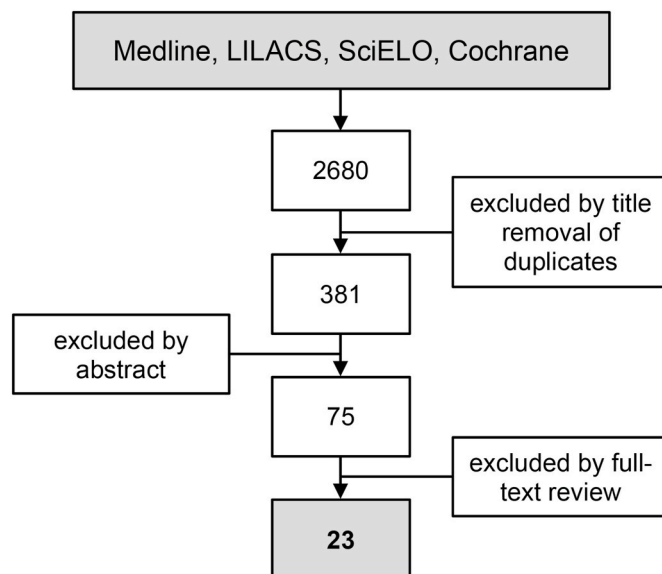
Descriptive information of the selected articles was systematically analyzed through a protocol developed before the survey. The following data were extracted: author, year, country, number of participants, age, type of cleft, speech characteristics (compensatory articulation disorder, velopharyngeal insufficiency, nasal emission), main results.

We classified the selection studies according to their level of evidence in the following six levels [67]: Level 1, evidence resulting from the meta-analysis of multiple randomized controlled clinical studies; Level 2, evidence obtained in individual studies with experimental design; Level 3, evidence from quasi-experimental studies; Level 4, evidence from descriptive studies (not experimental) or with a qualitative approach; Level 5, evidence from case reports or experiences; Level 6, evidence-based on expert opinions.

## 3. Results

### 3.1. Selection of studies

We found a total of 2680 articles. Of these, 2299 studies were excluded by title and removal of duplicates. Following a review of the



**Fig. 1.** Stages of the literature review process.

remaining 381 research papers, 306 studies were excluded by the abstracts' reading. Finally, 75 articles were read completely, of which 23 were used to develop preliminary suggestions for the evaluation and treatment of speech and language in children with CP using TP (Fig. 1).

### 3.2. Study characteristics

Table 2 summarizes each study's information (author, year, and country), the characteristics of the participants (number, age, type of cleft, speech disorders, and procedures) in the experimental and control

group, together with the level of evidence of each.

In a descriptive analysis of the articles, only 4 of the 23 studies found corresponded to TP reports, one on an assessment by TP [37] and three on therapy by TP [24,36,48]. Most studies were conducted in Latin American countries, 9 in Mexico [24,27,29–33,35,44], 1 in Brazil [38], and 1 in Nicaragua and the USA [36]. Meanwhile, 7 investigations were conducted in the USA [28,34,37,42,45–47], 2 in India [41,43], 1 in Turkey [40], 1 in Korea [39], and 1 in Ireland and the UK [48]. Four of the studies were published before the 21st century [27–30], which shows the greatest research development during the current century. In

