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دراسة إدراكية لفرط الأنفية في إنتاج الكلام لدى الأطفال العراقيين الذين يعانون من الشق الشفاهي الحنكي(CLP) و/ او القصور البلعومي(VPI)

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الملخص

تتناول هذه الدراسة تحليل فرط الأنفية، كنوع من اضطراب الكلام، وتقدم تحليلاً إدراكيًا لفرط الأنفية في إنتاج الكلام لدى الأطفال العر اقيين. وهي تبحث في كيفية تأثير فرط الأنف الناتج عن الشفة المشقوقة والحنك المشقوق ((CLP) و/أو القصور البلعومي (VPI) على إنتاج الكلام للمرضى العرب من العر اقيين. ولهذا يقوم، ذوي الخبرة الذين يعملون كمحلفين، بعملية تقييم فرط الأنفية في إنتاج الكلام لدى المرضى وتحديد خصائص الكلام لذوي الشق الحنكي (CSCs)ولدى الأطفال الذين يعانون من الشفة المشقوقة . تتناول هذه الدراسة فرط الأنفية على ثلاث مراحل: ما قبل الجراحة، وبعد الجراحة، وبعد العلاج. وبالتالي، فهي تقدم تحليلاً ووصفًا لخصائص اللفظ الموجودة في كلام المرضى. وقد قدمت الدراسة، بعد إجراء التحليل، نتائج تتعلق بالاصوات الأكثرشيوعاً التي تنطق انفياء ودور الجراحة والعلاج، وحالات الاضطراب التي يصعب تحسينها أكثر من غيرها.

الكلمات المفتاحية: فرط الأنفية، اضطراب الكلام، الشق الشفاهي والحنكي (CLP)، القصور البلعومي (VPI)، خصائص الكلام لذوي الشق الحنكي (CSCs)

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Abstract

This study provides an analysis of speech disorder cases. It offers a perceptual analysis of hypernasality in the speech production of Iraqi children and investigates how hypernasality due to cleft lip and cleft palate and/ or velopharyngeal insufficiency affect speech production of Iraqi-Arabic patients. Thus, experienced listeners, who act as jurors have been asked to perceptually evaluate hypernasality in the patients' speech production and to identify the cleft speech characteristics of each patient. This study approaches hypernasality over three stages: pre-surgery, post-surgery, and post-therapy. After carrying out the analysis, it provids certain findings regarding the most common consonants that are nasalized, the role of surgery and therapy, and the disorder cases that are more difficult to improve .than others

Keywords: hypernasality, speech disorder, cleft lip, cleft palate,velophrangeal insufficient, clef speech charactristics

Introduction

This study investigates speech disorders in Iraqi children with cleft lip/palate (CLP) and velopharyngeal insufficiency (VPI). By analyzing hypernasality and cleft speech characteristics (CSCs) across pre-surgery, post-surgery, and post-therapy stages, the research aims to understand the impact of surgical and therapeutic interventions on speech production

1-Defining Normal Resonance

Resonance refers to the quality of voice that emerges from the vibration of the sound within the pharynx, oral cavity, and the nasal cavity (Kummer and Lee,1996; Stelck, et al. 2011; Prathanee, et al. 2013). This process involves the vocal tract filtering these sounds, thus selectively amplifying certain harmonics based on the tract's dimensions and shape. The quality of speech and voice hinges on the equilibrium of sound vibrations across these regions, which is maintained when the velum elevates to touch the pharynx's rear wall, facilitating velopharyngeal closure. This action is crucial for generating air pressure and sound in the mouth for articulating various speech sounds. The velopharyngeal (VP) valve plays a pivotal role in determining speech resonance, along with other factors such as the size and shape of resonating cavities, tongue position, and the mouth's openness. The modulation of these aspects affects the vocal tract's dimensions and shape, thereby influencing resonance quality. Normal resonance achieves a balance between oral and nasal sound energies, differing across vowels, consonants, and languages (Peterson, et al., 2010

2-Resonance Disorders: Definitions and Varieties

Resonance disorders arise from disruptions in air flow due to openings, inconsistent movements, or blockages, .and are classified into hypernasality, hyponasality, and cul-de-sac resonance

1-Hypernasality occurs with excessive nasal cavity resonance during speech, often sounding nasally. This can lead to nasal air emission and weakened consonants (Lohmander and Olsson, 2004; Kummer, 2008; Makarabhirom, et al.,2023) This type makes the patient sound as if he/she were speaking through the nose. In severe hypernasality, other abnormal speech characteristics can occur. For instance, nasal air emission (air that escapes out of the nose) can be heard in the production of specific consonants (such as /p/, /t/, /k/, /s/, / sh/, and/ch/). When there is nasal emission, the consonants become weak or they can be omitted. Moreover, the child might use abnormal speech sounds (like a hard " uh" instead of the consonant sound /g/) because of the lack of air pressure in the mouth. Hypernasality is attributed to an abnormal opening between the mouth and nose during speech. This is normally due to a form of velopharyngeal dysfunction (velopharyngeal insufficiency or velopharyngeal incompetence). Common causes include a history of cleft palate or submucous cleft palate. Hypernasality can occur after adenoidectomy in some cases. A few neurological problems might lead to poor movement of the velopharyngeal structures, resulting in hypernasality. (Paal, 2005 and Lewis et (al., 1993

