

# Deliberate Practice: Preliminary Results of a Useful Strategy for Correcting Articulation in Children With Cleft Palate

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**Abstract:** Children with cleft palate frequently show speech and language disorders. In the related scientific literature, several reports have described the use of different strategies for treating speech disorders in children with cleft palate. However, only a few studies have addressed the use of these strategies within a meaningful linguistic context.

Deliberate practice is a procedure or strategy, which proposes that the key for achieving high levels of expert performance is dedicating long time for practice. Deliberate practice has been studied mainly in the areas of sports and intellectual games. The purpose of this article is to study whether the use of a strategy originally designed for achieving expert performance in sports and intellectual games, can be useful for the speech intervention of children with cleft palate.

For this project, 32 children with cleft palate were studied. The children were randomly assigned to 2 independent groups. Both groups received speech therapy based on the principles of the Whole Language Model. In addition, deliberate practice was used in the children included in the active group.

After a speech intervention, although both groups of children demonstrated significant improvement in articulation placement, the active group demonstrated a significantly higher improvement as compared with the control group.

In conclusion, these preliminary results seem to suggest that the use of deliberate practice can be effective for enhancing articulation in children with cleft palate.

**Key Words:** Cleft palate, language, phonology, speech, therapy

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Children with cleft palate (CCP) frequently present with an articulation disorder. Certain articulation disorders are generally regarded as compensatory behaviors secondary to velopharyngeal insufficiency (VPI). These errors include dysfunction not only of the velopharyngeal sphincter, but also of the entire vocal tract and higher levels of articulation control in the central nervous system.<sup>1,2</sup> These

abnormal articulation patterns are usually referred as compensatory articulation disorder (CAD). Compensatory articulation disorder severely affects intelligibility and usually requires a prolonged period of speech pathology treatment.<sup>3,4</sup> Thus, articulation placement has become the main topic in the speech pathology intervention for CCP. Chapman in 1993 described the typical articulation errors in this population. She found that CCP produced the same types of phonological process errors than children without clefts, but they keep using the same process errors for longer periods of time. In addition, she also found that these children used the phonological process of backing with greater frequency and for more sounds than typically developing children. She concluded that these findings suggested that the articulation errors of CCP were of the same phonological nature as the typically developing children, and that the high occurrence of backing indicated that compensatory gestures had become incorporated into the children's phonological rules.<sup>5</sup> These compensatory errors have to be corrected through a speech pathology intervention.

One of the principles' paramount for an effective speech pathology intervention is that the phonologic system is integrated with the language system. Hoffman, in 1992, stated that children's speech sound production and perception errors are related not only to phonological knowledge, but also to higher organizational levels of language processing.<sup>6</sup> However, as the intimate relationship between articulation and language is only beginning to be recognized, the presence of language disorders in CCP has received relatively little attention in the current related scientific literature.<sup>7</sup> Recently, evidence that CCP are at risk of developing language disorders is increasing. Richman and Nopoulos<sup>8</sup> studied the performance of CCP on language processing in areas like vocabulary, fluency, rapid verbal labeling, and sentence repetition.<sup>8</sup> They found that CCP have deficits in both receptive and expressive language areas. Another study also identified delays in vocabulary development in these children.<sup>9</sup> Two different reports have described a higher prevalence of language delay in CCP as compared with children without clefts and an even higher prevalence in children with cleft palatal exhibiting CAD.<sup>10,11</sup> Therefore, it makes sense to include language organization in the global assessment of CCP, as well as provide speech pathology treatment within a linguistic context.<sup>11</sup>

Some methodologies for speech pathology intervention suggest that language and speech should be addressed as a whole in order to introduce significant contexts for learning all linguistic elements involved. This approach has been described as the whole language model (WLM).<sup>12</sup>

Many strategies for correcting articulation have been described.<sup>13,14</sup> Some of the most commonly used strategies include: Modeling,<sup>7,15</sup> Phonemic Cues,<sup>16</sup> Minimal Pairs,<sup>6,17</sup> Cycles,<sup>13</sup> Imitation and drills,<sup>18</sup> Requests for clarifications,<sup>19</sup> Phonetic changes,<sup>16</sup> and Expansions,<sup>7</sup> among others. However, authors do not usually specify how they can be used within a whole and/or meaningful language context. For this purpose, strategies focusing on specific parts within the whole could be used.

