Available online at www.jlls.org

JOURNAL OF LANGUAGE AND LINGUISTIC STUDIES

ISSN: 1305-578X

Journal of Language and Linguistic Studies, 17(Special Issue 2), 811-829; 2021

Treatment techniques of disordered sibilants in Arabic: A descriptive-analytical study

Ibtisam Hussein[a] [1], Al-Orefi Jihad[b], Ayman Yasin[c]

[a] *Philadelphia University, Jordan*
[b] *University of Jordan, Jordan*
[c] *Princess Sumaya University for Technology*

APA Citation:
Hussein, I., Al-Oreifi, J., & Yasin, A. (2021). Treatment techniques of disordered sibilants in Arabic: A descriptive-analytical study. *Journal of Language and Linguistic Studies, 17*(Special Issue 2), 811-829.
Submission Date:27/09/2020

Acceptance Date:17/01/2021

Abstract

This paper addresses the techniques of treating patients with functional disorders of pronouncing sibilants in Arabic. The sounds under question are /s/, /z/, /ṣ/. The main disorders that are studied here are: substitution and distortion. A descriptive analytical approach was followed; patients from different ages of functional pronunciation disorders of sibilants were observed. The researchers collected data from a questionnaire which was distributed to 46 speech therapists. The questionnaire focused on the techniques these therapists use with patients who have sibilant production disorders. The research first reviews the techniques used to treat the /s/ sound as a main sibilant and then builds on these techniques to treat /z/ and /ṣ/ sounds. The research found that the treatment techniques depend on the type and form of the speech disorder, and the transitional arrangement for treating hissing sounds in Arabic starts with treating /s/ which is the easiest to pronounce - then /z/ and finally /ṣ/. The findings also emphasize that while treating the patient, it is important to increase his/her mental and auditory awareness of the problem. Finally, it was found that the number of treatment sessions varies according to the patient's motivation and ability to correct the sound after hearing it, in addition to his/her follow-up treatment outside the treatment sessions.

Keywords: Hissing, sibilants, substitution, distortion, phonetic placement.

1. Introduction

Children start uttering speech sounds at a very early age. Some of these sounds are easier and thus acquired and mastered earlier. However, some other sounds take a while to master and therefore children start pronouncing them at a later age (Van-Borsel et al., 2007). Amayreh and Dyson (1998) found that children produce /s/ and /ṣ/ between 4-6.4 years, while they acquire /z/ at the age of 6.4 years. If the child does not acquire speech sounds by a certain age, she is diagnosed as having a speech pathology.

Pronunciation problems, in general, can be attributed to some physical source such as hereditary diseases or some developmental diseases such as autism, deafness or some other nervous system diseases caused by brain damage (American Speech and hearing Association (ASHA, 2016). In other cases, the source of speech pathology is unknown and therefore it is attributed to pronouncing the sound in an erroneous

[1] Corresponding author.
E-mail address: author@affiliation.xxx.xx

way, or acquiring it erroneously during the child's acquisition of speech sounds. This kind of disorder is called 'functional articulation disorder' which refers to any disorder of unknown source (Aihara, Takigutchi, & Ariki, 2013).

Speech disorders affect the understanding of the linguistic message to varying degrees, and the vagueness of this message increases when the disorder is present in more than one sound. The recipient's lack of understanding of the lisping speaker prompts him to ask the later to repeat what they said more than once. This situation increases the embarrassment of the lisping person and hence their unwillingness to speak. It may also lead to anxiety and fear of speaking and confronting the society. Some may further face difficulty integrating with society in general due to the negative treatment they receive from the surrounding linguistic environment (Hall, 1991; Silverman & Falk, 1992).

Lisping of sibilant sounds is a common speech disorder among speakers of Arabic. The sibilant sounds include /s/, /ṣ/ and /z/ and if a person does not articulate any of these sounds properly, s/he tries to avoid uttering them all. This indicates that s/he does not produce the hissing feature generally in these three sounds. Accordingly, this increases the probability of speech disorder in the person's speech (Hussein, 2011).

Hussein (2011) found that the difficulty of uttering this group of sounds is not only found in Arabic, but also in the English as the /s/ sound is largely mispronounced by native speakers regardless of the language. The state school for speech pathology assessment pinpoints that a sibilant sound is one of the most treated sounds among native speakers (Mowrer & Sundstrom, 1988) and ranks second in terms of difficulty after /r/. This also applied to sibilant sounds in Arabic as the percentage of their treatment is almost the same as the treatment of the trill /r/. These two groups of sounds - i.e. trills and sibilants are the most treated among the cases of functional speech disorders (Hussein, 2011).

The focus of this research is only on two types of disorders: substitution and distortion. Substitution represents pronouncing a sound instead of another (Shriberg & Kent, 2003: p.3), while distortion represents producing a sound that is not in the list of the target language sounds (Kocjančič, 2004) though it is similar to the intended sound in some characteristics (Bernthal & Bankson, 1988, p. 2). The patient in this case fails to produce the target sound although he/she grasps some of its characteristics.

In a study conducted on children between (3-7) years, Al-Saeed (2002) noticed that /s/ is usually substituted by /ʃ/ , /ɵ/ , or /f/, while /z/ is substituted by /ɵ/ or /dʒ/, and /ṣ/ is replaced by /ɵ/ and /s/. Al-Nahhas (2007) calls these sound changes "lisping 's'" and noticed that /s/ is replaced by /ɵ/, /ʃ/ or /x/. Al-Beblawi (2003) also found that /s/ is replaced by /ɵ/, /ʃ/ or /t/ whereas /ṣ/ is substituted by /ɵ/ and /z/ by /ð /. We note here that the substitution of /ṣ/ by /ɵ/ or /t/ is not the same as the substitution of /s/ by the same sounds, as the sound substitutions tend to be partially emphatic when replacing the emphatic /ṣ/ (Hussein, 2011). We also notice that the substitutions are closely related to the sibilant sound in terms of place and manner of articulation, with the exception of three substitutions /x/, /f/, and /ʃ/ which are not familiar but rather idiosyncratic (Smit, 1993).

Before we move on to the "Treatment Techniques", we need to stop first at the most important characteristics of the sibilant sounds which may cause speech disorder. When uttering these sounds a longitudinal groove is formed in the center of the tongue in the alveolar ridge area. In order for a "groove" to form, the two blades of the tongue rise and touch the molars to prevent air from escaping (Bauman-Waengler, 2004). Thus, the air stream moves in the center of the tongue, and with this movement, the blades rise to form a tight longitudinal groove around the gum.

This groove must maintain a certain degree of localized constriction when the air molecules rush on both sides. This degree of constriction has a central role in generating friction that reaches its highest point turning air into some sort of a storm. Therefore, it rushes quickly and centrally towards the upper molars and knocks them forcefully, which, in turn, increases the intensity of the wind blowing. Thus, it

turns into a kind of "air vortex" (Johnson, 1997) due to the strong rebound of air particles at the moment of collision with the upper molars, hence producing the hissing sounds (Hussein, 2011).