2-Hyponasality manifests insufficient nasal resonance, producing a congested sound, typically (caused by blockages where enlarged tonsils or adenoids are often the cause. (Prathanee, et al. 2013
3-Cul-de-sac resonance results from trapped sound in the throat or nose, rendering the speech muffled. These conditions stem from velopharyngeal dysfunction, with cleft palate being a primary cause. (Kummer, 2006

Hypernasality, in particular, can occur with other types of abnormal speech characteristics: (Kummer 2006; (Oren et al, 2020

A- Nasal air emission (including a nasal rustle or nasal snort) is commonly associated with hypernasality. Nasal air emission refers to the audible release of the air through the nose during speech. Sometimes the (sound of nasal air escape is soft, and at other times it is very loud and distracting nasal rustle. (Kummer 2006

B- Weak consonants and short utterance length are also common characteristics with hypernasality, particularly if there is a significant nasal emission. The loss of air pressure through the nose lessens the air pressure in the mouth. This causes the consonants to be weak. In addition, the patient has to take frequent (breaths during speaking to replace the lost air.(Cyran, 2008

C- Abnormal articulation (speech sound production) is also common in patients with resonance disorders. They might be unable to produce sounds normally in the mouth, if he/she loses sound air pressure through the nose. Therefore, the child may learn to produce sounds in an alternate way (compensatory articulation) by using the air pressure in the throat for speech

3-Velopharyngeal Dysfunction (VPD) and Cleft Lip and /or Cleft Palate (CLP

VPD indicates inconsistent or incomplete closure of the velopharyngeal valve during oral sound production, encompassing velopharyngeal insufficiency (VPI), incompetence, and mislearning. These issues can lead to speech resonance disorders, with a significant number of cleft palate surgery patients experiencing VPI (Marsh,2003; Kummer and Baylis, 2009; Woo, 2012

Cleft palate is the condition most commonly associated with VPD (Kummer, et al, 2015). Overall, up to 30% of the individuals who have undergone cleft palate repair experience continued to have a velopharyngeal insufficiency (Witt et al., 1998; Phua & de Chalain, 2008; Zhao et al., 2012; Ha et al., 2015

A cleft is an abnormal opening or fissure in a body part or organ. According to Stedman's Medical Dictionary, 26th edition, clefts of the lip and palate are congenital anomalies that result from incomplete merging or fusion of embryologic processes normally uniting in the formation of the face (Spraycar, 1995

4-Procedure

The study involved ten Iraqi children, aged 5 to 13, diagnosed with different types of cleft conditions. Speech samples were collected at Dr. May Yaqoob's pathological laboratory in Basra, where subjects repeated a list of 174 words three times in a soundproof room. Experienced jurors then perceptually evaluated hypernasality and CSCs. The data was analyzed to identify the types of speech errors and the effectiveness of surgery and therapy

4.1-Testing Materials

A List of 174 Iraqi Arabic single words acted as a speech assessment tool (henceforth GOS.SP.ASS Iraqi Arabic) and was designed for the description of cleft speech in Iraqi Arabic based on the GOS.SP.ASS that was clarified by (Sell et al., 1999) as a standard assessment tool for cleft speech used in the UK, i.e. it was English-based. The test includes a list of 174 words for the elicitation and repetition respectively of the consonants of Iraqi Arabic in different positions. The stimulus words were chosen to be imaginable and commonly used in the lexicon of Iraqi children, regardless of the region from which the participants come. Transcription of those words is given using the International Phonetic Alphabet (IPA; IPA 1999), the Extensions to the IPA for the transcription of atypical speech (Ball et al., 1995) and Voice Quality Symbols (VoQS; Ball et al., 1995; ExtIPA; Duckworth et al., 2009), in order to capture as much information as possible about the children's speech .production. Speech samples used in the testing material are transcribed by the researcher

4.2-The Recording Sate

The speech recording is performed in a noiseless soundproof room at Dr. May Yaqoob's pathological laboratory in Basra. Each subject is seated, and a condenser microphone, FANTECH electric condenser microphone 50Hz stereo, 16 bit, is placed 15 cm from the subject's lips. Then, each subject is asked to say certain words for three times while maintaining natural pitch and volume. The data are then analyzed using the improved cestrum method. The CSCs of each patient are investigated to identify the type of errors (disorder) in their speech .production