Deliberate practice (DP) was first described by Ericsson in 1993.<sup>20</sup> He described that the key for achieving high levels of expert performance is to dedicate a high number of hours to

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practice. Deliberate practice has been studied for sports, science, and intellectual games and the results claim that expert performance is related to the amount of DP (ie, accumulation of practice leads to improvement or maintenance of skill). Deliberate practice consists of training activities with the goal of improving performance by optimizing feedback and thus, the correction of errors. The author states that the activities, which are typically effortful and not enjoyable, should be carried out for long periods of time every day.<sup>21</sup> However, it should be considered that children's learning processes are usually enhanced when they are immersed in meaningful and enjoyable activities. Thus, for this project which studied children with a palatal malformation, although most principles of DP were followed, including the one stating that activities should be carried out for long periods of time, all the activities planned for the children were aimed to result in pleasant experiences.

Previous reports describe the difficulties faced by speech pathologists when they try to emphasize all the targeted linguistic elements during the same activity. Deliberate practice can be useful for addressing articulation deficits in a meaningful and integral way.

The purpose of this article is to study whether using DP can be useful as an additional strategy for treating articulation disorders in CCP, specifically CAD.

## MATERIALS AND METHODS

This study was carried out at the Hospital Gea Gonz lez in Mexico City. The Bioethics Committee and Internal Review Board of the Hospital approved the protocol, and the study was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki's and its later amendments. Before the inclusion of each child into the study group, the parents or legal guardians were carefully explained about the procedures and the methodology of the protocol. All parents of the children included in the study group, agreed to participate, and gave their informed consent prior to the inclusion in the study.

Sample size was calculated at an Alfa of 95% confidence interval and a Beta power of 80% for a comparative study of 2 groups. The distribution of the severity of CAD across patients during the last 2 years was considered for defining the sample size. The aim was to detect a difference of at least 20% between categories. According to these calculations, a minimum of 16 patients classified in each group should be included in the study.

To qualify for the study group, patients had to meet the following criteria:

- (a) Repaired unilateral, complete cleft of primary and secondary palate<sup>22</sup>
- (b) No known neurological or genetic syndromes
- (c) No identified severe language disorders according to the SDS-Model evaluation practiced in our clinic routinely and reported previously<sup>13</sup>
- (d) Velopharyngeal insufficiency after palatal repair demonstrated by clinical assessment and video nasopharyngoscopy
- (e) Compensatory articulation disorder in association with VPI had to be demonstrated during a complete phoniatric clinical evaluation
- (f) Chronological age between 3 and 7 years of age at the time of selection for the study group
- (g) Normal hearing demonstrated by conventional pure-tone audiometry

## Subjects

According to the sample size calculation, 32 CCP who met the inclusion criteria were studied. Children were randomly divided into 2 groups. The age of the children ranged from 43 to 81 months

of age. Children assigned to the active group were matched by gender with patients included in the control group. The age range of the children was kept as similar as possible.

All children received a complete clinical evaluation of language, speech, and voice. Especial attention was focused on the detection of compensatory articulation patterns, the placement and manner of articulation of these patterns, and the phonological rules of the phonological system of each child. For this purpose, children were videotaped interacting with a trained speech pathologist during storytelling for 30 minutes. A 20-minute segment was selected where a high level of verbal interaction occurred. The 20 minutes of interaction were transcribed verbatim for analyzing the presence and severity of compensatory articulation.

All speech and language pathologists (SLPs) participating in this study had been performing phonological transcriptions of CCP for at least 3 years.

A Goldman–Fristoe test (Spanish version) test of articulation was used for demonstrating adequate placement and manner. In addition, for measuring advances in articulation the severity of the CAD was measured according to a previously validated and reported scale.<sup>23</sup> This scale focuses on the severity of CAD in each child as well as the process being followed by the child for correcting CAD. The categories of the scale can be briefly described as follows:

- *Appropriate articulation.* (Level 6) The child is able to produce adequate placement and manner of articulation during spontaneous speech, including nonpresent situations.
- *Inconsistent articulation.* (Level 5) The child exhibits compensatory articulation errors inconsistently during spontaneous speech. Intelligibility of speech is mostly adequate.
- *Articulation within context.* (Level 4) The child is able to self-correct articulation placement when using speech within a specific context. For example, during telling a story from a story book which the patient already knows well. Nonetheless frequent compensatory errors during are produced during spontaneous speech.
- *Articulation in sentences.* (Level 3) The child can achieve correct articulation placement repeating selected short phrases as the clinician models correct articulation placement.
- *Articulation in words.* (Level 2) The child can achieve articulation placement correctly only during the production of selected short words when the clinician uses specific phonologic strategies.
- *Articulation of isolated phonemes.* (Level 1) The child is able to correct articulation placement only in isolated phonemes through direct instruction.
- *Constant CAD.* (Level 0) The child is not able to correct articulation not even in isolated phonemes and despite direct instruction.

