

Articulation of Igbo vowel sounds by Tongue-tied children: An experimental analysis using PRAAT

DOI: <https://doi.org/10.60787/jnlp.v6i2.73>

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Abstract

It is widely accepted that every typically developing child will acquire the language(s) to which they are exposed, often effortlessly, as posited in Chomsky's (1963) Language Acquisition Device (LAD) theory. However, certain speech impairments, sometimes subtle and difficult to detect, can hinder effective language acquisition. One such impairment is tongue-tie, a condition that can significantly affect speech production. This study focuses on the phonetic consequences of tongue-tie in the articulation of Igbo vowels by Igbo-speaking children. The research undertakes an experimental phonetic analysis to examine the ease or difficulty experienced by children with tongue-tie during vowel articulation. Data were purposively collected from five Igbo children aged between eight and sixteen through structured observations and oral interviews, using sound articulation tasks. The participants were asked to pronounce words containing Igbo vowels positioned at word-initial, word-medial, and word-final locations. The recorded data were analyzed using the Praat software. Findings from the study reveal that back vowels pose the greatest articulation challenges for Igbo children with tongue-tie. These results highlight the need for early detection and intervention to support affected children in achieving clearer and more accurate speech.

Keywords: Igbo, tongue-tie, tongue-free, mis-articulation.

1. Introduction

Travis (1971) defines speech as the communication through the conventional vocal organs. This is supported by Garuba (1996) who asserts that speech on its own involves the production of audible sounds, which represent the basic symbols for oral language. It is therefore the major mode through which language is transmitted. Language on the other hand is a method of communicating ideas, wishes, and feelings using a unique pattern of symbols. (Garuba,1996). Heward and Orlansky (1984) as cited in Egaga (1997) submit that speech is a complex motor behavior. Language and speech are components of communication; speech is a part of language, which involves verbal communication, and an individual's anatomical capabilities and psychosocial maturity and adjustment affect both speech and language (Okeke 2001, p. 112). Deviations and abnormalities in anatomical capabilities and psychosocial maturity and adjustment of an individual may result in speech and communication disorder. Van Riper (1972) notes that speech is assumed as defective if it deviates from the speech of other people to the extent that it attracts attention to itself, interferes with communication, or gives rise to maladjustment in the person using the speech. This is supported by Perkins (1976), who points out that speech is defective when it is ungrammatical, unintelligible, culturally, or personally unsatisfactory or abusive of the speech mechanism. Its characteristics include that: it draws the listener's attention to the speaker instead of what is being said, it hampers or interferes with communication and it can lead to the feeling of inferiority in social situations or avoidance of speech in public. Therefore, a speech disorder basically is an impairment in the articulation of speech sounds. It can manifest itself in misarticulations, non-fluency and voice unsteadiness.

Tongue-tie is one of the phonological disorders that occur in children that may not be a cause for serious concern at first but will eventually thwart or affect a child's articulation and speech. Fernando (2021) states that tongue-tie can be defined as a structural abnormality of the lingual frenulum. When the frenulum is normal, it is elastic and does not interfere with the movements of the tongue in sucking, eating, clearing food off the teeth in preparation for

swallowing and, of course, in speech. When it is short, thick, tight, or broad, it has an adverse effect on oromuscular function, feeding and speech. He goes further to explain that ‘tongue tie’ also known as ‘ankyloglossia’ or ‘anchored tongue’ is a common but often overlooked condition. It is seen at birth and causes a wide range of difficulties that affect the sufferer in different ways.

Fernando (2021) reports that there are several methods of measuring and classifying a tongue- tie. They include: measurements of ‘free tongue’ and the height to which the tongue can be lifted, appearance of the margin of the tongue; whether indentation is present, function and ability to protrude or to elevate the tongue, breastfeeding, and any problem related to speech. Horton, Crawford, Adamson, and Ashbell (1969), add that diagnosis of tongue-tie may be difficult; it is not always apparent by looking at the underside of the tongue, but often dependent on the range of movement permitted by the genioglossus muscles. For infants, passively elevating the tongue tip with a tongue depressor may reveal the problem. For older children, making the tongue move to its maximum range will demonstrate the tongue tip restriction. In addition, palpation of genioglossus on the underside of the tongue will aid in confirming the diagnosis. Once a tongue -tie has been diagnosed, the primary need is to correct the structural anomaly causing the problem. The type of treatment that is most appropriate depends on the problems that have been experienced. A lingual frenectomy is a surgical procedure used to remove this band of lingual tissue to release tongue so it can move more freely.