**Table 2**  
Summary of the information and participants of the included studies.

Study information		Experimental group					Control group					Level of evidence
Author, year	Country	n	Age	Cleft	Speech	Procedures	n	Age	Cleft	Speech	Procedures	
Pamplona et al., 1996 [27]	Mexico	11	3;7y	CP ± L	NR	ST with their mothers	10	3;9y	CP ± L	NR	ST without their mothers	2
Scherer, 1999 [28]	USA	3	2y	CP ± L	NR	Early vocabulary intervention	NR	NR	NR	NR	NR	5
Pamplona et al., 1999 [29]	Mexico	14	57.64 m	CP ± L	VPI; CAD	Phonological intervention	15	55.33 m	CP ± L	VPI; CAD	Articulatory intervention	2
Pamplona & Ysunza, 2000 [30]	Mexico	21	3;7y	CP ± L	CAD	ST with their mothers	20	3;8y	CP ± L	CAD	ST without their mothers	2
Pamplona et al., 2001 [31]	Mexico	31	3;7y	CP ± L	NR	ST with their mothers	28	3;8y	CP ± L	NR	ST without their mothers	2
Pamplona, 2004 [32]	Mexico	15	57.3 m	CP ± L	VPI; CAD	Naturalistic intervention	15	57.4 m	CP ± L	VPI; CAD	Phonological intervention	2
Pamplona et al., 2005 [33]	Mexico	45	68.95 m	CP ± L	CAD	Speech summer camp	45	70.02 m	CP ± L	CAD	ST	2
Scherer et al., 2008 [34]	USA	10	27.4 m	CP ± L	CAD	Mother training to deliver the intervention	10	20.2 m	NCLP	Without impairment	NST	2
Pamplona et al., 2011 [35]	Mexico	50	4;4–10;11y	CP ± L	VPI; CAD	Speech summer camp	NR	NR	NR	NR	NR	4
Glazer, 2011 [36]	Nicaragua; USA	10	3-7y	CP ± L	VPI; CAD	ST by TP	NR	NR	NR	NR	NR	5
Whitehead et al., 2012 [37]	USA	9	5-14y	CP ± L	VPI	Speech evaluation by TP	NR	NR	NR	NR	NR	4
Graziani et al., 2015 [38]	Brazil	3	7,14 and 20y	CP ± L	NR	Speech evaluation: stomatognathic system	NR	NR	NR	NR	NR	4
Ha, 2015 [39]	Korea	17	19.5 m	CP ± L	CAD	Mother training to deliver the intervention	9	16.4 m	CP ± L	CAD	NST	3
Aydinli et al., 2016 [40]	Turkey	17	5;9y	CP ± L	CAD	Speech evaluation: voice	17	6;3y	CP ± L	Without impairment	Speech evaluation: voice	3
Pushpavathi, 2017 [41]	India	6	2-3y	CP ± L	NR	ST with their mothers	NR	NR	NR	NR	NR	5
Kaiser et al., 2017 [42]	USA	8	24.3 m	CP ± L	CAD	EMT + PE	11	26.6 m	CP ± L	CAD	BAU	2
Pushpavathi, 2017 [43]	India	6	2-3y	CP ± L	NR	ST with their mothers	NR	NR	NR	NR	NR	5
Pamplona et al., 2017 [44]	Mexico	41	58.98 m	CP ± L	VPI; CAD	ST, mother training and audiovisual materials	41	58.24 m	CP ± L	VPI; CAD	ST	2
Frey et al., 2018 [45]	USA	19	15–36 m	CP ± L	CAD	Speech evaluation: child and caregiver responses	19	12–42 m	NCLP	Without impairment	Speech evaluation: child and caregiver responses	3
Skirko et al., 2018 [46]	USA	21	3-21y	CP ± L	VPI	Speech evaluation: VELO-Spanish	NR	NR	NR	NR	NR	4
Scherer et al., 2020 [47]	USA	15	23.13 m	CP ± L	NE; CAD	EMT + PE	15	24.07 m	CP ± L	NE; CAD	BAU	2
Sweeney et al., 2020 [48]	UK; Ireland	23	2;9-7;2y	CP ± L	VPI; CAD	PLAT by TP	21	2;9-7;2y	CP ± L	VPI; CAD	NST	2
Pamplona & Ysunza, 2020 [24]	Mexico	43	4-12y	CP ± L	VPI; CAD	ST by TP: language and articulatory	NR	NR	NR	NR	NR	4

**Abbreviations:** NR = not reported; n = number; y = years; m = months; CP ± L = cleft palate with or without cleft lip; NCLP = without CLP; VPI = velopharyngeal insufficiency; CAD = compensatory articulation disorder; NE = nasal emission; ST = speech therapy; NST: without speech therapy; TP = telepractice; EMT + PE = Enhanced Milieu Teaching with Phonological Emphasis; BAU = nontreatment, business-as-usual; VELO-Spanish = Velopharyngeal Insufficiency Effects on Life Outcomes; PLAT = Parent Led Therapist Supervised Articulation Therapy.

total, the 23 studies included 666 children and adolescents, with a range of 3–88 participants per study and an age between 13 months and 21 years.

### 3.3. Intervention and results of the included studies

Table 3 presents the interventions (evaluation or therapy) and the main results of the included studies.

## 4. Discussion

The purpose of this study was to design preliminary suggestions and audiovisual material to adapt to synchronous, asynchronous, and hybrid speech and language TP, directly in children with CP and indirectly with their parents and caregivers, through a systematic literature review. This process was complemented by reviewing flowcharts and recommendations of the GES Clinical Guide for Cleft Lip and Palate and the authors' expert opinion.