4.3-The Sample of the Study

Ten unpaid Iraqi patients from five to thirteen years of age represent the sample in the current study
(Six cleft palate patients who had undergone palatoplasty, and four patients who had undergone surgical resection of cleft lip and cleft palate). Not all of the patients have the same type and degree of hypernasality. That is why their hypernasality is rated as mild, moderate, and severe qualitatively by six jurors from different .educational sectors

4.4-Hypotheses

1-Patients with the cleft type ICP will exhibit the highest number of speech disorder cases in the pre-surgery stage compared to other cleft types
2-The post-surgery stage will show only a slight improvement in speech disorder cases compared to the pre-surgery stage
3-The post-therapy stage will demonstrate a significant improvement in speech disorder cases compared to the pre-surgery stage

5-Data Analysis and Discussion of Results

5.1-Sound Substitution

Cleft palate is the most common craniofacial birth defect and it can affect the children's communication skills. The following analysis aims to evaluate the most problematic sounds in the speech production samples of the participating children
Karrar aged 5 years and was diagnosed with UCLP. His speech was characterized with nasalizing six consonants including: /n, s, ʃ, l, ð, θ/ both in word-initial and word-medial positions. The consonants /n, s, l, ð, θ/ have continued to be nasalized after surgery and the speech treatment application. The participant substituted /ʃ/ with /j/ rather than /θ/. /x/ sound was substituted with / ħ/ when occurring initially and finally; yet, he was able to pronounce it initially rather than finally after both surgery and intervention phases. The sound /ɣ/ was replaced either by [ʔ] or [q] initially before and after surgery, but it was correctly pronounced after being treated. /k/ sound was pronounced as [ʔ] before surgery, but was later pronounced as /d/ after surgery and treatment. /g, s/ sounds were replaced by [n̪] initially before and after surgery, but /g/ was pronounced correctly as /g/ after treatment phase. Other sounds are also replaced by [n̪] initially, these were /ʃ, f/. For /ʃ/, it was pronounced as /ʧ/ finally after the treatment phase. However, /f/ did not show any improvement after surgery or intervention and the participant continued to replace it by /b/. Occasionally, /s, ʤ/ were .substituted by /d/in the post-surgery and treatment phases
Um-Albaneen who was aged 6 years was diagnosed with ICP. She kept pronouncing nasalized /n, l, ş, d/ after surgery and treatment application. She also substituted /r/ with nasalized [l̪̃]; yet /s/ was replaced by [t̪̃] only in the post-surgery phase and was correctly pronounced in the post treatment phase. / sˤ/ was replaced by [s̪ˤ] during both the pre and post-surgery phases, but it was correctly pronounced in the post treatment phase. In final position, / s / was replaced by [t̪̃] during the pre and post-surgery phases, but it was

pronounced /s/ after intervention. However, /d/ continued to be uttered as [d̪] in the pre, post-surgery as .well as treatment phases

Um-Albaneen who was aged 7 years was diagnosed with ICP. She replaced medial /χ/, final /g/, /ɣ/, and initial /k/ by [h], [ʔ], respectively. The pronunciation of both /χ/ and /g/ improved after intervention; while the production of /ɣ/ and /k/ did not indicate any improvement and continued to be pronounced as [ʔ]. In word-initial position, the participant also kept substituting /d, z, ʤ/ with [n̪] during the pre, post-surgery and post intervention phases. Similarly, initial and medial /b/ and initial /ʤ/ did not improve and were .pronounced as [m] and /d/, respectively

Hassan who was aged 9 years was diagnosed with BCLP. [n̪] sound was substituted for initial /n/, /s/ and [l̪] sound was substituted for final /r/ in all of the phases. Initial /k/ was replaced by [ŋ]. Initial /t/, /ð/ and final /l/ were both replaced by [n̪] in all of the three phases. Final and medial /b/ was replaced by [m] in the pre, post-surgery and post treatment phases. Initial /ʃ/ and medial /s/ were both substituted with [n]. .For /ʃ/ did not indicate any improvement, while /s/ was pronounced correctly in the post treatment phase

Muntadhar who was aged 6 years was diagnosed with BCLP. Initial /tˤ/, /z/ and /sˤ/ were replaced by [t̪ˤ], [ɬ̪], respectively, in all of the three phases. This is also true of initial and medial /s/ which was replaced by [ɬ̪] in the pre, post-surgery and port treatment phases. However, initial /tˤ / showed the production improvement, as it was pronounced as [tˤ] rather than [t̪ˤ]. Final /l/ also showed the production improvement, as it was pronounced [l] rather than [l̪] in the post-treatment phase. Initial /ɣ/ was .pronounced as [q] in all of the three phases