2. An overview of Igbo language and its speakers

The Igbo people are found in South-Eastern Nigeria. This area is divided by the Niger River into two unequal sections – the Eastern region and the Midwestern region. The term *Igbo* is used to refer to both the people and their language. According to Ohiri-Aniche (2013), the Igbo language is spoken homogenously in the five South-Eastern States of Nigeria, namely, Abia, Anambra, Ebonyi, Enugu, and Imo. A sizeable number of speakers are found in Delta,

and Rivers States, while some Igbo communities are also found in Edo, Akwa-Ibom, Cross River, Benue and Kogi States. The latest estimate of the Igbo population is at approximately 40 million speakers (Lingua Language Centre, 2023).

According to Manfredi in Bendor-Samuel (1989) Igbo is the common ancestor of varieties of Igbo, including the antecedents of a modern standard Igbo. Igbo is grouped under the New Benue-Congo group of languages in the Niger-Congo language family. According to Ohiri-Aniche (2013) the unified standard orthography for the Igbo language cluster produced by Emenanjo (2011) contains 10 vowels and 67 consonants. This includes the 36 alphabets of the Onwu orthography and other 39 letters drawn from other varieties which are not generally phonemic. However, it should be noted here that the new 39 are phonetic, as most of them are variants used by the dialects in place of some sounds, for example; where members of the eastern inland Igbo use [ibha] “to scold” for /iba/. [bh] is among the unified standard orthography, it is not phonemic but is just contained in the document, which sets out to incorporate all producible sounds in the language.

Standard Igbo consonants: The Igbo language has 28 consonants, /p b t d k g kp gb kw gw ɸ ɖ ʒ f v s z ʃ ɣ ɦ m n ɲ ŋ w l j w r/ involving the labial, the labiodentals, the alveolar sounds, post alveolar, palatal, palato-alveolar, velars, labialized velars and glottal sounds.

Standard Igbo vowels: Igbo has eight vowels. The vowels are grouped into two sets which are delineated along an important phonetic parameter, \pm ATR (Advanced Tongue Root). For the + ATR vowels, the tongue root is advanced for the articulation of the affected vowels while the –ATR vowels involve the retraction of the tongue root in their articulation. Apart from the advanced tongue root description, all vowel sounds can occur in word initial, medial, and final positions, as can be seen below:

The two sets in Igbo are:

[+ATR]		[-ATR]	
i	u	ɪ	ʊ
e	o	a	ɔ

Table 1: Distribution of standard Igbo vowel sounds

Phonemes	Orthographic representation	Occurrence in word initial position with gloss)		Occurrence in word medial position (with gloss)		Occurrence in word final position (with gloss)	
i	i	/ɪba/	malaria	/m/	suck	/ntɪ/	ear
ɪ	i	/itiri/	darkness	/biri/	live	/obi/	heart
a	a	/ara/	madness	/mara/	know	/ɲma/	beauty
e	e	/esu/	millipede	/efere/	plate	/ite/	pot
u	u	/utfe/	intelligence	/furu/	get lost	/ɲvu/	throng
ʊ	ur	/vɔ/	sweet	/ɔvɔvɔ/	many	/vfu/	pain
o	o	/opi/	flute	/soro/	follow	/udo/	peace
ɔ	o	/ɔtʃa/	white	/tʃɔ/	want	/nsɔ/	holy

Source: Fieldwork 2024

This study set out to fulfill the following objectives: to investigate how Igbo children with tongue-tie deficit realize Igbo vowel sounds, Identify the vowel sounds that pose the highest difficulty for the impaired child, and ascertain how the impairment impacts on the semantics of their speech. The research will also create awareness on tongue-tie, and its impact on the speech of affected children. It will also enable the parents and their children to identify the phonological limitations the deficit presents, the sounds that are often most affected, how to

work on individual child's discrepancies to eliminate instances of ridicule and the best techniques in drilling the patients to achieve near-perfect articulation.