As for the place of articulation, when the speaker begins producing a sibilant sound, the tip of the tongue rises towards the gingival area but centered somewhere behind the upper molars or behind the lower molars or between them (Borden & Gay, 1987). If the blade is centered behind the lower molars, it may/ may not touch its interior, and the hissing in both positions preserves its energy. By contrast, if the blade is centered behind the upper molars, it needs to be close to it without touching it, because if the contact occurs, hissing does not occur or is reduced to a noticeable degree. Furthermore, the blade needs to be directed towards the upper teeth, but not in a retroflex position (Shriberg, kent, 2002). If this retraction occurs, the narrowing necessary to produce the hissing sound expands, leading to a markedly weakening of the air friction energy necessary for generating this hissing quality (Hussein, 2011).

The study is divided into eight main sections. After the introduction, we present the general techniques of treating the sound /s/ independently, in syllables and in words. The third section reviews the therapeutic techniques based on a questionnaire that was completed by 46 therapists. Section four is devoted to detailing treatment mechanisms depending on the type of speech disorder. The section is divided into two main parts: techniques for treating phonetically distorted hissing sounds, and techniques for treating sound substitution. Section five focuses on treating the hissing sounds independently, in syllables and in words. Section six addresses age differences and their impact on the choice of treatment technique whereas section seven tackles the number of treatment sessions and the reason for their variation between patients. Section eight concludes.

2. General techniques of treating /s/

Many techniques of treating disordered /s/ start with the sound in isolation, then move to another level where the sound appears in a meaningless syllable, followed by placing the sound in the context of the word, then in phrases and finally with the most advanced stages that represent the introduction of the target sound in continuous speech (Riper, 1972. p. 206).

2.1. Techniques of treating /s/ in isolation

Therapists differ in the aspect that should be addressed in the first steps in treatment. Some of them start with increasing auditory awareness of the characteristic sound properties of the /s/ in isolation which is called ‘auditory contrast’ of the target sound (Creaghead, Newman & Secord, 1989. p. 254). The therapist begins by uttering /s/ according to the aforementioned gradation, and asks the patient to focus on the auditory characteristics. The therapist produces it once correctly and another in a distorted way. In this training, the patient begins to perceive the auditory differences between what s/he utters and what s/he should utter. In each time, the therapist asks the patient to distinguish the correct pronunciation (Landis, Woude & Jongsma, 2004, p. 194) and leaves room for the patient to think about the speech errors they make in the production of the distorted /s/. Thus, the patient begins to correct the wrong production of the target sound to avoid it in the following attempts.

Among the mechanisms that some therapists also adopt as a first step in treating the /s/ in isolation is the technique of "distinctive features", which are the characteristic features of the sound that distinguish it from other sounds (Edwards, 1992, p. 26). If the speech disorder involves replacing /s/ with a sound that contrasts with its place of articulation (PoA), then the therapist will focus on the feature of the PoA as it makes the patient's conscious of the two places; the place of the target sound and the one switched to. However, if the disorder involves the manner of articulation (MoA), the therapist's focus is on teaching the manner of articulation of /s/ in terms of hissing, continuity and release characteristics, and how the tongue is positioned and shaped to produce it. The therapist may direct the patient, for example,

to place the tip of the tongue behind the upper or lower teeth (Bleile, 2006. p. 71) without touching the upper front teeth because if this happened, the hissing feature of /s/ would not be produced. This distance between the tip of the tongue and the upper teeth is estimated by a quarter of an inch (Bleile, 2006. p. 73). The air molecules pushing out of the alveolar ridge could collide with the bottom of the upper incisors while getting out, and thus enhance the hissing quality.

In order for the therapist to make it easier for the patient to grasp the characteristics of /s/, s/he uses a variety of tools in which the senses are employed greatly. For example, the therapist may use a mirror, pictures or drawings to show the place of articulation. Some therapists employ the sense of taste, by placing a lollipop in the place where the tongue is placed, or use a "tape", which contains small medical plasters containing food flavors that the child favors. These are stuck behind the teeth and the child is asked to focus the tip of the tongue on them (Sigal, 2011 and Sacks, 2014). (See Figure 1)

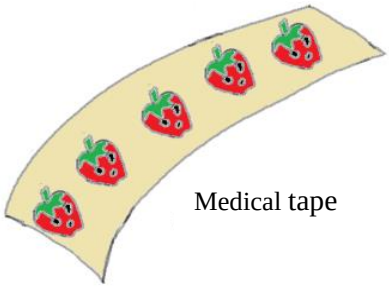

Fig 1. A Medical tape used in the treatment of /s/

2.2. Treating /s/ in syllables and words

After the patient masters the hissing feature of /s/ independently and masters placing the tongue in the right place, s/he moves to the syllables and words stage, where the target sound is placed in syllables with various phonemic contexts such as "sa", "si" and "su" and may move to the production of two consecutive syllables with contrasting vowels such as “sa si” and then to the production of three different syllables with different vowels “su sa si”. The target sound may be placed in syllables with various consonant contexts as in “saka” (Smit, 2004. p. 107). Then, the therapist proceeds to choose different meaningful words that include /s/ (Weaver-Superlock & Brasseur, 1988). S/He begins by choosing words in which /s/ comes word-initial as in the word *su:q* "market", then word-final as in *kaʔs* "cup", and finally in the middle of a word as in *yasu:q*, “drive”. It is necessary to have various syllables where /s/ appears with different vowels to train the jaw to capture the different positions of /s/ (Sacks, 2014). The therapist begins with simple, single-syllable words and gradually moves to more difficult and complex words according to the patient's performance (Creaghead, Newman & Secord, 1989. p. 145). The reason for starting with /s/ word-initially, then word-finally, and finally word-medially is that when the sound is at the beginning or the end of the word, the contextual variable is the transition of the tongue from the place of /s/ to the place of the subsequent phoneme or the transition from the previous consonant or vowel to the target sound. However, the phonological context of /s/ in the middle of the word is coupled with two variables: the preceding and the following sound, which makes the production of the target sound more complex.

It is noted that some patients may be able to utter /s/ in certain contexts but not others due to the coarticulation in these contexts of the target sound (Pickett, 1999. p. 143), and for this reason it is preferable to start treatment with words that are easy and familiar to the patient and meaningful at the same time (Bleile, 1995. p. 199). Sigal suggested using the most common words in the language because they will be among the most used vocabulary in the patient's speech later (Sigal, 2011). Although most

studies focus on the importance of training the patient on meaningful words, some of them tend to adopt nonsense words or sequences if the first approach was difficult for the patient. Here, the focus is only on the phonetic environment with various phonetic sequences and with gradual difficulty (Sacks, 2014).

The therapist has to evaluate the patient's performance at each stage of treatment, and changes the treatment according to the patient's condition and response (Kamhi, 2006). Once the patient has grasped the characteristics of /s/ at the word level, he will move to /s/ at the phrase and sentence levels.

3. Techniques for treating hissing sounds based on the structured questionnaire of this study and practical experience of treatment and previous studies

Forty-six therapists with clinical experiences between three to eighteen years participated in filling out the questionnaire of this study. Despite the fact that the treatment techniques they mentioned and the observations they made intersect with the previous studies and general techniques of treating the aforementioned /s/, there are some methodological additions that we came up with, especially with regard to the sound of the emphatic /ṣ /that is characteristic of Arabic.