Batool who was aged 7 years was diagnosed with ICP. Initial /r/ was pronounced as [l̪] in all of the three phases. Medial /z/ was pronounced as [ɬ] in the pre-surgery phase, but it was pronounced as [z̪] in both the post-surgery and post therapy phases. Initial /z/ continued to be pronounced as [n] in both of the post-surgery and intervention phases. Initial /d/ medial /χ/ and /ħ/ were uttered as [h] in the pre-surgery phase, but these sounds were correctly pronounced in the post-surgery and post therapy phases. However, initial /θ/, initial /ð/, final /ʤ/ initial /d/, initial /sˤ/, medial /ʤ/, medial /g/, final and medial /b/, and final /k/ .did not indicate any production improvement in both of the post-surgery and treatment phases

Abbas who was 7 years was diagnosed with ICP. His speech was characterized by replacing medial /s/ with [ɬ] in the pre- and post-surgery phases; while it was pronounced as [s̪] in the post treatment phase. Similarly, initial /sˤ/ and /k/ were produced as [ɬ] and [h] in the pre- and post-surgery phases; while they were correctly pronounced in the post treatment phase. Initial /χ/ was pronounced as [ħ] in all of the three phases. In the same way, /ʃ/ continued to be pronounced as [ɬ] in all of the three phases. On the other hand, /q/ indicated a noticeable production improvement in both of the post-surgery and post- .treatment phases

Jumana who was 7 years was diagnosed with ICP. The participant's speech was characterized with the pronunciation of medial /s/ as [s̪], but after the surgery and treatment application, /s/ production considerably improved. Similarly, initial and medial /χ/, and /ʕ/ improved in both the post-surgery and post treatment phases that the participant pronounced as [χ] rather than [ħ]. However, the participant .continued to pronounce initial /r/ as [l̪] in all of the three phases

Aseel who was aged 9 was diagnosed with ICP. The participant used to pronounce initial /ð/ as [d̪] in the pre- and post-surgery phases, but the same sound was pronounced correctly in the post treatment phase. In the same way, initial and medial /θ/, initial /ʤ/, and medial /s/ the production of which showed a considerable improvement after treatment. On the other hand, the participant could not improve the .[production of initial /k/ and continued to pronounce it as [t

Ali who was aged 9 years was diagnosed with BCLP. In his speech production, initial /s/ was replaced by [ɬ]; yet after treatment the same sound production considerably improved. Initial /ʤ/ and initial /g/ also

significantly improved after surgery and treatment. However, initial /k/, initial /ʧ/ and medial /χ/ did not .show any production improvement in all of the three phases

5.1.1-Frequency of Sound Substitution Cases

In the preceding section, the problematic sounds produced by each patient are discussed separately according to each patient's case. In this section, the most and least problematic sounds for all patients are provided. The analysis shows that the substitution of /n/ with [n̪] has happened four times in the pre-surgery stage, post-surgery stage, and post-therapy stage. No improvement is noticed with this sound .production

Further, the replacement of /r / with [l̪], as the analysis reveals, is a frequent problem. There are six occurrences of such a replacement in the speech of the children in both the pre-surgery stage and post-surgery stage. It is only in the post-therapy stage that the number of this substitution decreased to .five, which shows a relative improvement

The change of /k / sound into [ʔ] occurs five times in the speech of children with cleft palate in the pre-surgery stage and post-surgery stage. In the post-therapy stage, only one case improved and the number of the problematic cases became four. Another sound substitution which occurs in the speech of the patients is /z/into [ɬ]. In the pre-surgery stage, four cases are recorded. These cases of speech disorder .decreased to three in the post-surgery stage and the post-therapy stage

Less frequent cases of sound substitution are the replacement of /s / with [ɬ], / ʃ / with [ɬ], /l / with [l̪], /g/ with [ʔ], and /dʒ/ with [d], where three occurrences of each case are noticed. In the case of the change of /s / into [ɬ], the three cases remain unchanged in the pre-surgery stage and post-surgery stage. However, they decreased into two in the post-therapy stage. Similarly, the cases of replacing /l / with [l̪] and /g/ with [ʔ] are the same in the pre-surgery stage and the post-surgery stage, three in number for each. They only changed into two in the post-therapy stage. Relatively different is the substitution of / ʃ / with [ɬ]. In the pre-surgery stage, three cases are detected, but these cases became two in both the post-surgery stage and the post-therapy stage. The three cases of /dʒ/ to [d] substitution in the pre-surgery .stage and the post-surgery stage decreased to two in the post-therapy stage