3. Methodology

The research is experimental, which investigates how Igbo children with tongue-tie produce Igbo speech vowel sounds. The purpose of the research strategy is to establish the existence of a cause-and-effect relationship, and to evaluate how the deficit impedes speech production and to explore other linguistic effects. The children were given a wordlist containing all Igbo vowels at different environments of occurrence, the essence being to justify the possibilities of a sound not being challenging at a position, but being challenging when it occurs elsewhere. An acoustic analysis was done on these pronunciations in order to ascertain which of the sounds would be more problematic for a tongue-tied child. The research areas are Aba in Abia State and Awka in Anambra State. The use of the two areas was due to dialectal considerations, which would encapsulate the nuances between their phonological peculiarities. The population of people with tongue-tie in the research area is not known, however the researcher used five selected Igbo children exposed to the Igbo language from birth, for the study. The sample was chosen via purposive sampling. This according to Johnson (2005, p.66) is a selection of sample based on personal judgement of the researcher using a set of criteria determined ahead of time as the rationale for the selection. Thus, the presence of a restricted frenulum was taken into consideration and formed the conditionality which was used to select the tongue-tied children from the population.

Data for the study were collected through one-on-one sessions with the Igbo children, who have the tongue condition. They were encouraged to produce the words in the wordlist, carefully chosen to incorporate all Igbo sounds in different environments, the essence of this measure was to checkmate discrepancies, as a sound which did not pose any challenge during its production in the word initial position, might pose difficulty in word medial or final position. This was tape recorded and transcribed. Validity was ensured by using Praat

software to make sure that what is captured adequately represents what is produced. The data were analyzed by noting the ease or difficulty encountered by each as he tried to pronounce the sounds in the words. This was further authenticated using the Praat software to ascertain the actual sounds produced. The wave formant description ascertained if the intended sounds were realized, and noted other phonological processes that eventually surfaced in the attempt to articulate the intended sounds. Finally, the results were presented in tables, which were organized to reflect both the intended and actually realized sounds, stating the frequency of the distinct forms. The acoustic evidence for each production was also presented as figures in the appendix.

4. Theoretical Framework

The research is based on the tenets and postulations of Source and Filter theory by Chiba and Kajiyama (1942). Chiba and Kajiyama published their research on vowel acoustics and the vocal tract in their book, *The Vowel: Its nature and structure*. By creating models of the vocal tract using X-ray photography, they were able to predict the formant frequencies of different vowels, establishing a relationship between them.

In the source and filter theory, the mechanism of speech production is described as a two stage process:

- a. The air coming from the lungs induces tissue vibrations of the vocal folds (ie. Two small muscular folds located in the larynx) and generates the “source sound. Turbulent airflows are also created at the glottis or at the vocal tract to generate noisy sound sources.
- b. Spectral structures of these source sounds are shaped by the vocal tract “filter”. Through the filtering process, frequency components corresponding to the vocal tract resonances are amplified, while the other frequency components are diminished. The source sound mainly characterizes the vocal pitch (ie. Fundamental frequency), while the filter forms the timbre. The source-filter theory provides a very accurate description of normal speech production and has been applied successfully to speech analysis, synthesis, and

processing. Separate control of the source (phonation) and the filter (articulation) is advantageous for acoustic communications, especially for human language, which requires expression of various phonemes realized by a flexible maneuver of the vocal tract configuration. Based on this idea, the articulatory phonetics focuses on the positions of the vocal organs to describe the produced speech sounds.