In the systematic review, a low percentage (17%) of the studies address speech therapy intervention through telepractice. 83% of the selected scientific articles are works carried out in a clinical setting. In this regard, a systematic review of telehealth use in the sciences of speech, language, and hearing reported only one TP study in CP [25].

In terms of level of evidence, there were 11 studies on level 2 (evidence obtained in individual studies with experimental design) [27, 29–34, 42, 44, 47, 48], 3 on level 3 (evidence from quasi-experimental studies) [39, 40, 45], 5 on level 4 (evidence from descriptive studies, not experimental) [24, 35, 37, 38, 46], and 4 on level 5 (evidence from case reports or experiences) [28, 36, 41, 43]. Previously, a systematic review of speech and language therapy interventions for children with cleft palate found little evidence to support any specific intervention, based on data reported, and it was difficult to ascertain which approach (linguistic or motor) is more effective [61]. Other systematic literature reviews found limited empirical support for early language intervention effectiveness for children with CLP [59].

The speech evaluation in CP using TP presents a level of evidence 4 [37]. Meanwhile, telepractice speech therapy presents levels of evidence 5 [36], 4 [24], and 2 [48]. Also, specialists' recommendations in the current pandemic are a level of evidence 6 (evidence-based on expert opinions) [68, 69]. The current context allows specialists to reach users in other cities or regions, including other Spanish-speaking countries. However, along with implementing these methodologies, evaluation and telepractice therapy should be studied to measure its effectiveness and implement improvements in healthcare providers.

First of all, the review's main findings were to initiate the intervention before age 3 years by early stimulation of vocabulary and speech sounds [28, 34, 39, 41–43, 45, 47, 48]. Assess the characteristics of speech, voice, stomatognathic system, velopharyngeal function, and quality of life [37, 38, 40, 46]. Use audiovisual material [44] for an intervention that allows incorporating various therapeutic approaches [24, 29, 32, 33, 48]. And very importantly, actively include parents, through education and training [27, 30, 31, 34, 39, 43–45].

Next, TP's preliminary suggestions for the evaluation, treatment, and early stimulation of speech and language are discussed. Also, there is access and instructions for the use of the audiovisual material for Spanish-speaking children available on the open channel of YouTube *Fonoaudiología - Fundación Gantz - Smile Train (Spanish)* and the digital version of the *Information Guide for parents and caregivers of children with cleft lip and palate (Spanish)*, with early stimulation strategies for children from 0 to 12 months, since it is essential to educate parents from the first days of life of children to achieve active participation in treatments [2]. Finally, the preliminary statistics of the channel are described.

### 4.1. Screening of orofacial anatomy-functional evaluation

In the planning of speech and language therapy, it is essential to start

**Table 3**  
Summary of intervention and main results of the included studies.

Author, year	Intervention	Main results
Pamplona et al., 1996 [27]	The adult-child mode of interaction of the experimental group was evaluated and modified. All parents from both groups received information about linguistic stimulation at home. All children's intervention was in sessions of 1 h, three times a week for 8 m.	Children who received therapy accompanied by their mothers showed linguistic progress. The level of play after speech therapy was not significantly different in patients from both groups.
Scherer, 1999 [28]	Milieu intervention combines six components: environmental arrangement, responsive interaction, modeling, mand-model, incidental teaching, and time delay procedures. The intervention occurred for 50 min, twice a week—three baseline sessions and five to nine sessions within each treatment and maintenance phases.	Vocabulary intervention using an environment model increased phonological and vocabulary performance. After treatment, the children were maintaining the target vocabulary.
Pamplona et al., 1999 [29]	In the phonological intervention, the children modified the groups of sounds that seemed to be treated similarly and emphasized establishing previously neutralized phonological contrasts. In the articulatory intervention, the children treated the errors on a phoneme-by-phoneme basis (e.g., production of /p/, first, isolated, then in words, later in sentences). Both interventions consisted of 1 h sessions, twice per week.	The phonological intervention significantly reduced the time to correct the CAD. The phonological approach required less time to be effective than the articulatory approach: phonological = 14.5 m and articulatory = 30.07 m. There was no fixed period of therapy time, but rather what the patient required to eliminate the CADs. The longest time was 46 m.
Pamplona & Ysunza, 2000 [30]	Both groups did symbolic play activities, including representation of everyday events and non-familiar events accompanied by the following strategies: parallel talk, language modeling, and expansion of utterances produced by the children. In the experimental group, the mothers of the children were active participants. The intervention consisted of 3 sessions of 1 h per week, for 12 m.	All the children show an improvement in cognitive and communicative behavior after the therapy period. However, the children accompanied by their mothers during speech therapy achieved better language skills.
Pamplona et al., 2001 [31]	Same intervention that Pamplona & Ysunza, 2000 [30]. However, the focus was on the communicative interaction of mothers.	Mothers who participated in therapy with speech therapists and children modified their style and mode of interaction.
Pamplona, 2004 [32]	Naturalistic intervention occurs according to the Whole Language principles. Play and storybooks were the primary contexts for intervention, and all the speech sounds affected by CAD were treated indistinctly. The	The naturalistic speech intervention was useful but did not reduce the time to correct the CAD. There was no fixed period of therapy time, but rather what the patient required to eliminate the CADs.