The number of sound substitution cases, with two occurrences, is twelve

These cases can be summarized in the Table given below

Table 1: Sound Substitution Cases with two Occurrences

No.	Sound Substitution	Pre-surgery	Post-surgery	Post-therapy
1	/s/ → [d̪]	2	2	2
2	/ sˁ/ → [ɬ]	2	2	1
3	/ s̪ˁ/ → [s̪ˁ]	2	2	1
4	/ z/ →[d]	2	2	2
5	/d/ →[n]	2	2	2
6	/ð/ →[d]	2	2	1
7	/ð/ →[d̪]	2	2	1
8	/dʒ/→[ɬʒ]	2	2	1
9	/dʒ/→[ʔ]	2	2	1
10	/ɣ/→ [ʔ]	2	2	2
11	/ʧ/→ [ɪʔ]	2	2	2
12	/k/ → [h]	2	2	0

As shown in the above Table, each of the sound substitution cases appears twice in the pre-surgery stage. What is noticeable here is that none of the cases is improved in the post-surgery stage. Nevertheless, in the post-therapy stage, the improvement differs from one case to another. In the five substitution cases (/s/ → [d̪], / z/ →[d] , /d/ →[n], /ɣ/→ [ʔ], and /ʧ/→ [ɪʔ]), no improvement is detected, and the number of disorder cases remains the same. In six cases of consonant sound shift (/ sˁ/ → [ɬ], /sˁ/ → [s̪ˁ], /ð/ →[d], /ð[→/[d̪], /dʒ/→[ɬʒ], and /dʒ/→[ʔ]), the two substitution cases in each of these six examples became one only. Finally, the two cases of shift of /k/ to [h] in the pre-surgery stage did not show up in the post-.therapy stage

There are other consonant shift cases with low frequency in the speech production of the patients. These less frequent sound substitution cases are not significant as each of them shows up only once in the .pre-surgery stage. Such cases are not accounted for here, yet they can be found in Table 2

The analysis above indicates that certain sound shifts seem to present persistent challenges across multiple cases. It also highlights that while some patients showed noticeable improvements in speech .production following treatment, others exhibited limited progress or even persistent difficulties

5.2-Individual Case Analysis of CSCS of the Patients: A Statistical Analysis

Table (2) is a detailed presentation of speech disorder cases noted in the speech of the patients. It thoroughly displays the type of the cleft and the number of cases for each patient. It moreover shows if/when a change happens in the characteristics of cleft speech over the different stages: pre-surgery, post-surgery, and post-.therapy

Table (2) Patients' Speech Disorder Cases

he name of the patien	age	the type of cleft	no. of the cases			
Karrar	5	UCLP	21	17	14	
		CSCs	Pre-surgery(pct. %)	post- surgery/(pct.%)	post therapy sessions/(pct. %)	improvement (pct %)
		lingo bilabial	6 (28.5)	6 (35.29)	6 (42.85)	null
		backing to pharynges	1 (4.7)	0(0)	0(0)	100%
		backing to glotal	2(9.5)	2(11.76)	2(14.28)	null
		nasal realisation	4 (19)	4 (23.52)	2(14.28)	50
		plosive substitution	8 (38 %)	5 (29.41)	4 (28.57)	50
Um-Albaneen	6	ICP/VPI	19	19	17	
		CSCs	Pre-surgery(pct. %)	post- surgery/(pct. %)	post therapy sessions/(pct. %)	improvement (pct %)
		lingo bilabial	2 (10. 52)	2 (10. 52)	2 (11.76)	null
		Dental Lateralizatior	5 (26.31)	5 (26.31)	5 (29.4)	null
		backing to glotal	5 (26.31)	5 (26.31)	3 (17.64)	40
		nasal realisation	4(21.05)	4(21.05)	4 (57.14)	null
		plosive substitution	3(15.78)	3(15.78)	3 (17.6)	null
Muntadhar	6	BCLP	6	6	2	
		CSCs	Pre-surgery(pct. %)	post- surgery/(pct. %)	post therapy sessions/(pct. %)	improvement (pct %)
		Dental Lateralizatior	5 (83.33)	5 (83.33)	2 (100)	60
		plosive substitution	1 (16.66)	1 (16.66)	0	100
Abbas	6	ICP	6	5	2	
		CSCs	Pre-surgery(pct. %)	post- surgery/(pct. %)	post therapy sessions/(pct. %)	improvement (pct %)
		Dental Lateralizatior	4 (66.66)	4 (80)	2 (100)	50
		backing to glotal	2 (33.33)	1 (20)	0	100
Batool	7	ICP	16	13	12	
		CSCs	Pre-surgery(pct. %)	post- surgery/(pct. %)	post therapy sessions/(pct. %)	improvement (pct %)
		Dental Lateralizatior	4 (25)	3 (23.07)	3 (25)	25
		backing to glotal	6 (37.5)	4 (30.76)	4 (33.33)	33.33
		nasal realisation	3 (18.75)	3 (23.07)	3 (25)	null
		plosive substitution	3 (18.75)	3 (23.07)	2 (16.66)	33.33
Jumana	7	ICP	11	6	6	
		CSCs	Pre-surgery(pct. %)	post- surgery/(pct. %)	post therapy sessions/(pct. %)	improvement (pct %)
		Dental Lateralizatior	5 (45.45)	3 (50)	3 (50)	40
		backing to pharynges	2 (18.18)	0	0	100
		plosive substitution	4 (36.36)	3 (50)	3 (50)	25
Hassan	9	BCLP	11	11	10	
		CSCs	Pre-surgery(pct. %)	post- surgery/(pct. %)	post therapy sessions/(pct. %)	improvement (pct %)
		lingo bilabial	1 (9.09)	1 (9.09)	1 (10)	null
		Dental Lateralizatior	3 (27. 27)	3 (27. 27)	3 (30)	null
		nasal realisation	7 (63. 63)	7 (63. 63)	6 (60)	14.28
Aseel	9	ICP	7	5		
		CSCs	Pre-surgery(pct. %)	post- surgery/(pct. %)	post therapy sessions/(pct. %)	improvement (pct %)
		Dental Lateralizatior	5 (71.42)	3 (60)	0	100
		plosive substitution	2 (28.57)	2 (40)	0	100
Ali	9	BCLP	12	6	3	
		CSCs	Pre-surgery(pct. %)	post- surgery/(pct. %)	post therapy sessions/(pct. %)	improvement (pct %)
		Dental Lateralizatior	5 (41.66)	2 (33.33)	1 (33.33)	80
		backing to glotal	6 (50)	3 (50)	2 (66.66)	66.66
		nasal realisation	1 (8.33)	1 (16.66)	0	100
Yousif	13	ICP	11	9	4	
		CSCs	Pre-surgery(pct. %)	post- surgery/(pct. %)	post therapy sessions/(pct. %)	improvement (pct %)
		Dental Lateralizatior	2 (18.18)	1 (11.11)	1 (25)	50
		backing to glotal	5 (45.45)	5 (55.55)	2 (50)	60
		plosive substitution	1 (9.09)	1 (11.11)	1 (25)	null
		nasal realisation	3 (27.27)	2 (18.18)	0	100