In the implementation of the source–filter theory of speech production, the sound source, or excitation signal, is often modelled as a periodic impulse train, for voiced speech, or white noise for unvoiced speech. The glottal wave provides sources for voiced sounds such as vowels (e.g., [a], [e], [i], [o], [u]), diphthongs (i.e., combinations of two vowel sounds), and voiced consonants (e.g., [b], [d], [g], [v],[z],[ð],[ʒ],[dʒ], [h],[w],[n],[m],[r],[j],[ŋ],[l]). In addition to the glottal source, noisy signals also serve as the sound sources for consonants. Here, air turbulence developed at constricted or obstructed parts of the airway contributes to random (aperiodic) pressure fluctuations over a wide range of frequencies. Among such noisy signals, the one generated through the glottis or immediately above the glottis is called “aspiration noise.” It is characterized by a strong burst of breath that accompanies either the release or the closure of some obstruents. “Frication noise,” on the other hand, is generated by forcing air through a supraglottal constriction created by placing two articulators close together (e.g., constrictions between lower lip and upper teeth, between back of the tongue and soft palate, and between side of the tongue and molars) (Shadle, 1985, 1991). Ladefoged and Johnson (2011), in explaining some applications of Source and Filter theory in sound distinction add that when discussing difference in quality, the quality of a vowel depends on its overtone structure, implying that a vowel contains a number of different pitches simultaneously; there is a pitch at which it is spoken; there are the overtone pitches that give it a distinctive quality, and one vowel is distinguished from another by the differences in the overtones. The overtones are called formants, and the lowest three formants distinguish vowels from each other. They went further to say that the lowest, formant 1, also called F1 can be seen going up for the first four vowels and down for the second four vowels (i, ɪ, e, ε,

- a, ɔ, ʊ, u). the second formant F2, goes down in pitch in the series of vowels (i, ɪ, e, ɛ, æ) as can be heard more easily, when these sounds are whispered. The third formant, F3, adds to quality in distinctions, but there's no easy way of making it evident.

Gunnar Fant, a pioneering speech scientist, used Chiba and Kajiyama's research involving X-ray photography of the vocal tract to interpret his own data of Russian speech sounds in *Acoustic theory of speech production*, which established the source-filter model. This theory would therefore be also applied in this work to help differentiate between consonants and vowels, in which case, its tenets would be used as a basis to distinguish the realized sounds from the intended sounds. With these, when analyzing the speech form produced by the tongue-tie respondent, one can look at the acoustic spectrogram, with these pieces of evidence to rightly say that the first or second respondent produced /k/ instead of /g/ based on the dark patches displayed on the spectrogram as obvious with voiced sounds, or that the respondent produced /a/ instead of /e/ based on the figures of the F1 and F2 formants, or that a voiced sound/vowel was produced and not a consonant based on the bulky waveform that appears as the sound is produced.

5. Data Presentation and Analysis

The table in 2 shows how the Igbo children with tongue-tie deficit realized Igbo vowel sounds.

Table 2: The phonetic realizations of front vowels /a, e, i, ɪ/ by the respondents

Front vowel sounds	Realizations in word initial position			Realizations in word medial position				Realizations in word final position			
	Sound realized	Frequency	%		Sound realized	Frequency	%		Sound realized	Frequency	%
/a/ Resp 1-5	a	5	100%	/a/ Resp. 1-5	a	5	100%	/a/ Resp. 1-5	a	5	100%
Total		5	100%			5	100%			5	100%
/e/ Resp 1-5	e	5	100%	/e/ Resp. 1-5	e	5	100%	/e/ Resp. 1-5	e	5	100%
Total		5	100%			5	100%			5	100%
/i/ Resp 1-5	i	5	100%	/i/ Resp. 1-5	i	5	100%	/i/ Resp. 1-5	i	5	100%
Total		5	100%			5	100%			5	100%
/ɪ/ Resp 1-5	ɪ	5	100%	/ɪ/ Resp. 1-5	ɪ	5	100%	/ɪ/ Resp. 1-5	ɪ	5	100%
Total		5	100%			5	100%			5	100%

Source: Fieldwork 2024

From the data above, there was 100% phonetic realization of all front vowels by the five respondents in both word initial, medial and final positions. The spectrograms showing these

realizations are presented in the Appendix as figures 14, 15, 16, and 17, since there were no variant realizations, a sample of each pronunciation would be used to represent the others, since all the respondents made same production.