To determine if there were differences in the articulation between children from both groups, complete articulation evaluations were performed at the onset and at the end of the intervention period.

For assessing the reliability of the evaluation of the severity of CAD, a blind procedure was used, whereby all analysis was independently conducted by 2-trained SLPs. Whenever there was a disagreement, each patient was discussed until a consensus was reached.

Velopharyngeal insufficiency was diagnosed by perceptual evaluation and video nasoendoscopy. None of the patients had undergone surgical procedure for correcting VPI at the time of the study.

## Intervention

Children were divided in groups depending on age, language, and cognitive level. This allows interaction and working on specific

TABLE 1. Examples of the Strategy DP

Activity	Example	DP	Target Sounds
Cooking	Read a related book that provides structure to the experience like: “Let’s make pizza.” Talk about the recipe and ingredients. Before, during, and after cooking practice the words with target sounds. Invite children to “share about their pizza before eating.” Make a pattern to be used while sharing. Correct articulation <sup>7</sup>	I put . . . Toma <u>to</u> on my <u>pi</u> zza <u>C</u> heese on my <u>pi</u> zza <u>P</u> epperoni on my <u>pi</u> zza	Plosives: /k, p, t, ch/ Fricative: /s/
Singing	Choose an adequate song. Sing it along. Help understand the meaning for comprehension. Represent the lyrics. Choose a fragment of the song that has the target sounds. Correct articulation	<u>C</u> lean his <u>ch</u> est <u>C</u> lean his <u>t</u> ummy <u>C</u> lean his <u>p</u> aws	Plosives: /k, p, t, ch/

DP, deliberate practice.

needs. In each group, language and articulation were addressed. Both groups received fifteen 45-minute sessions of speech therapy aimed to correct CAD. All activities were planned according to the principles of the WLM<sup>13,16</sup> and were designed to maximize opportunities for articulation in a naturalistic environment. As mentioned herein the speech pathology intervention based on the WLM addresses articulation within a linguistic context; that is, language and speech are addressed as a whole. In this way, phonologic strategies were used during storybook reading, playing, cooking, or singing in both groups (ie, during storybook reading the clinician used modeling or modeling with stress and gave instruction throughout the activity). In addition, DP was used as additional strategies within the activities for the children included in the active group. Deliberate practice strategies include the use of relevant words, sentences, or drills related to the main event with the aim to focus on adequate articulation placement and manner. This sets the intention, gave structure for the clinician, and increased the time for practice.

The idea of using DP was to dedicate time for articulation placement and manner practice within each activity in a meaningful way while making it fun at the same time. Also, the following learning principles were considered:

- To provide phonological information as well as an opportunity for practicing articulation within the activities being carried out during the study. All activities (story reading, cooking or choir, among others) established the context of meaning. Thus, the phonologic information was related to a main topic. This allowed making sense of the information at all levels in a meaningful way.
- Learning goes from whole to part (ie, the storybook plot gave the structure for the pattern or drill designed as DP).
- Learning occurs within a significant context.
- Learning involves repeated opportunities to interact and explore complex information—once children got a general idea about the activity or topic, they were able to focus on phonologic information through DP.
- Language is “whole,” that is, it is presented in a context of meaning and use, not broken up and analyzed in small parts within an artificial setting.

With these principles as a guide, the activities were selected for establishing the context. In the active group, one or more parts could be chosen for working articulation with the strategy DP. Around 10 to 15 minutes of each session were dedicated to this strategy (see Table 1 for examples of DP).

### RESULTS

A total of 32 patients met the inclusion criteria and were included in the study group. Sixteen patients were randomly selected and were included in the first group—active group. The other 16 patients were included in the control group. Both groups underwent a

phonological intervention program of speech therapy based on the principles of the WLM. In addition, the strategy DP was used with patients included in the active group.

The age of the patients from both groups ranged from 3 to 7 years. Ages of both groups were kept as similar as possible. A Student *t* test demonstrated a nonsignificant difference between mean ages of both groups (active group X = 59.44 months vs control group X = 60.5 months; *P* > 0.05).