1-Karrar

In the case of the first patient, Karrar, the cleft type is UCLP, and the number of speech disorder cases is 21. In the pre-surgery stage, as can be seen in Table (2), 6 instances of "lingo bilabial" are noted, which constitute 28.5% of the whole cases. One example of "backing to pharyngeal" speech disorder is found, with a percentage of 4.7%. In "backing to glottal" disorder, 2 examples are recorded in the speech of Karrar, 9.5%. It is also disclosed that there are 4 cases of "nasal realization" speech disorder, with a percentage of 19%. The highest .frequency of speech disorder is that of " plosive substitution", as 8 cases (38%) are documented

In the post-surgery stage, the number of the cases in Karrar's speech has decreased to 17. As the Table reveals, the only instance of "backing to pharyngeal" and the 8 " plosive substitution" cases have changed into (0) and 5 successively. The other cases of speech disorder have remained unchanged after the surgery. After the post-therapy sessions, the cases related to "lingo bilabial" have shown no change in comparison with the pre-surgery or post-surgery stages. Their number has remained the same, 6. Similarly, the two cases recorded in "backing to glottal" speech disorder have also shown up in the post-therapy stage. Similar to post-surgery, the case of "backing to pharyngeal" does not exist in the post-therapy sessions. The cases of "nasal realization" .and "plosive substitution" have decreased to the half, as their numbers have become 2 and 4 successively

Therefore, the improvement in Karrar's speech disorder happened in "backing to pharyngeal" with a .percentage of 100%, and in "nasal realization" and "plosive substitution" with 50% for each

2-Muntadhar

The second patient is Muntadhar whose type of the cleft is BCLP. In the analysis of this patient's speech, as shown in Table (2), two CSCs are identified: dental lateralization and plosive substitution. Dental lateralization has occurred 5 times, with a percentage of 83.33%. On the other hand, only one instance of plosive substitution is noted. In the post-surgery case, as displayed in the Table, the same number of both dental lateralization and plosive substitution continues to appear. It is only in the post-therapy sessions that a significant change is noted. In the case of dental lateralization, only 2 cases exist. And in the plosive substitution disorder, no case is detected. Thus, the improvement percentages of dental lateralization and .plosive substitution are 60% and 100%, successively

3-Um-Albaneen

In the case of the third patient, Um-Albaneen, the analysis shows that the type of the cleft is ICP/VPI, and the number of speech disorder cases in the pre-surgery stage is 19. Out of the 19 CSCs, 5 examples of "Dental Lateralization" are recorded in the speech of the patient, and they constitute 26.31% of the total cases. Likewise, 5 instances of "backing to glottal", with a percentage of 26.31% are found. These two CSCs are the highest cases in Um-Albaneen's speech. A less frequent case is "nasal realization" with 4 occurrences, 21.05%. Three instances of "plosive substitution" speech disorder are noted, and they form 15.78%. The " lingo bilabial" has scored the smallest number, with only 2 examples and a percentage of 10.52%. In the post-.surgery stage, the Table shows that the number of cases is still 19, with no change found