We previously mentioned that the types of hissing disorders studied here are substitution and distortion. The latter has multiple forms that were adopted from a study we had previously conducted on speech disorders on hissing sounds (Hussein, 2011). These techniques were divided according to the direction of the air into three main categories: central distortion, lateral distortion, and nasal distortion. Other forms branch out from the central distortion according to the location and shape of the tip of the tongue: dental distortion, alveolar distortion, retroflex distortion and the strident distortion (see Figure 2). These types of distortions are not peculiar to hissing sounds in Arabic (Bauman-Waengler, 2004. p. 219). Scholars found these forms of hissing distortions in English /s/ and /z/. In this study we benefitted from their studies in addition to following up the pronunciation of Arab patients in the studied sample during the production of the three hissing sounds. It must be noted that the term *central distortion* was not used in foreign studies which sufficed with applying the term *distortion* only to dental distortion, alveolar distortion, and retroflex distortion. However, this term was used to distinguish between the direction of the air during the production of hissing distorted forms. The air either escapes from the center of the mouth, or from both sides of the tongue or from the nose (Hussein, 2011). In spite of these variations in the forms of hissing speech disorders, there are clear intersections in the treatment mechanisms that all sibilants share. These are the techniques used to form the distinctive groove for this class of sounds, and therefore it is important to train the patient to raise the tip of his/her tongue towards the gingival dental region and push the air particles to blow the air into the upper folds. This is what most therapists indicated in filling out the questionnaire, as forty-three of them had alluded to that similar general mechanisms in the treatment of hissing sounds. Three therapists indicated different techniques according to the sound under question.

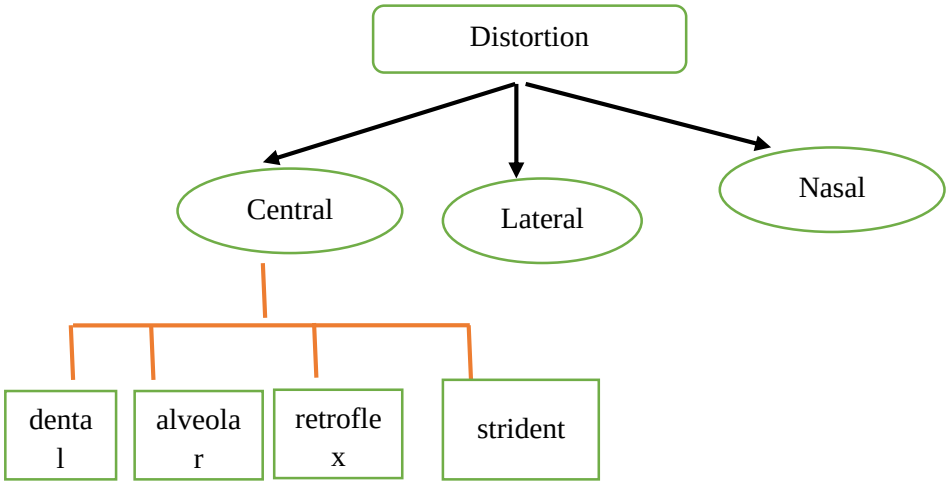

Fig 2. Distortion forms of sibilants

When starting the treatment, therapists usually begin with the easiest sound among sibilants; in Arabic it is /s/ as it has neither the loudness energy associated with /z/ nor the emphatic characteristic of the /ṣ/. This transitional arrangement of starting with /s/ and then /z/ and ending with /ṣ/ was the approach of most therapists (31) who participated in the qustionnaire, while 14 preferred the sequence /s/, /ṣ/, /z/ and only one indicated that the order depends on the most reasonable and closest to the speed of treatment. It is worth mentioning here that children produce /ṣ, z/ after the age of (6.4) years while they acquire /s/ between (4-6.4) (Amayreh & Dyson, 1998).

The study does not reject the second order adopted by 14 therapists, as when the patient holds the card of /ṣ/, s/he is asked to pronounce the sound with emphasis, similar to the other emphatic sounds in Arabic. The therapist begins to compare, in front of the patient, verbally and acoustically between /t/ and its emphatic counterpart /ṭ/, /d/ and /ḍ/ until the patient begins to make a mental balance between emphatic and non-emphatic sounds, and consciously applies it to the target sound /ṣ/, especially when s/he has no problem with the emphatic characteristic as a distinctive feature. In this study, we suggest that the therapist should start with the sound which the patient finds easiest because the patient is the one who leads treatment and not the therapist who should only examine the patient in every therapeutic stage.

It should be noted that the speech disorder that occurs in the pronunciation of /s/ is the same as that occurring in both /z/ and /ṣ/ in many cases. If the patient substitutes /s/ to another sound, the type of speech disorder is substitution for all siblings, and if it were distortion, then it applies to the whole group. This was the opinion of 41 therapists compared to 5 who observed the lack of consistency to the speech disorder in one way, as they see that the location of the sound in the context of a single word affects the type and shape of the disorder. What concerns us from the above is treatment that is related to the type of disorder and the appropriate treatment approach for it. If it appears in the initial evaluation of the case that the patient adheres to one type of speech disorder- and this is the norm- then the therapist must decide on a therapeutic approach that increases the patient's awareness of speech, hearing and performance towards the problem. This is what we will discuss in the following sections. But before we move on to that, it must be noted that in the questionnaire we included a central question in the therapy, which scholars called the use of Non-Oral Speech Motor Exercises (NOSME). These are general muscle exercises for the oral systemic organs that precede the work on the producing the sound in isolation. These exercises aim to strengthen the speech organs, by making the patient able to round the lips, blow, raise the tongue, shake it, move it towards the nose or chin, smile and fill the mouth with air (Lof, 2008).

Not a few therapists (16 in our questionnaire) tend to start treatment with such general exercises, as they focus in these exercises on moving the tongue muscle, training the jaw muscles and rounding the lips in general. However, studies have not proven the efficacy of such exercises which differ in their principles and objectives from other exercises called phonetic placement. These are exercises used in traditional therapy and focus on employing motor exercises directed to the pronunciation of target sounds (Lof, 2008). They are more used to approach the target sound production mechanism than the former exercises because they direct the patient to move the spontaneous organs when producing /s/, for example, towards raising the tip of the tongue in the alveolar region and feeling it. So, the patient begins to get used to this movement when producing this sound; a muscular training that strengthens the muscle to be employed in the production of the target sound rather than training them in an open and general way. This is because the patient with sibilant disorders does not have a problem with the speech organs and does not need to strengthen them in general since s/he is able to produce most sounds without an organic or speech problems. However, s/he faces a real problem in the mechanism of moving these organs to produce specific sounds.