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Table 3 (continued)

Author, year	Intervention	Main results
Pamplona et al., 2005 [33]	phonological intervention was the same described by Pamplona et al., 1999 [29]. Both interventions consisted of 1 h sessions, twice per week. In the speech summer camp, the children received therapy 4 h per day, five days a week for three weeks. All camp activities were designed around a topic to maximize opportunities for articulation in a naturalistic environment, always within a linguistic context. Control subjects received speech therapy in 1 h sessions, twice a week, for 12 m, based on phonological principles and the whole-language model.	The speech summer camp was a valid and effective method to correct the CAD in a shorter period.
Scherer et al., 2008 [34]	SLP trained the mothers of children in the CLP group to use a focused stimulation approach to facilitate target words that contained stop consonants. The parents and children in the NCLP group did not receive the training or intervention procedures. The parents received two to four 45 min training sessions until they achieved 80% accuracy in their child's practice sessions.	The intervention performed by trained mothers increased the sound inventory, speech precision and reduced the CAD. These mothers demonstrated an increased use of modeling of target words, increased expansions of their children's utterances, and decreased use of commands.
Pamplona et al., 2011 [35]	During the summer camps, SLP divided the children into small groups depending on age, linguistic development, and cognitive level. SLP used the following strategies: modeling, modeling with stress, cloze procedure with phonemic cues, phonetic changes, think aloud in phonemic awareness. The camps consisted of 4 weeks with 4 h a day of the intervention.	Some speech therapy strategies corrected the CAD. The CAD severity scale was useful for planning speech intervention. The SLP selected the speech therapy strategies according to the severity of CAD.
Glazer, 2011 [36]	Each child underwent 2 or 3 monthly telehealth sessions with an SLP. Parents were also instructed on exercises and goals to perform and reinforce daily with the children at home. Also, the expert SLP remotely trained another SLP to teach and reinforce the teleconference sessions.	The Contextual Probes of Articulation Competence-Spanish showed that the TP improved the speech intelligibility. The Cleft Palate Speech-Related Quality-of-Life survey improved significantly following TP.
Whitehead et al., 2012 [37]	Spanish-speaking SLPs developed an informal protocol to evaluate several speech characteristics. Two evaluations were carried out simultaneously to the patients, one in person and the other through TP. Also, the parent's experience with TP was obtained through a satisfaction survey.	TP's speech evaluation is an effective method, particularly to assess oral muscle tone, resonance, lingual lateralization, oral pressure, and dentition. The survey showed family satisfaction with the speech evaluation performed using TP.

Table 3 (continued)