In the post-therapy sessions, the number of cases has changed to 17. The number of "backing to glottal" cases is now 3 instead of 5. All the other cases show up unchanged in comparison with the pre-surgery stage. The only improvement recoded in the case of Um-Albaneen is the "backing to glottal" speech disorder case. The (percentage of improvement is 40%, and it happens only after the therapy sessions. See Table (2

4-Abbas

In the case of the fourth patient, Abbas, the type of the cleft is ICP, and the number of speech disorder cases

found in the pre-surgery stage is 6. As can be seen in Table (2), 4 instances of "dental lateralization" exist, which constitute 66.66% of the total cases. In addition, 2 examples of "backing to glottal" are recorded, with .a percentage of 33.33%

The post-surgery stage reveals that the number of the "dental lateralization" cases does not mark any change, .as 4 examples appear. Contrariwise, only 1 instance of "backing to glottal" shows up in the post-surgery stage

The case is different in the post-therapy stage. As one notices in the Table, only 2 cases of "dental lateralization" are found, and the "backing to glottal" speech disorder case disappears. Consequently, the improvement ."percentage in Abbas's case is 50% in the "dental lateralization" and 100% in "backing to glottal

5-Batool

Batool is the fifth patient in the present study. Table (2) shows that the type of the cleft here is ICP. The CSCs found are "dental lateralization, backing to glottal, nasal realization, and plosive substitution." In the pre-surgery stage, 16 cases of speech disorder are revealed. The most frequent CSC in this patient's speech is "backing to glottal", where 6 instances are found, which form 37.5% of the whole cases. "Dental lateralization" comes in the second place; 4 examples are disclosed, with a percentage of 25%. Moreover, the analysis illustrates that 3 instances of "nasal realization" speech disorder are noted, and the percentage is .18.75%. Equally, 3 examples of "plosive substitution" show up in the pre-surgery stage, constituting 18.75%

In the post-surgery stage, the results demonstrate a slight difference. The number of "backing to glottal" cases is now 4. Additionally, 3 examples of dental lateralization exist. Unlike these two CSCs, nasal realization .and plosive substitution remain unchanged, i.e. each one occurs 3 times in this stage

A slight change is noted in the numbers of the speech disorder cases in the post-therapy stage. In comparison with the post-surgery stage, the cases of "backing to glottal" remain unchanged, 4 in number. Similarly, each of the "dental lateralization" and "nasal realization" cases occur 3 times, which bring no change. The only change in this stage is the decrease of the "plosive substitution" cases Consequently, the improvement rates in Batool's case are 3.33% in "backing to glottal" and "plosive substitution". The improvement in "dental ."lateralization" cases is 25%. And the only case where there is no improvement noticed is in "nasal realization

6-Jumana

In the sixth patient's case, Jumana, the type of the cleft is ICP, and the number of speech disorder instances found in the pre-surgery stage is 11. Table (2) uncovers that there are 5 instances of "dental lateralization", which form 45.45% of the cases. Furthe, there are 4 examples of plosive substitution, with a percentage of 36.36%. The third CSC detected in this patient's case is "backing to pharyngeal", where there are 2 occurrences .constituting 18.18%

In the post-surgery stage, the total number of speech disorder cases is 6. Three instances of dental lateralization are noted. Likewise, 3 cases of plosive substitution are recorded. In the post-therapy stage, no change is detected in comparison with the post-surgery stage; the number of speech disorder cases is 6: 3 dental lateralization cases and 3 explosive substitution ones are documented. The improvement percentage in the .dental lateralization cases is 40%, 100% in the "backing to pharyngeal", and 25% in the plosive substitution

7-Hassan

The seventh patient in the study is Hassan whose the type of the cleft is BCLP. The number of the speech disorder cases is 11 in the pre-surgery stage. Table (2) shows that there are 7 instances of "nasal realization" which constitute 63.63%. Three examples of dental lateralization also exist in this stage, with a percentage of 27.27%. Finally, one case of lingo bilabial is found, which forms 9.09%. In the post-surgery stage, no change is

.noticed, and the number of cases remains the same
In the post-therapy stage, 10 cases of speech disorder occur. As shown in the Table, 6 instances of nasal realization are found in this stage. Three instances of dental lateralization and 1 case of nasal realization exist. Therefore, the improvement in the case of Hassan is 0% in lingo bilabial & dental lateralization, and .14.28% in nasal realization