4. Techniques for treating hissing sounds based on the type and form of speech disorder:

It was previously mentioned that only two types of speech disorder were adopted in this study: distortion and substitution. We based this selection on a statistical analysis study that found that the "forms of speech disorders that appeared in a sample of 180 cases were mainly distortion and substitution: (79) substitution cases compared (101) distortion cases (Hussein, 2011). The study was conducted on both children and adults. As for adults, there were (45) distortion cases compared to (6) substitutions. On the other hand, children had (56) distortion cases, compared to (73) substitutions (Hussein, 2011). The study divided distortion according to the direction of airflow into three main categories: central distortion, lateral distortion, and nasal distortion. Other forms branched out from the central distortion according to the location and shape of the tip of the tongue: dental distortion, alveolar distortion, retroflex distortion, and strident distortion (Hussein, 2011). However, there were 4 substitutions: /θ/ and /t/ as substitutes for /s/ and /ṣ/, and /ð/ and /d/ as substitutes for /z/. Most of them were fricatives as there were (57) substitutions compared to only (15) cases of stop substitutions (Hussein, 2011).

In our study, we adopt these divisions to clarify the treatment techniques and mechanisms which intersect when at the syllable, word, sentence and continuous speech levels. It was noticed that most therapists use general methods when treating sibilants without taking into account the type and shape of disorder although they ultimately enable the patient to produce this group of sounds. Our goal here is to focus on the treatment techniques and define them to be easier and shorter in time, as the effectiveness of the treatment is measured by the time and effort of treatment (Williams, 2003. p. 138).

4.1. Techniques for treating central distorted hissing sounds:

The most common cases of central distortion in children and adults are the *dental*, followed by *alveolar*, then *lateral* and finally strident distortion (Hussein, 2011). They all share the fact that the airflow comes out from the center of the tongue and gets out from the middle area of the lips.

At the beginning of the treatment of these forms of distortion, the therapist focuses on increasing the patient's awareness of what s/he is doing during the production of the hissing sound. So, the patient begins to compare what s/he is doing and what they should do. Raising awareness here helps in programming the brain to produce the required sound with the mechanism described visually and acoustically in front of him/her in order to enable them to avoid the way in which they move their vocal organs involved in producing the target sound(s). If, for example, the patient pushes air during the production from both sides of the tongue, s/he is directed to push it from the center of the tongue. S/he

is instructed to feel the particles of air rushing through the two upper incisors, and that s/he must close the two lateral side by raising the edges of the tongue and make them completely close the upper jaw. If s/he sets the tip of the tongue backward while pushing the air in the gingival area, the therapist raises their awareness of the importance of placing the tip of the tongue towards the front of the mouth and towards the upper incisors in the alveolar region. Increasing awareness here means that the patient is consciously and mentally aware to a specific type of movement that they must perform.

Therefore, the starting point is very important in the treatment as it increases the patient's focus on what s/he will be doing in the treatment sessions. These therapeutic introductions have not been paid much attention to by therapists, because their starting mechanism is often the same regardless of the type of disorder; some start with general speech exercises and then move to exercises related to certain places of articulation, while others start directly with the place of articulation. Notably, in the two approaches emphasis is not placed on what the patient speaks and what s/he must say; a point that we alluded to in the introduction of treatment.

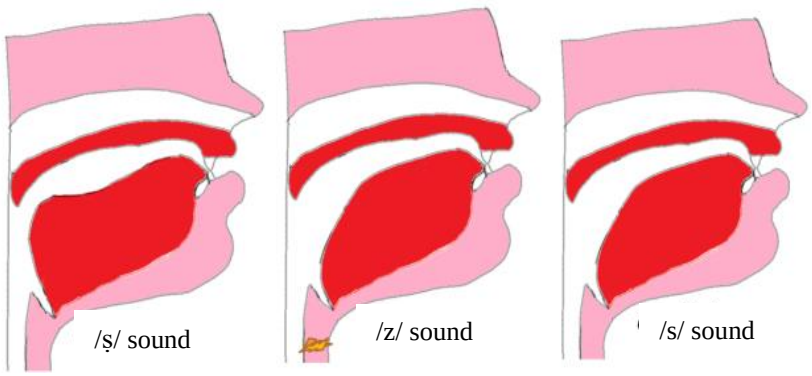

Fig (3). Position of the tongue and its tip when producing the three hissing sounds

4.1.1 Techniques of treating hissing sounds of dental central distortion:

The patient may produces /s/ with a teeth distortion when s/he pushes the tip of the tongue while it is in a flat or in a groove-like position. Thus, the tip is positioned behind the foot of the upper incisors so that it is either very close to them, touching them, or pressuring them (Bauman-Waengler, 2004 p. 219). The phonetic output here is acoustically perceived as a sound close to /ɵ/ or /ð/ or some sound between them and the hissing sounds. Then, the patient is asked to center the tongue in the gingival region without touching the upper incisors, and he/she may use the figures of the tongue and the position of its tip (see Fig. 3). Alternatively, s/he may use the sense of taste using a tape in the gingival region, provided that the tongue tip does not touch the upper incisors, because if this happens the hissing characteristic of this sounds set will not be achieved. The therapist here has to specify the patient's utterance region because if the latter advances his/her tongue or retracts it slightly, s/he will no longer be able to generate the hissing sound resulting from the collision of the rushing air stream in the narrowing near the upper incisors. If the distance decreases or increases, the hissing rate decreases to varying degrees (Hussein, 2011).

When the patient begins to place the tip of his tongue in the required area of the articulation region, the therapist proceeds to the second stage; helping the patient to form the groove required for producing hissing sounds. Since the tongue with this form of distortion is flat in some cases and semi-grooved with others, the goal of treatment must focus on forming this feature. The therapist can manually intervene with providing visual and auditory cues. Marshalla mentioned the technique of training the tongue to the *butterfly position* in which the tongue blades raise to pronounce the sound in a way similar to the wings of a butterfly (see Fig. 4). This is done by making a groove by pressing on the back edges of the tongue against the teeth and focusing on lowering the center of the tongue to enable it to form the

required concavity in the middle (Marshalla, 2008; Bleile, 2006. p. 74). A tooth pick may be used after breaking its sharp end to avoid hurting the tongue, as it is placed in the center of the tongue and is pressed down, so the patient begins to sense that the middle of the tongue is lower than the edges ((Bleile, 2006. pp.72-73).

butterfly position with teeth closed *butterfly position with teeth open*

Fig. 4 Butterfly position

Two therapists in the questionnaire mentioned that they use the technique of "supportive sound" which is based on the idea of starting with a sound that the patient can master and then moving to the target sound, such as starting with /t/ in the phoneme sequence /ts/. Two other therapists used auditory distinction and phonetic placement and gave instructions to pronounce the sound with an emphasis on simulating the correct sound. For most therapists, treatment technique comes in two paths: the "imitation" technique, followed by 22 therapists. It entails mimicking the audible sound and observing the mechanism of the movement of the speech organs. this technique. The second technique, adopted by 20 therapists, focuses on "phonetic placement".