Author, year	Intervention	Main results
Graziani et al., 2015 [38]	Two SLP created the first version of the orofacial myofunctional assessment protocol for individuals with CP $\pm$ L. This version was analyzed by two other SLP experienced in CP $\pm$ L assessment. Finally, five examiners evaluated and applied the proposed protocol and judged each item regarding its clarity to validate the content.	The assessment protocol was finalized with 13 items related to structural and functional aspects. The content of a proposed orofacial myofunctional evaluation was validated.
Ha, 2015 [39]	The intervention program consisted of parent training and parent-implemented intervention at home during a 3-month period. Parent training consisted of a description of children's language-speech characteristics with CP $\pm$ L and instruction of language stimulation skills and communication strategies.	The children who received intervention implemented by the parents showed a significant improvement in language and speech: the greater extent of change in expressive vocabulary size, total words, and mean length of utterance.
Aydınlı et al., 2016 [40]	The voice evaluation protocol included acoustic analysis, Pediatric Voice Handicap Index (pVHI), and perceptual analysis (Grade, Roughness, Breathiness, Asthenia, Strain method).	Greater impact on the vocal quality of children with CAD. The total pVHI score and the subscales were significantly higher. Jitter and roughness were the differences between the groups.
Pushpavathi, 2017 [41]	An interactive play way method was used to improve vocabulary, vowel and consonant inventory, and increase meaningful utterances. A focused stimulation approach was demonstrated to the mother during therapeutic sessions. The mother was told to carry out a similar training program at home. The intervention consisted of 20 sessions of 45 min.	The language ES program performed with the mothers improved the inventory of speech sounds, high and mid vowels, bilabials and fricatives showed significant differences. There was also a reduction in the non-verbal behaviors in the toddlers.
Kaiser et al., 2017 [42]	EMT with Phonological Emphasis is a naturalistic, conversation-based strategy for teaching specific language targets. The EMT + PE incorporates during play strategies such as responsive interaction, modeling, expansions, systematic prompting using milieu teaching strategies, and targeted modeling and recasting of whole words and speech sounds to provide corrective models. The experimental group received forty-eight 30 min sessions, biweekly during a 6 m period.	The early intervention of naturalistic communication and the EMT + PE improved speech and language. Children in the experimental group made greater gains on receptive language, expressive vocabulary (per parent report), and consonants correct.
Pushpavathi, 2017 [43]	Same intervention that Pushpavathi, 2017 [41]	Counseling, training, and active participation of mothers is important for the development of speech and language. The total number of words, utterances, and different words showed a significant difference.
Pamplona et al., 2017 [44]	Both groups received therapy aimed to address all areas of language with an emphasis on articulation.	The audiovisual support materials designed to practice proper articulation are effective in reinforcing and improving

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Table 3 (continued)

Author, year	Intervention	Main results
	Experimental group patients also received a set of audiovisual support materials to use at home, and parents were instructed with strategies and ideas about how to use the materials. The material was used at least 3 times per week, but children could use it by themselves as often as they wanted.	treatment. The group of patients using audiovisual materials at home demonstrated significantly greater improvement in articulation.
Frey et al., 2018 [45]	This study compared the language use of children with CP ± L and their caregivers' responses to investigate the influences of child speech intelligibility and rate on caregivers' linguistic responses.	The intelligibility and productive language of children with CP ± L decreases opportunities to respond to the caregiver. Caregivers of children with CP ± L were more likely to respond to unintelligible utterances with a question.
Skirko et al., 2018 [46]	Spanish linguistic validation of the Velopharyngeal Insufficiency Effects on Life Outcomes: VELO-Spanish by a standardized linguistic validation process included forward and backward translation, reconciliation, and cognitive interviews with patients and families.	Linguistic validation in Spanish of the instrument for evaluating the nasal voice's impact on life quality. The VELO-Spanish instrument demonstrated excellent test-retest reliability.
Scherer et al., 2020 [47]	Same intervention that Kaiser et al., 2017 [42]	The early intervention of naturalistic communication and the EMT + PE improved the consonant inventories, speech accuracy, and compensatory articulation, especially in the children in the EMT + PE group who had higher-rates of word use at pre-intervention (greater than 7–10 WPM).
Sweeney et al., 2020 [48]	Parents in the experimental group were trained for 2 days by a specialist cleft SLT. They were given objectives to achieve with their children and material to work at home. Parents performed the therapy sessions 5 times per week, for a total of 10–15 min each day for 12 weeks, supervised by an SLP using FaceTime. In the control group, parent-child dyads received six therapy sessions over 12 weeks with a research SLT, comparable with usual care.	Through TP, and supervised by a speech therapist specializing in CP ± L, PLAT effectively changes speech, participation, and activity.
Pamplona & Ysunza, 2020 [24]	All patients underwent TP to correct CAD according to the Whole Language Model (WLM). All language areas were addressed with an emphasis on articulation. Also, they were invited to participate in a virtual choir singing session. TP and singing sessions were provided by one Speech Pathologist taking care of a small group of children. Each session was imparted in ZOOM.US, for 45 min at a frequency of 1 per week for a period of 1 m.	TP's speech therapy in small groups following the Comprehensive Language Model principles improved the severity of the CAD.