At the onset of the speech therapy period, all patients showed CAD. Even more, all patients from both groups demonstrated severe CAD and were in the lowest categories of the scale of severity of articulation (0–2) used for this study. A Mann–Whitney test demonstrated a nonsignificant difference between initial levels of severity of both groups at onset of the study (*P* > 0.05). That is, both groups were homogeneous (see Tables 2 and 3).

After the speech therapy period, a Wilcoxon test demonstrated a significant improvement when levels of severity at onset and at the end of the treatment period were compared for both groups (*P* < 0.05).

A Mann–Whitney test demonstrated a significant difference between groups when levels of severity at the end of the treatment period were compared (*P* < 0.05). The active group demonstrated a significantly higher improvement as compared to the control group (see Table 4 and Fig. 1).

For assessing severity of articulation at the onset and at the end of the speech therapy period, a blind procedure was used whereby

TABLE 2. Age and Levels of Severity of Articulation at the Onset and at the End of the Speech Therapy Period

Active Group				
Number	Age, mo	Initial Level	Final Level	Advanced Levels
1	43	0	4	4
2	45	2	4	2
3	48	1	4	3
4	49	0	4	4
5	51	0	3	3
6	51	0	2	2
7	54	1	4	3
8	56	0	3	3
9	58	1	4	3
10	60	0	3	3
11	63	1	4	3
12	66	1	4	4
13	70	0	4	4
14	76	1	4	3
15	80	2	5	3
16	81	1	4	3

**TABLE 3.** Age and Levels of Severity of Articulation at the Onset and at the End of the Speech Therapy Period

Control Group				
Number	Age, mo	Initial Level	Final Level	Advanced Levels
1	45	0	1	1
2	46	0	1	1
3	47	2	3	1
4	48	1	3	2
5	50	1	2	1
6	51	0	0	0
7	53	0	1	1
8	55	0	1	1
9	61	2	3	1
10	65	0	0	0
11	68	1	2	1
12	71	1	2	1
13	74	0	1	1
14	77	1	2	1
15	78	2	3	1
16	79	0	1	1

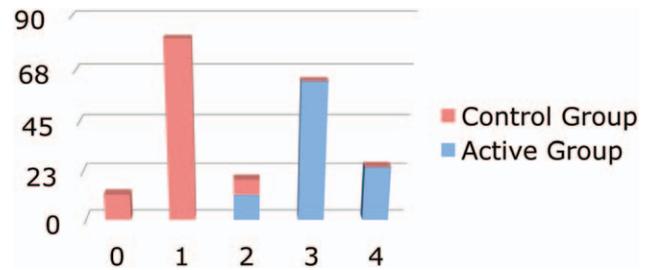
all analyses of child utterances were independently conducted by 2 speech pathologists that were trained in the procedures. A concordance value was obtained. Results showed a 96% agreement at pretest and a 95% level of agreement at post-test. In the small percentage of patients in which there were disagreements, the observations were discussed until a consensus was reached.

### DISCUSSION

Children with cleft palate demonstrate a high frequency of CAD, especially in developing countries. This disorder severely affects speech intelligibility.<sup>3</sup> Even more, recently, it has begun to be recognized that CCP are also at risk of having language delay.<sup>8,12</sup> It has been described that children’s speech sound production is related not only to phonological knowledge, but also to higher organizational levels of language processing.<sup>7</sup> Pamplona et al<sup>3</sup> confirmed this hypothesis. They found a relationship between language and the presence of CAD in CCP. In that study, CCP with CAD differ in their overall development of language, and not just speech productions, from children with repaired cleft palates that do not showed the CAD speech patterns. The authors concluded that it is necessary to provide children with CAD with a more integral and complete treatment that considers higher levels of language including comprehension and abstract thought for enhancing speech development and the elaboration of a more complex and coherent discourse.<sup>12,24</sup> Other studies have reported the use of WLM with CCP in speech and language pathology intervention with good results. They state that treating articulation within linguistic contexts leads to better advances in patients with CAD<sup>3,25</sup> and also in children without cleft palate.<sup>26</sup> That is why, in this study, articulation and language were treated as a whole

**TABLE 4.** Levels of Advance in Articulation Scale in Both Groups

Levels of Advance	Active Group	Control Group
0	0 (0%)	2 (12%)
1	0 (0%)	13 (81%)
2	2 (12%)	1 (7%)
3	10 (63%)	0 (0%)
4	4 (25%)	0 (0%)



**FIGURE 1.** Levels of advance in articulation in both groups. Mann–Whitney test: significant difference between groups when levels of severity at the end of the treatment period were compared ( $P < 0.05$ ). The active group demonstrated a significantly higher improvement as compared to the control group (2, 3, and 4 levels of advance vs 0, 1, and 2 from the control group).

focusing not only on articulation placement but also considering higher levels of linguistic organization.