4.1.2. Techniques for treating alveolar central distorted hissing sounds:

The techniques in this form of distortion intersect with the previous form, but it differs in the therapeutic approach. With the alveolar central distortion, the patient raises the tip of the tongue and pulls it slightly backward or raises the center toward the front of the alveolar ridge and the gum, producing hissing sounds in that area. The position of the hissing in this type of central distortion shifts from the gum region to the area of the gingival edge and the front of the alveolar ridge (see Fig. 5). The sound produced here is closer to the sibilant /ʃ/ (Deniloff & Wilcox, 1980). The resulting friction of this sound is diffused with the flat narrowing, because the air is pushed along the stretch of the flat narrowing formed at the gingival edge and the front of the alveolar ridge. However, in the case of the semi-alveolar narrowing, the air passes through a groove that is not constricted enough (Deniloff & Wilcox, 1980), which causes the airflow to lose its energy and velocity required for generating hissing sounds.

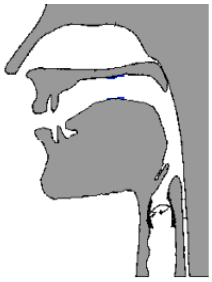

Figure (5): The position of the central alveolar distortion at the area of the gingival bridge and the front of the alveolar ridge with tongue center raised

The therapist begins by asking the patient to raise the tongue tip towards the gingival area while being careful not to pull the body of the tongue back or raise its center towards the alveolar ridge. Here, the patient's perceptual awareness is programmed by moving the tip of the tongue towards the target area. Because the air with this form of distortion goes out flat, the patient has to focus on the groove-forming characteristic through which the air escapes. This is a very important point with this form of distortion. The patient may be asked to place his palm in front of the lips to sense the difference between the diffuse air energy and the air coming out of the groove. The "lollipop" or the "tooth pick" may also be used here to help the patient form the groove (see Fig. 6),

Fig (6): Placing the "tooth pick in the center of the tongue to help the patient form the groove

4.1.3. Central retroflex distorted hissing techniques:

At the beginning of the treatment here, the therapist is only required to alert the patient not to bend the tip of the tongue backward when producing a sibilant (see Figure 7). The tongue body must be facing the roots of the upper incisors. The therapist can hold the tongue tip with a toothpick to stop it from bending backward and raise the patient's awareness to avoid such movement. S/he may also use the figures and graphs that explain the wrong movement that the patient may make. Finally, the therapist moves to the phonetic placement related to forming the groove mentioned earlier.

Figure (7): The retroflex movement of the tongue tip when producing sibilants

4.1.4. Techniques of treating central distorted strident hissing sounds:

This type of distortion- as Bauman-Waengler (2004) describes- is caused by an excessive amount of air rushing through the grooved narrowing during the high turbulence needed to form the hissing sounds (see Figure 8). The strident sound resembles a whistle. The reason for strident sound is the imbalance between the air pressure and the groove narrowing through which the particles of the thrusting air pass. Therefore, the auditory impression that is observed in this type of distortion is represented by higher value of the hissing sound than the natural degree of hissing (Hussein 2011). Thus, the patient produces an annoying sound that disturbs others.

Fig. (8): Variation in air energy between the normal (healthy) /s/ and the strident /s/

The treatment here focuses on making the patient repeatedly hear his/her own voice using a recorder and getting him/her to differentiate between the healthy /s/ and the strident one because many patients become accustomed to the sound and do not distinguish between the healthy sound and the ill-formed one. By making the patient fully aware of the difference between the two sounds, s/he is asked to reduce the intensity of the air thrust by hand-sensing technique, or by using *Praat*. The patient utters /s/ in front of a loudspeaker and adjusts the intensity of the sound. If a red line appears, it indicates high hissing energy. The patient continues trying until the green line appears, indicating that s/he is approaching the normal production of sound (see Figure 9).

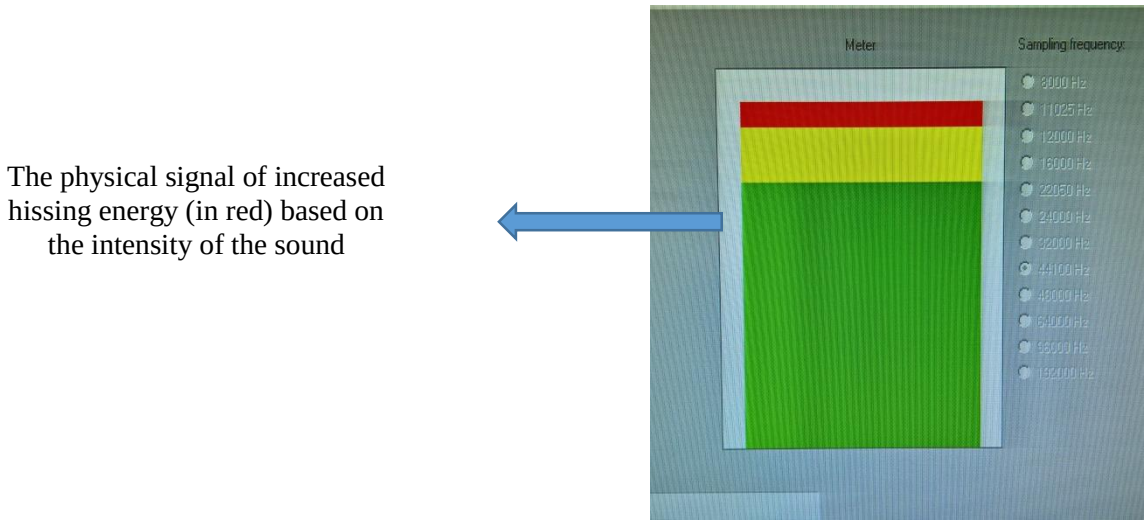

Figure (9): Increased hissing energy indicated by the red line at the top of the *Praat* audio recording screen

Twenty-two therapists believe that they have to direct the patient to reduce the air thrust, while twenty focus on imitating the target sound several times. Three therapists combine the auditory distinction of the normal and strident sound and directing the patient towards reducing the airway thrust. One therapist depends on choosing the treatment technique based on the patient's "readiness", as he believes that the

therapist should pay attention to which of the aforementioned techniques the patient responds better and thus makes progress.

4.2. Techniques for treating laterally distorted hissing sounds:

Lateral distortion is one of the most difficult types of distortion to treat (Speechlanguage-Resources, 2016), as air passes from one or both sides of the tongue or from several directions diffusely (Marshalla, 2008).

The treatment here focuses on the patient's sense of the direction of the air escaping from one or both sides of the tongue, by placing a tissue in front of the patient's mouth, and then trying to direct the patient to close the tongue sides and focus on pushing the air out from the center of the mouth. Another treatment technique is to ask the patient to place his tongue at the base of the mouth without lifting or moving it, and the therapist works to raise the lower jaw so that the tongue approaches the upper jaw without closing it completely. During that, the patient is asked to try to form a groove in the middle of the tongue and feel the air as it passes through (Speech Language-Resources, 2016). Moore (2016) mentioned that in the treatment of lateral distortion, it takes longer time to explain what the patient is doing when pushing the air from both sides. The patient is, then, given words that end with the sound /t/ so that s/he can sense the air passes through the center of the mouth. Finally, s/he is asked to imitate the sound of deflating air from a car's wheel (Moore, 2016).