**Abbreviations:** h = hour; m = month; min = minute; CP ± L = cleft palate with or without cleft lip; VPI = velopharyngeal insufficiency; CAD = compensatory articulation disorder; ES = early stimulation; TP = telepractice; EMT + PE = Enhanced Milieu Teaching with Phonological Emphasis; PLAT = Parent Led Therapist Supervised Articulation Therapy; SLP = speech-language pathologist; WPM = speaking rate.

evaluating the speech organs (see Appendix 1) [2,49]. The orofacial anatomy-functional screening provides relevant anatomical and functional information for the evaluation of velopharyngeal function and speech, such as the existence of fistulas (connecting the mouth and nose), the presence of undiagnosed submucous cleft, hyperplastic palatine tonsils that can affect the resonance of the voice, the altered lingual frenulum (ankyloglossia), dental-maxillary anomalies (occlusion), and absence of teeth, among others [22,38,49]. Also, orofacial dysfunctions are more frequent in children with CLP [50].

If the therapist did not previously evaluate the patient face-to-face, synchronous online evaluation is suggested, along with the request for photos and videos that allow him to complete an orofacial anatomy-functional screening. Both situations need to use audiovisual equipment (microphones, headphones, web camera, cell phone, tablet) connected to a good internet signal.

In this regard, it is important that when restarting the face-to-face therapy sessions, the professional corroborates that the information recorded at a distance is correctly described, both for the orofacial anatomy-functional evaluation and for the evaluation of speech and velopharyngeal function. This is due to reports on the efficacy of the speech therapy evaluation of speech organs (stomatognathic system), speech articulation, and velopharyngeal function by TP in children and adolescents with CP [36,37].

#### 4.2. Articulatory evaluation of speech - sound inventory

The sound inventory of children with CP should be characterized from an early age [36,51]. That is, to identify all sounds produced correctly and those that are absent, substituted, distorted, with articulatory alterations "adopted" by the presence of bad occlusion or absence of teeth and those with "poorly adapted" articular alterations called compensatory articulations disorders [22,33].

If the therapist needs to reevaluate or did not perform the patient's evaluation face-to-face, the therapist should request videos or audio from the children's parents. Videos are suggested in which it is possible to observe the speech organs during the speech. The recordings should have the best possible quality in both formats. It is also suggested that parents and caregivers sign an informed consent form that describes the evaluation process through TP.

In children older than 4 and 5 years, it is suggested to send the parents a list of simple words (they can also be images to name) to determine the sound inventory. Meanwhile, in children under 4 years or in anyone who does not collaborate in the task of repetition or naming, it is suggested to guide the parents and record an activity designed by the therapist, preferably in the context of the play, using stimuli that allow characterization of the child's speech.

#### 4.3. Compensatory articulation disorders - assessment scale

From the results of the speech evaluation, it is suggested that high-pressure sounds (/p/,/t/,/k/,/f/,/s/and/ch/) with CAD should be classified individually in the CAD severity scale of Pamplona et al. [24,33,35]. This scale allows establishing the level at which each sound is located and planning a more efficient intervention for children [22].

This information should be obtained from the analysis of the videos sent by parents and caregivers. If necessary, other speech samples should be requested (isolated phoneme, syllables, words, phrases, speech in closed context, open context, or spontaneous speech) of the sounds with CAD. During TP, therapists should frequently request videos or audio

from parents (suggested every week). This information will allow us to adapt the therapeutic objectives and evaluate each child's progress, in addition to observing that the parents deliver the appropriate model.

#### 4.4. Perceptual evaluation of velopharyngeal function during speech

In children older than 4 years, it is suggested that correctly articulated sounds but with signs of velopharyngeal insufficiency (nasal emission and hypernasality) should be evaluated perceptually using the universal parameters for the report of the velopharyngeal function described by Henningsson et al. (2008) [52]. In words, sentences and samples of spontaneous speech were obtained from the parents' videos and audio. During the resonance evaluation, the presence of hyponasality should also be determined, which corresponds to reduced nasal resonance in nasal sounds usually produced by the presence of nasal or pharyngeal obstruction [49].

#### 4.5. Report of parents and caregivers

On the other hand, it is suggested to complement the evaluation of children's speech, language and velopharyngeal function with parents' and caregivers' reports by applying validated and informal, formal questionnaires based on the literature.

Some questionnaires validated in Spanish are the Voice Handicap index [40,53], the Intelligibility in Context Scale [54,55], and the Velopharyngeal Insufficiency Effects on Life Outcomes [46]. Besides, each therapist can design questionnaires aimed at language and communication skills, play development, and child learning and development [27,56,57]. These questionnaires can be designed and sent asynchronously to parents using Google Forms or other similar platforms.