In table 3, we present the phonetic realizations of back vowels /o, ɔ, u, ʊ/ by the respondents.

Table 3: The phonetic realizations of back vowels /o, ɔ, u, ʊ/ by the respondents

Back vowel sounds	Realizations in word initial position			Realizations in word medial position				Realizations in word final position			
	Sound realized	Frequency	%		Sound realized	Frequency	%		Sound realized	Frequency	%
/o/ Resp 1-5	o	5	100%	/o/ Resp. 1-5	o	5	100%	/o/ Resp. 1-5	o	5	100%
Total		5	100%			5	100%			5	100%
/ɔ/ Resp 2, 3,4 Resp 1,5	ɔ a	3 2	60% 40%	/ɔ/ Resp. 1-5	ɔ	5	100%	/ɔ/ Resp. 1-5	ɔ	4	100%
Total		5	100%			5	100%			5	100%
/u/ Resp. 1,3,4 Resp. 2 Resp. 5	u n i	2 1 2	40% 20% 40%	/u/ Resp. 1-5	U	5	100%	/u/ Resp. 1-5	u	5	100%
Total		5	100%			5	100%			5	100%
/ʊ/ Resp.1,3, Resp. 4,5	ʊ n	2 2	40% 40%	/ʊ/ Resp. 1-5	ʊ	5	100%	/ʊ/ Resp. 1-5	ʌ	5	100%

Resp.2	i	1	20%								
Total		5	100%			5	100%			5	100%

Source: Fieldwork 2023

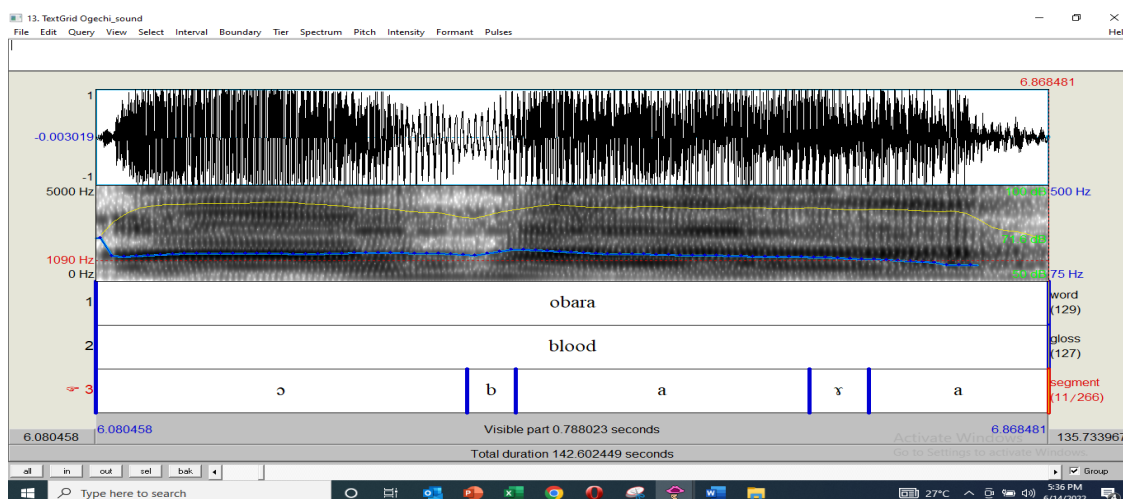
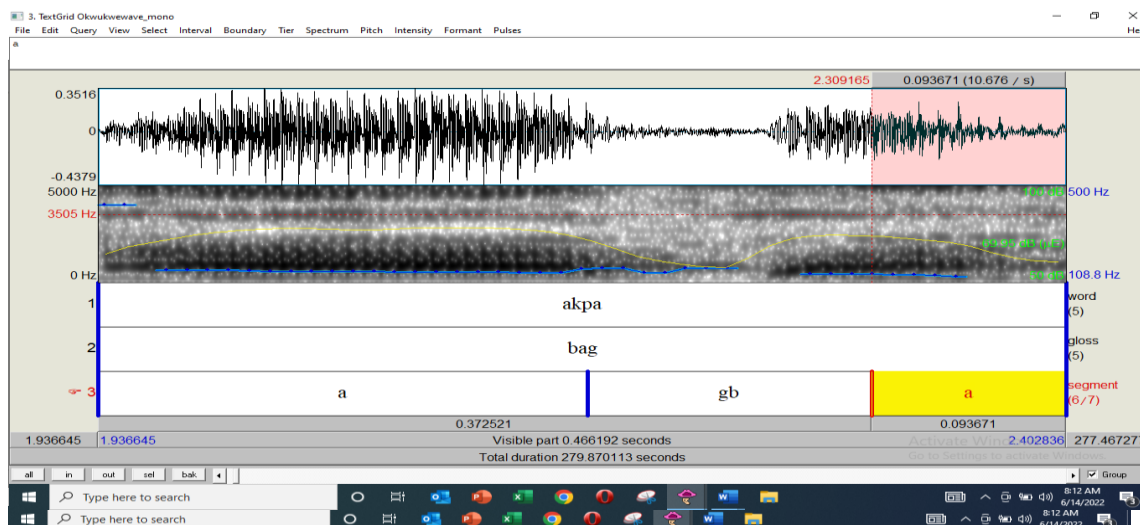
From the table above, the sound /o/ was realized 100% by all the respondents in word initial, medial and final positions. In the production of the sound /ɔ/ in word initial position, 80% actualized the sound as /ɔ/ while the other 20% produced it as /a/, while it was realized 100% by the respondents in word medial position, and 100% in word final position.