It seems that the characteristic of producing /t/ mentioned by Bleile (2006) is close to Arabic aspirated /t/, as a large amount of air is pumped out when the two speech organs separate, hence a sound close to /s/ is heard.

In the questionnaire adopted here, we found that 29 therapists adopted the technique of phonetic placement and shifting the air movement from both sides to the center. They also mentioned that they use auxiliary tools such as a "toothpick" to facilitate the exit of air from the central front part of the tongue to prevent air from escaping from both sides. Twelve therapists said that they adopt the imitation and simulation technique, hence focusing on auditory and visual sources, so that the patient observes the correct pronunciation and tries to simulate it repeatedly. Three therapists tended to use the "supportive sound" technique where the patient starts pronouncing a sound like /t/ and then moves to the target sound /s/. One therapist mentioned that he combines the techniques of auditory distinction and phonetic placement.

4.3. Techniques for treating distorted nasal hissing sounds:

Some scholars use the term "nasal emission" for this type of hissing distortion (Kummer, 2012), in which air escapes from the nasal cavity instead of the oral cavity, or it may escape through both cavities. The patient here places the tongue tip in the alveolar region in its correct groove shape, but as soon as they begin to push air from the lungs, part of it leaks from the soft palate, hence producing a nasalized sound. This distortion is noted by the fog that is seen on the mirror when it is placed below the patient's nose. (Hussein, 2011).

The therapist focuses here on helping the patient to push all the air out of the mouth but not from the nose. S/he increases the patient's awareness of what they are doing by using pictures and graphs that show the path of air movement when producing sibilants. Auditory distinction is made between the target sound and the distorted one by using a mirror in front of the nose and observing the fog that forms on it when air leaks from the nose. The therapist utters nasal and oral sounds and lets the patient notice the difference. Thirty-four therapists adopted this technique.

Hall, Tomblin, and Kummer (1975) adopt the technique of using the sound /t/ to help train the patient who is asked to say /t/ with high energy, thus producing a sound that is close to /ts/. The oral explosive sound /t/ is similar to the target sound /s/ in the place of articulation (Hall & Tomblin, 1975) & Kummer (2008). We can also use (See-Scape) tool, which is a glass tube with a cylindrical piece resembling a cork at its base that is affected by the air movement when it is outside the nose. It rises to the top as the nasal air enters the tube using another plastic tube whose front is placed in front of the patient's nostril (see Figure 10). This tool can be replaced by using paper tissues, a straw or a listening tube, which is an easy-folded plastic tube where one end is placed in front of the nostrils and the second in the ear. If the patient is not able to produce the target sound from the mouth, the auditory sound distinction technique can be used so that the patient listens to nasal and oral sounds, thus increasing his auditory awareness of the difference between them (Kummer, 2008).

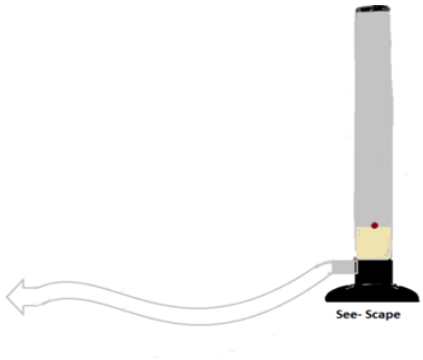

Fig (10): See-Shape

4.4 Techniques for treating hissing sounds due to sound substitution:

In this type of speech disorder, the patient substitutes hissing sounds with other Arabic ones: /θ/, /ð/ and /t/ and /d/ which are phonemes that the patient pronounces correctly and distinguishes them acoustically from hissing phonemes. This type of speech disorder plays an important role in changing the semantic meaning of words. So, it is a matter of substitution rather than distortion. In other words, the patient does not change the target sound with another "distorted" one that is not present in the list of spoken language sounds. Rather s/he replaces it with a sound that is present in the language and pronounces it correctly, and here lies the semantic problem. If the patient utters /θa:r/, 'revolted' instead of /sa:r/ 'marched' or /daʕam/ 'support' instead of /zaʕam/ 'claimed,' the denotations will be mixed and understanding the linguistic messages becomes a problem (Hussein, 2011). It appears that some substitutions are stops while others are fricatives. Studies maintain that fricative substitutions are more frequent than stops. In our study, among the 72 cases studied, 57 of them were fricative substitution, as opposed to 15 cases of stops (Hussein, 2011). On the other hand, substitution in children greatly exceeds that of adults (73 vs 6).

If the patient finds it difficult to differentiate the place of articulation, therapists work on the auditory and visual distinction first. For example, the patient is asked to watch the therapist's mouth as they pronounce /s/ vs /t/ to observe the tongue movement. In the meantime, the therapist describes the phonemic properties of both sounds. Thus, the therapist focuses on the *stop* property of /t/ in comparison to the *continuity* property of /s/. After these audio comparisons between the target sound and the substituted one, the therapist begins training the patient on how to place the tongue tip behind the upper or lower incisors while leaving a relatively small distance to allow the air escape and collide with the inside of the upper incisors. The therapist continues to utter the target sound in front of the patient using

drawings, visual aids and other tools such as a mirror to help the patient visually see where the tip of the tongue should be placed (Baker & Ryan, 1979. p. 34).

Accordingly, therapist needs to start the therapy with distinguishing the target sound and the substituted one in order to increase the latter's awareness of what s/he is doing and what they need to do. That would save a lot of time and effort. However, that was not the case with most therapists in the questionnaire as 31 pointed out that they use the mechanisms of phonetic placement and direct imitation of what the patient sees and hears without distinguishing the type of substitution s/he makes. On the other hand, 10 therapists stated that they adopt the *supportive sound* technique by moving from one sound to another (successive approximation). Five therapists mentioned that they follow the technique of direct imitation of the audible sound.

4.4.1 Techniques for treating /z/:

When training the patient to pronounce /z/ correctly, s/he has already mastered /s/ on the word, sentence and connected speech levels. The therapist needs to draw the patient's attention to the vibration of the vocal cords through feeling it by hand, as the patient places his/her fingers on the throat and senses the vibration of the two vocal cords when pronouncing /z/. This is what all the therapists in the questionnaire adopted in this study. If the patient finds it difficult to form the vibration, they can utter any other voiced sound such as /b/ and /ð/ and try to sense the laryngeal vibration. Then, the therapist comes back to the target sound again, and the purpose of that is to enable the patient to access the same vibration that accompanies other voiced sounds, and to increase the patient's awareness that the only difference between /s/ and /z/ is voicing/ vibration. Here, /s/ and /z/ can be placed in phonemic minimal pairs such as *sa:r* 'walked' and *za:r* 'visited' or *ka:s* 'cup' and *ka:z* 'kerosine' to increase the patient's awareness of the auditory and speech distinction between them (Creaghead, Newman & Secord, 1989. p. 207). It is also possible to use pictures of words if the patient is a child. Graphs can also be used for adults and children.