For assessing and intervention, the conception of this complex problem adds difficulty for the SLP who is conducting the intervention since it is not easy to address language and articulation as a whole. The SLP has to acquire a stronger knowledge about both, speech, and language in general, cleft palate treatment, and strategies for speech intervention, focusing on cleft palate speech, among others. Thus, it is of paramount importance to be able to use several different strategies for achieving an effective intervention for CCP.

The purpose of this article was to study whether the use of DP as an additional strategy for focusing on articulation could enhance the correction of CAD. The results of this study seem to support this hypothesis. Children with cleft palate who practiced deliberately articulation through DP within a linguistic context reduced significantly the severity of CAD.

The use of DP during the speech pathology intervention in CPP exhibiting CAD can be useful for focusing attention on different language elements during the intervention. Usually, the clinician focuses either on articulation placement or linguistic organization but it is actually uncommon to be able to comprehensively address both aspects simultaneously. Deliberate practice seems to be a reliable tool for being able to address articulation in a linguistically meaningful context. Although DP can be used alone or in combination with other strategies, by combining DP with WLM clinicians can address the different needs of each child.

The phonological approach for treating CAD in CCP does not reject well-established principles of conventional approaches for articulation disorders. Articulation placement must be recognized as a critical aspect of speech sound development under any theory. Phonological principles should be considered as adding new dimensions and a new perspective to an old problem.<sup>13</sup>

The use of strategies seeks to scaffold the child’s communicative turns to increase the child’s speech and language performance.<sup>27</sup> These strategies serve to assist the child in formulating messages with greater complexity, specificity of meaning, accuracy, and clarity of expression. Scaffolding strategies consist of various types of prompts, questions, information, restatements, and other procedures that provide support to the child as he/she is actively engaged in the process of communicating a message.<sup>16</sup> From the results of this study, it seems that scaffolding strategies can be more effectively used when DP techniques are incorporated into the speech pathology intervention for correcting CAD. Deliberate practice can be helpful for providing structure to the SLP in order to be able to reinforce articulation placement within naturalistic contexts. Naturalistic contexts such as story telling allow working with event structures and related language while focusing on the sounds of speech through DP. The results of this study seem to support the statement that using structured activities based on DP principles

within meaningful events can provide adequate contexts for effectively carrying over articulation into connected speech.

Deliberate practice is defined as engagement in highly structured activities that are created specifically to improve performance in a domain through immediate feedback. It has been stated that DP requires a high level of concentration, and it is not inherently enjoyable.<sup>28</sup> If, in addition, DP can be made enjoyable by creating a fun drill or song related to the main event, CCP will be delighted to practice. Ericsson et al distinguished DP from work and play. They state that work includes competitions, services rendered for pay, and other activities directly motivated by external rewards. Play includes activities that have no explicit goal and that are inherently enjoyable. Deliberate practice includes activities that have been specially designed to improve the current level of performance.<sup>20</sup> Thus, DP can be used for improving articulation in CCP, but it will be essential to design meaningful activities in order to be able to engage the children in the task.

Although the reduced and homogenized number of patients included in this study, precludes obtaining definite results, the results of this paper seem useful and promising.

In conclusion, the use of DP studied in this paper involves selecting and manipulating specific parts of the linguistic material or activity with the purpose of practicing articulation placement and manner while maintaining the linguistic complexity of a whole event. The underlying principle of WLM is that phonological proficiency is parsed with linguistic interactions rather than interactions are built out of the sum of smaller units. Articulation is targeted simultaneously with pragmatic, semantic, syntactic, and morphological complexity.<sup>12,16</sup> Adequate articulation is addressed through increasing the level of verbal inputs, which need to be linguistically organized by the child, providing conversational feedback focusing on the child's expression of situational appropriate meaning.

This would facilitate carrying over adequate articulation placement and manner into connected-conversational speech. Thus, DP seems to be useful for treating CCP with CAD. By combining WLM with DP clinicians can find structured activities for addressing the various needs of each child. Speech and language deficits are approached as a whole while making the intervention amicable and fun.

It will be necessary to study larger numbers of patients in different situations, as well as compare with other strategies designed for enhancing language and phonologic development. Studying which strategies can be more effective during intervention will lead to better speech results in developing countries.

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