8-Aseel

In the case of the eighth patient, Aseel, the type of the cleft is ICP, and the number of speech disorder cases in the pre-surgery stage is 7. As can be seen in Table (2), the analysis reveals that there are 5 cases of dental .lateralization, forming 71.42%, and 2 instances of plosive substitution with a percentage of 28.57%
A change is documented in the post-surgery stage of Aseel. The number of dental lateralization cases is now 3, while the 2 cases of plosive substitution remain unchanged. And the change in the number of cases in the post-therapy stage is noticeable, as no case shows up here. Eventually, the improvement percentage is 100% .for each case

9-Ali

The ninth patient in the current study is Ali, whose the type of the cleft is BCLP. The number of cases, as Table (2) shows, is 12 in the pre-surgery stage. The highest CSC found is "backing to glottal", where 6 instances appear with a percentage of 50%. In the second place, 5 cases of speech disorder, dental lateralization, exist, .forming 41.66%. finally, 1 case of nasal realization is recorded; 8.33%
In the post-surgery stage, a big change is noted. Here, only 3 instances of "backing to glottal" exist, which indicates that the number has dropped by half. Similarly, 2 cases of "dental lateralization" are found in this .stage. This shows that the number drops a lot. It is only in the case of nasal realization that no change is noted
The post-therapy stage indicates further changes. The number of CSCs is 3 only. Two examples of "backing to glottal" and 1 instance of "dental lateralization" occur. Thus, the improvement percentage in the "backing to glottal" case is 66.66% and 80% in "dental lateralization". The "nasal realization" disorder case marks an .improvement percentage of 100%

10-Yousif

The tenth patient, the last in the study, is Yousif. The type of the cleft, as displayed in Table (2), is ICP, and the number of cases found in the pre-surgery stage is 11. Five instances of "backing to glottal" occur, forming 45.45% of all cases. Less frequent in this patient's speech disorder is "nasal realization", which appears 3 times with a percentage of 27.27%. In "dental lateralization", 2 instances show up constituting 1.18%. Finally, 1 case .of "plosive substitution" is found, 9.09%
In the post-surgery stage, a slight difference is seen. Five cases of "backing to glottal" and 1 "plosive substitution" are found in this stage. This shows that no change happens in comparison with the previous one. On the other hand, in the cases of "dental lateralization" and "nasal realization", there is a change in the .number of cases, as the former appears once and the latter twice
In the post-therapy sessions, only 4 cases are found. The analysis reveals 2 cases of "backing to glottal", 1 "dental lateralization", and 1 "plosive substitution". The improvement percentages in Yousif's case are 100% ."in "nasal realization, 60% in "backing to glottal", and 50% in "dental lateralization

6-Conclusion

After the perceptual analyses of the speech of the Iraqi patients of the study are conducting, the study arrives

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1-Patients with cleft lip/palate have shown many speech disorder cases in the production of the words .selected for the study

2-The therapeutic sessions prove to be useful in the improvement of the cleft speech characteristics in the .speech production of the patients

3-The perceptual analysis of the study data reveals that the highest number of speech disorder cases appears in the speech of patients with the cleft type ICP, where 71 instances are found in the pre-surgery stage. Cases related to patients with BCLP come in the second place, with 29 examples in the pre-surgery stage. The lowest cases are 21in the pre-surgery stage, which belong to patients having he cleft type UCLP. This means that, conclusion No. 3 verifies Hypothesis No. 1 that reads "patients with the cleft type ICP will exhibit the highest ."number of speech disorder cases in the pre-surgery stage compared to other cleft types

4-In the perceptual analysis of the patients' speech, it is also disclosed that there is a little improvement of the disorder cases in the post-surgery stage in comparison with the ones in the pre-surgery stage. The number of CSCs in the pre-surgery stage is 121, and it is 96 in the post-surgery stage. This indicates a low improvement percentage, 20.66%. Based on that ,hypothesis No.2 : "the post-surgery stage will show only a .slight improvement in speech disorder cases compared to the pre-surgery stage" is varified

5-As far as the post-therapy stage is concerned, the perceptual analysis of the study data uncovers that a noticeable change characterizes the speech disorder cases in this stage. It is recognized that there is an important improvement here. Out of the 121 total cases documented in the pre-surgery stage, 64 instances of cleft speech characteristics still exist. This means that the improvement percentage after the therapy sessions is 47.10%. this result verifies hypothesis No.3 which reads, "the post-surgery stage will show only a ."slight improvement in speech disorder cases compared to the pre-surgery stage

6-Regarding the frequency of the cleft speech characteristics (CSCs), the study displays that " dental lateralization" is the most dominant CSC with 38 occurrences in the speech of the patients in the pre-surgery stage. "Backing to glottal", "nasal realization", and "plosive substitution" come then, with 26, 23, and 22 instances successively. In the fifth place comes "lingo bilabial" with 9 cases. The least frequent CSC is " .backing to pharyngeal" with 3 occurrences only

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