4.4.2 Techniques for treating /ṣ/:

/ṣ/ is an emphatic dental alveolar sound that rises with the back of the tongue towards the soft palate while the tongue root withdraws towards the posterior throat wall with its tip fixed in the alveolar ridge area. The therapist here pronounces /s/ with a bit of exaggeration or emphasis, and pronounces the two sounds back to back until the patient distinguishes the emphatic feature. The patient may be asked to utter minimal pairs with /s/ and /ṣ/ as *sa:r* 'walked' and /*ṣa:r* 'became'. If the patient is not able to produce this feature, s/he is asked to produce minimal pairs with other emphatic sounds such as /t/ versus /ṭ/. A pressure pad may also be used to help the patient move the back and root of the tongue to the desired position.

In the questionnaire, 28 therapists adopted the two techniques: mental awareness of what the patient should do in terms of speech organs' movement, and auditory and visual distinction technique of the target sound. 11 therapists recommended using imitation and simulation techniques, while 7 stated that they use some other emphatic sounds and then move to /ṣ/. In this research, we found that the patient can start with back open unrounded /ɑ/, which is inherently emphatic. Then, s/he can move to pronouncing /ṣ/ which also has an empathic feature that assimilates to that in /ɑ/.

5. Techniques for treating hissing sounds at the word level:

In speech therapy, training is usually based on the traditional method; starting with the sound at the beginning of the word and then moving on to practice it at the end and finally in the middle (Creaghead, Newman & Secord, 1989, pp. 132-133). In some methods, the therapist begins by examining the pronunciation of the sounds in several positions in the word and in different phonological contexts in order to identify the positions in which the sound is not pronounced correctly (Shipley & McAfee, 1992, p 132). The therapist begins treatment at the word level depending on the patient's performance and ability. Thus, they select *key words* that are easier for the patient (Bleile, 1995. p. 199 & Riper, 1972, p. 208). Then, they move to harder words with more complex phonemic contexts until the patient masters the sound in all positions and in different phonetic environments.

Weaver-Spurlock and Brasseur (1988) pinpointed that working on target sound in all contexts and positions at the same time facilitates 'generalization'. However, we find that this technique may not be of any use with those who find it difficult to pronounce the target sounds in different phonetic contexts. Therefore, we suggest that each case is evaluated and dealt with independently while maintaining the general framework of treatment.

We found that the majority of therapists in the questionnaire (33) follow the systematic arrangement of the target sound according to its occurrence at the beginning of the word first, then at the end and finally in the middle. However, seven of them said that they start with the target sound word-initially, then in the middle and last word-finally. Six therapists mentioned that they focus on starting with *keywords* which the patient finds easiest and then move gradually to more difficult ones. Only one therapist mentioned that that he focuses on the target sound in the middle of the word at the beginning of treatment. The systematic arrangement mentioned above seems the most common and useful for phonological and contextual reasons since the sound at the beginning and end of the word is influenced by a single phonemic context, while in the middle it is influenced by the sounds preceding and following it, which needs more effort.

6. Age differences and their impact on the choice of treatment techniques:

Twenty-six therapists said that young people do not need that much effort of training, whereas adults need a variety of techniques. They also indicated that with children, they often use techniques that employ different senses as this facilitates the training mechanism for them. However, they do not do that as much with adults. On the other hand, 11 therapists believed that training adults is easier because they understand the instructions during the training session better, and because they want to get rid of that disorder that causes them great social embarrassment. The nine remaining therapists think that there is no difference in the treatment techniques of the two groups; rather, it is the patient's response which comes first.

In general, the techniques of training children differ from adults because with children therapists employ the senses more and use pictures, drawings and perceptions more. Adults, by contrast, need theoretical instructions and more explanations. Children need cooperation between the therapist and the parents because they need to extend their training at home according to the therapist's instructions. Finally, there are therapeutic techniques in which the school is involved in monitoring and providing notes (Taylor, 1992).

7. The variation in the number of treatment sessions among patients:

The number of treatment sessions varies from one patient to another due to several reasons, including motivation (Kamhi, 2006) the patient's ability to correct the sound after the therapist utters it in front of

him/her (stimulability) (Shipley & McAfee, 1992, pp. 138, 139, Costello, 1984, p.15) in addition to the extent of the patient's follow-up treatment at home and outside the treatment sessions (Marshall, 2008). Here, we add another reason: the therapist's choosing of the appropriate treatment techniques. According to the questionnaire adopted in this study, the number of least treatment sessions (one hour each) ranged between four to twelve sessions, while the greatest number of treatment sessions ranged between (15-36).

8. Conclusions

In light of the questionnaire results, the study concludes the following:

1. The treatment techniques and mechanisms depend on the type and form of the speech disorder, and the approaches to treatment vary accordingly, which, in turn, saves time and effort and speeds up the treatment process.
2. The transitional arrangement for treating hissing sounds in Arabic starts with treating /s/ which is the easiest to pronounce - then /z/ and finally /ṣ/. The therapist begins treating the sound independently, then in syllables and words and ends with continuous speech. Each transition takes place after the patient has mastered the production of the sound in all contexts and positions.
3. While treating the patient, it is important to increase the patient's mental and auditory awareness of the problem. In addition, it is important to use supportive tools to speed up treatment.
4. The phonetic placement exercises achieve greater and faster benefits in treatment than using general exercises for the oral muscles.
5. The number of treatment sessions varies according to the patient's motivation and ability to correct the sound after hearing it, in addition to his/her follow-up treatment outside the treatment sessions, and to the therapist's good choice of the appropriate treatment techniques.

9. Ethics Committee Approval

The author(s) confirm(s) that the study does not need ethics committee approval according to the research integrity rules in their country (Date of Confirmation: 22.01.2021).

Acknowledgement

We would like to thank the therapists who participated in the questionnaire. Their time and effirts are highly appreciated

References

Aihara, R., Takigutchi, T., & Ariki, Y. (2013). Individuality- preserving voice conversation for articulation disorders using locality- constrained NMF. *Fourth workshop on speech and Language Processing for Assistive Technologies*, Grenoble, France, August 2013 at Association for Computational Linguistics, 3-8.

Al-Beblawi, I. (2003). *Speech Disorders - A Guide for speech therapists, teachers and parents*. 1st ed. Egypt: Egyptian Renaissance Library.

Al-Nahhas, M. (2007). A new preventive and treatment approach for utterance and speech disorders of ordinary people and people with special needs. A paper presented at the first scientific conference of the Department of Mental Health (*Special Education between Reality and Expectations*).

Al-Saeed, H. (2002). Substitution disorders in normal 3-7-year-old children. *Journal of Education*. 6(63), 253-257.

Amayreh, M. & Dyson, A. (1998). The acquisition of Arabic consonants. *Journal of Speech, Language, and Haring Research*. 41, 642-653.

American Speech and Hearing Association (ASHA) (2016). *Speech sound disorders: articulation and phonological problems*. Retrieved on June, 7, 2018 from http://www.asha.org/public/speech/disorders/SpeechSoundDisorders/#causes

Bauman-Waengler, J. (2004). *Articulatory and phonological impairments: A clinical focus*. Pearson Education, Inc., MA.

Bernthal. J. & Bankson. N. (1988). *Articulation and phonological disorders*. 2nd ed. New jersey: Prentice Hall.