#### 4.6. General principles of stimulation and treatment of speech and language

According to the "Early intervention model for children with cleft palate" by Scherer and Kayser (2010), to improve speech intelligibility in young children, support strategies should focus on increasing vocabulary, increasing sound inventory, and feedback from communicative attempts. The latter should be facilitated through receptive interaction (responding to the verbal or nonverbal communicative intention of the child) and the disposition of the environment (manipulating the physical environment, activities, routines, and behavioral support, and creating opportunities for the child to respond within the intervention) [51].

In young children, the relevance of stimulating the development of speech and language early, in conjunction with other areas such as cognitive development, early executive functions, sensorimotor, socio-emotional area, and play according to each age, is proposed, since all these areas are a complement for the stimulation of each child, contributing to their development and effective communication [27,34,41,42,58–60].

In the treatment of speech and language, it is suggested to integrate articulatory, phonological and naturalistic strategies [24,27,29,32,35,47,61] through the use of play [27,28,31,34,57] and functional activities within significant contexts [51,62]. This should be appropriate in synchronous, asynchronous, and hybrid TP activities indirectly with parents and caregivers and directly with children. It is also important to provide parents with the information necessary to understand the treatment of their children. For this reason, informative materials are concrete support to educate and prevent secondary alterations in this population [63–65].

During TP, parents of children under 3 years of age should interact with the therapist (indirect interactions) because screens should be avoided at this age. Meanwhile, children over 3 years old, in the company of an adult, will be able to interact directly with the therapist

through virtual platforms (Zoom, Meet, WhatsApp Video Call, etc.), ensuring that children under 7 years do not stay more than 2 h daily in front of a screen [66].

In summary, to provide children with CP and their families with comprehensive and informed support during TP, speech therapists should design and use a material that informs and addresses the following aspects:

1. Bases of the auditory system, speech, voice, and alterations in children with CP.
2. Activities to stimulate communicative attempts.
3. Activities to stimulate the development of receptive and expressive language.
4. Activities to stimulate an adequate acquisition of speech sounds.
5. Activities to stimulate an adequate development of oral feeding and the prevention of unhealthy oral habits.
6. Activities to support an adequate development of the game.
7. Activities to increase cognitive, psychosensory-motor, and socio-emotional development.

#### 4.7. Audiovisual material for the intervention of children with CP

During the treatment of speech and language, parents' active role should be strengthened [27,30,31,34,39,43,48,63,67], and audiovisual material should be implemented for work at home [44,65]. This is why, based on the results of this review and the experiences of the authors, the Gantz Foundation Speech Therapy Unit, with the support of Smile Train has developed more than 50 educational and interactive videos for therapists, parents, and children with CP, which address strategies for the correct production of speech sounds and the stimulation of some levels of language. All material is freely available on a YouTube channel called *Fonoaudiología - Fundación Gantz - Smile Train (Spanish)*, which can be visited by scanning the QR code of Fig. 2 cell phone camera. Besides, together with the organizations' Smile Train, Cleft and the Department of Communication Sciences of the University of Chile, a digital version of the *Information Guide for parents and caregivers of children with cleft lip and palate (Spanish)*, with strategies for early stimulation from 0 to 12 months can be downloaded by scanning the QR code of Fig. 3.

In this regard, Spanish-speaking speech therapists can use or



Fig. 2. QR code of access to the YouTube channel *Fonoaudiología - Fundación Gantz - Smile Train (Spanish)*.





Fig. 3. QR code to access the digital version of the *Information Guide for parents and caregivers of children with cleft lip and palate (Spanish)*.

replicate the material for TP with their patients. However, the videos are only a support for rehabilitation from their homes; they do not replace all the elements that should be addressed in the TP of children with CP.

To use the videos, the following instructions must be followed:

1. Before indicating a video, evaluate each child considering the suggestions provided in this document.
2. The videos' selection is based on the initial evaluation, and the progress achieved weekly, evidenced in contact with the parents and the weekly video to show how they are working with the child
3. In the beginning, the parents should be given the video explaining the phoneme to work on and then select 1 or 2 videos for the child.
4. Guide the parents that before sharing the videos with their child, they should watch the explanation videos designed for them and the videos to work with them.
5. Explain to the adult that this is a very entertaining process for the child. Ideally, watch the videos together and create a practice routine.
6. The child should be attentive to the video without interruption or other distractions.
7. It is not recommended to send many videos with different objectives. Routines and repetition strengthen and facilitate learning.
8. In parallel, the therapist should suggest stimulating their patients' expressive and comprehensive language with routines of games, songs, and stories.
9. The videos should be shared through email or chats such as WhatsApp, previously coordinated with the parents.