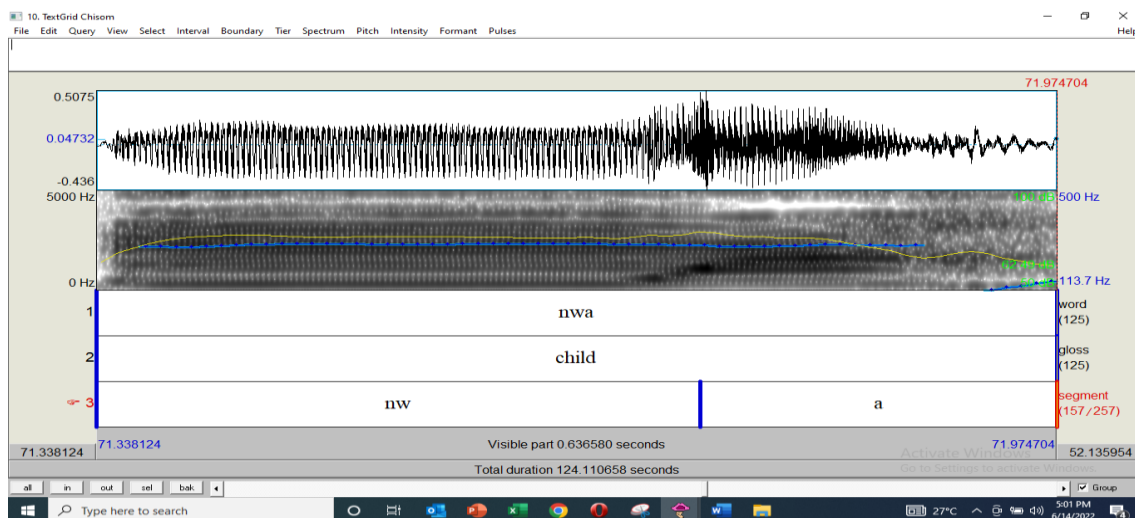
In word initial position, the /u/ sound was properly articulated by 60% of the respondents, 20% realized it as /n/, while the other 20% realized it as /i/, however, there was no deviant production in the word medial and final positions, as there was 100% realization of /u/ by the five respondents in both vowel positions.

For the sound /v/, in word initial position, 60% of the respondents approximated the pronunciation as /u/, 20% realized the sound as /n/ while the other 20% realized it as /i/. In the word medial position, the sound was realized 100% by all the respondents, while none of the respondents approximated the pronunciation in final position, there was 100% deviance, as all the respondents realized the sound as /ʌ/. The spectrograms showing these realizations are presented in the Appendix as figures 18, 19, 20, and 21.