Bleile, Ken (1995). *Manual of articulation and phonological disorders-infancy through adulthood*. Singular Publishing Group, Inc., San Diego.

Bleile, K. (2006). *The Late eight.* Plural Publishing Inc., San Diego, CA.

Costello, J. (1984). *Speech disorders in children*. college- Hill Press, Inc. San Diego, California.

Creaghead, N., Newman, P., & Secord, W. (1989). *Assessment and remediation of articulatory and phonological disorders*. 2nd ed. Macmillan Publishing Company, New York.

Edwards, H. (1992). *Applied phonetics: The sound of American English*. San Diego, California.

Hall, B. (1991). Attitudes of fourth and sixth graders toward peers with mild articulation disorders. *Language, Speech, and Hearing Services in Schools*. 22, 334-340.

Hall, P. & Tomblin, J. (1975). Case study: Therapy procedures for remediation of a nasal lisp. *Language, Speech, and Hearing Services in Schools*, 6(1), 29-32.

Hussein, I. (2011). Arabic sibilant disorders. *Arab Journal of the Humanities*. 115, 91-126.

Kamhi, A. (2006). Treatment decisions for children with speech- sound disorders. *Language, Speech, and Hearing Services in Schools, 271-279.*

Kocjančič, T. (2004). *IFA Report 144: The acoustic phonetic analysis of children's /r/,* University of Ljubljana. http://www.fon.hum.uva.nl/IFA-publications/Others/TanjaK_IFAreport144.pdf

Kummer, A. (2008). Speech therapy for squelae of velopharyngeal dysfunction (VPD). *ASHA Convention handout*. Retrieved on August, 8, 2018 from http://www.asha.org/Events/convention/handouts/2008/1913_Kummer_Ann_3/

Kummer, A. (2012). Resonance Disorders and Velopharyngeal Dysfunction: Evaluation and treatment. *ASHA Convention handout*. www.asha.org

Landis, K., Woude, J., & Jongsma, A. (2004). *The Speech- language pathology treatment planner*. John Wiley & Sons Inc. Hobken, New Jersey.

Lof, G. (2008). Evidence- driven speech sound intervention: alternatives to non-speech motor exercises. *ASHA Convention handout*, Chicago, IL. www.asha.org

Marshalla, P. (2008). *Practical therapy techniques for persistent articulation errors.* http://www.msha.ca/documents/PamMarshalla-FullRBasic.pdf

Moore, D. (2016). *Tips for articulation placement/ productions.* Retrieved on July 17, 2016 from www.expressionsspeech.com

Mowrer, D. & Sundstrom, P. (1988). "Acquisition of /s/ among kindergarten children who misarticulate /s/ as measured by the deep test of articulation". *Journal of Communication Disorders*. Elsevier Science B.V., Amsterdam, volume 21, 177-187.

Pickett, J. (1999). *The acoustics of speech communication: fundamentals, speech perception theory, and technology*, Allyn and Bacon, MA.

Riper, V. C. (1972). *Speech correction: Principles and methods*. Constable and Company Ltd, London, 1972.

Sacks, S. (2014). Time-Saving Approach to *Irl* and *Isl* remediation: An Rtl model, ASHA Convention handout, www.asha.org.

Shipley, K., & McAfee, J (1992). *Assessment in speech- language pathology: A resource manual*. San Diego.

Shriberg, D, & Kent, R. (2003). *Clinical phonetics*, 3rd ed. Boston, Pearson Education.

Sigal, S. (2011). *Sticky tape: helpful for carryover of /s/ and /z/ production and elimination of tongue thrust*. Retrieved on May, 8, /2018 from: http://blog.asha.org/2011/07/12/sticky-tape-helpful-for-carryover-of-s-and-z-production-and-eliminating-tongue-thrust/

Silverman, F. & Falk, S. (1992). Attitudes of teenagers toward peers who have a single articulation error. *Language, Speech, and Hearing Services in School.* 23, 187-188.

Smit, A. (1993). Phonologic error distributions in the Iowa- Nebraska articulation norms project, consonant singleton. *Journal of Speech and Hearing Research*. 36, 533-547.

Smit, A. (2004). Articulation and phonology resource guide for school-age children and adults, Cifton Park, NY. *Thompson Delmar Learning.*

Speech Language-Resources for Education Professionals. (2016). *Speech Sounds /s/. How to stimulate the /s/ sound*. http://www.speechlanguage-resources.com/speech-sounds-s.html

Taylor, J. (1992). *Speech- Language Pathology Services in the Schools. 2nd ed.* Clifton Park, NY. Allyn and Bacon. Boston.

Van-Borsel, J., Rentergem, S., & Verhaeghe, L. (2007). The Prevalence of lisping in young adults. *Journal of Communication Disorders*, 40, 493-502.

Weaver- Spurlock, S. & Brasseur, J. (1988). The effects of simultaneous sound position training on the generalization of /s/. *Language, Speech, and Hearing Services in School, 19, 259-271.*

Williams, A. (2003). *Speech disorders: resource guide for preschool children. Clifton Park, NY Thompson Delmar Learning.*

Arapçada düzensiz ıslıklıların tedavi teknikleri: Tanımlayıcı-analitik bir çalışma

Özet

Bu makale, ıslık seslerini Arapça telaffuz etmenin fonksiyonel bozuklukları olan hastaları tedavi etme tekniklerini ele almaktadır. Söz konusu sesler / s /, / z /, / ṣ /. Burada incelenen ana bozukluklar şunlardır: ikame ve distorsiyon. Tanımlayıcı bir analitik yaklaşım izlendi; farklı yaşlardaki hastalarda, kardeşlerin fonksiyonel telaffuz bozuklukları gözlendi. Araştırmacılar, 46 konuşma terapistine dağıtılan bir anketten veri topladılar. Anket, bu terapistlerin ısırgan üretim bozuklukları olan hastalarda kullandıkları tekniklere odaklandı. Araştırma önce / s / sesini ana ıslıklı ses olarak ele almak için kullanılan teknikleri gözden geçirir ve ardından / z / ve / ṣ / sesleri tedavi etmek için bu teknikleri geliştirir. Araştırma, tedavi tekniklerinin konuşma bozukluğunun türüne ve şekline bağlı olduğunu ve Arapça tıslama seslerini tedavi etmek için geçiş düzenlemesinin, telaffuzu en kolay olan / s / tedavisi ile başladığını buldu - sonra / z / ve son olarak / ṣ / . Bulgular ayrıca hastayı tedavi ederken soruna ilişkin zihinsel ve işitsel farkındalığını artırmanın önemli olduğunu vurgulamaktadır. Son olarak, tedavi seansları dışındaki takip tedavisine ek olarak hastanın motivasyonuna ve sesi duyduktan sonra düzeltebilme becerisine göre tedavi seans sayısının değiştiği bulunmuştur.

Anahtar sözcükler: Tıslama, ıslıklı sesler, ikame, bozulma, fonetik yerleştirme.

AUTHOR BIODATA

Hussein, Ibtisam, Philadelphia University, Jordan

Al-Oreifi, Jihad, University of Jordan, Jordan

Yasin, Ayman, Princess Sumaya University for Technology, Jordan