Finally, concerning YouTube Analytics statistics, from April to August 2020, the channel has had more than 5000 views from Chile, Ecuador, Peru, Mexico, Argentina, Colombia, El Salvador, and Guatemala. The total viewing time is 134.8 h, with an average duration of views of 1:57 min. Regarding the spectators' age, 92.7% were adults between 25 and 34 years old and 7.4% between 35 and 44 years old. Regarding gender, 87.3% of the audience was women, compared to

12.7% men. About the reproduction device, 50.7% used the mobile phone, 29.4% the computer, 11.9% the television, 6.2% the tablet, and 1.3% the game console.

These results reflect that the material has been reproduced in 8 countries in Latin America and Central America. Additionally, the visualizations' average shows that the videos are seen completely since, in general, the duration of these varies between 2 and 4 min. Another relevant aspect is that most spectators correspond to a young adult female population, which shows greater participation in mothers' therapy and low access to this material by parents and caregivers in middle and late adulthood. All considerations should be incorporated in future proposals of asynchronous audiovisual material for parents and children with CP.

#### 4.8. Limitations of the review

One of the limitations is that this systematic review was not registered. Moreover, the included studies addressed aspects of therapy and evaluation, with different objectives and approaches, in a wide age range, and highly heterogeneous methodological designs, which did not allow assessing the risk of bias of the studies or performing a meta-analysis of the results.

Another important limitation is the review's bias since the searching and analyzing the information was generated in a short period of time, and only with three researchers, which also prevented further discussion for the development of the preliminary suggestions and audiovisual material.

Finally, although this systematic review results allowed the discussion and development of preliminary suggestions and audiovisual material for speech therapy through TP in Spanish-speaking children with CP, a major limitation is that all this information must be proved in future clinical research.

## 5. Conclusion

The social distancing between children and therapists of interdisciplinary teams due to COVID-19 motivated the adaptation to a new distance care modality. The results of this systematic review provided some useful guidelines for performing speech therapy interventions in Spanish-speaking children with cleft palate through telepractice. Synchronous, asynchronous and hybrid methodologies with direct interactions with children and indirect interactions with parents are recommended. The audiovisual materials seem to be very useful for families that receive interventions asynchronously. It is suggested to use interactive videos for children and educational videos for parents.

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## Declaration of competing interest

All authors declare no conflicts of interest.

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## Appendix 1

Screening of speech organs evaluation in CLP patients		
Nose	septum deviation: [ ]no [ ]yes _____	nostrils symmetry: [ ]yes [ ]no _____
Superior lip	shape: [ ]A [ ]short	scar: [ ]no [ ]yes _____
Inferior lip	shape: [ ]A [ ]everted	
Tongue	size: [ ]A [ ]↑ [ ]↓	symmetry: [ ]yes [ ]no _____
	frenulum: [ ]A [ ]ankyloglossia	
Hard and soft palate	cleft: [ ]no [ ]yes _____	dehiscence: [ ]no [ ]yes _____
	scar: [ ]no [ ]yes _____	premaxilla: [ ]no [ ]yes _____
	depth: [ ]A [ ]↑ [ ]↓	width: [ ]A [ ]↑ [ ]↓
	fistula*: [ ]no [ ]1 a 2 mm [ ]2 a 5 mm [ ]>5 mm	rating***: [ ]I [ ]II [ ]III [ ]IV [ ]V [ ]VI [ ]VII
	velum length: [ ]A [ ]↑ [ ]↓	uvula: [ ]yes _____ [ ]bifid [ ]no
Velopharynx	mobility/a/: [ ]A [ ]↑ [ ]↓ [ ]deviation _____	VPI surgery: [ ]no [ ]yes _____
Palatine tonsils	right degree***: [ ]0 [ ]1 [ ]2 [ ]3 [ ]4	left degree***: [ ]0 [ ]1 [ ]2 [ ]3 [ ]4
Teeth	dentition: [ ]primary [ ]mixed [ ]permanent	orthodontics: [ ]no [ ]yes _____
	absence of teeth: [ ]no [ ]yes _____	prostheses: [ ]no [ ]yes _____
Dental occlusion	vertical: [ ]A [ ]↑ [ ]↓	sagittal: [ ]A [ ]↑ [ ]↓
	transverse - right: [ ]A [ ]crossbite	Angle: __left/ __right
		transverse - left: [ ]A [ ]crossbite

**Abbreviation:** [ ]A = adequate; [ ]↑ = increased; [ ]↓ = decreased; mm = millimeter.

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