The spectrograms below in Figure 1. shows the articulation of /a/ in word initial, medial and final position

Figure 1: Spectrograms showing the articulation of /a/ in word initial, medial and final position

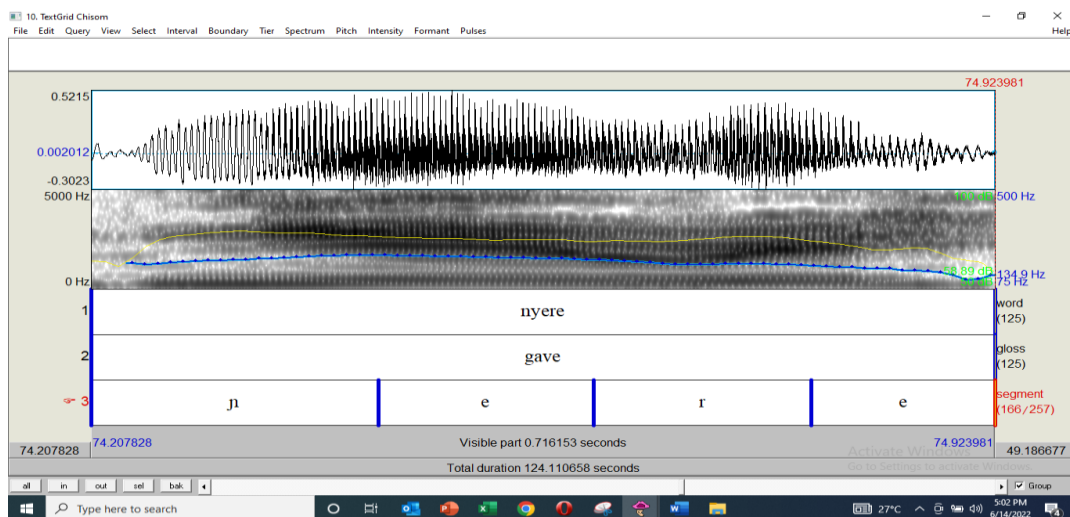
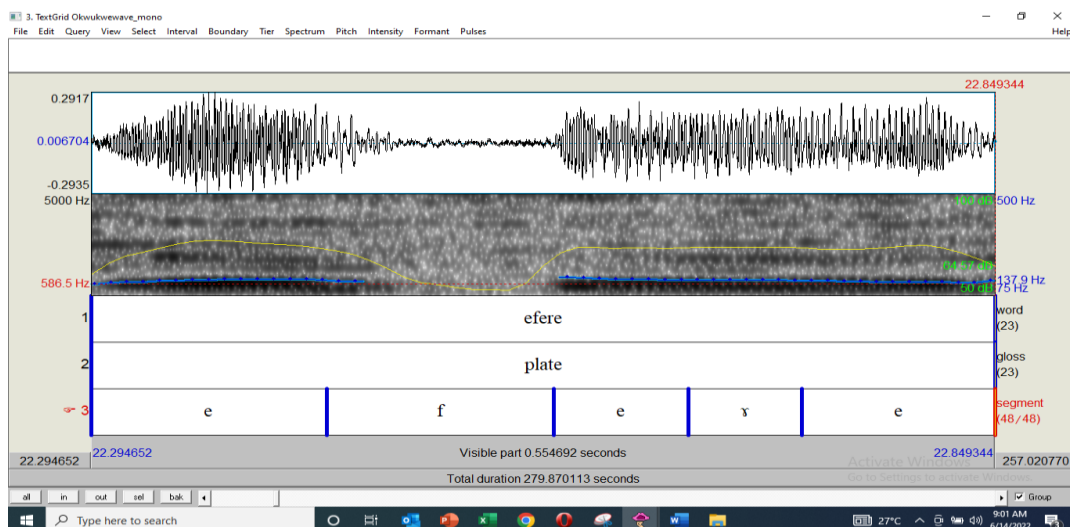


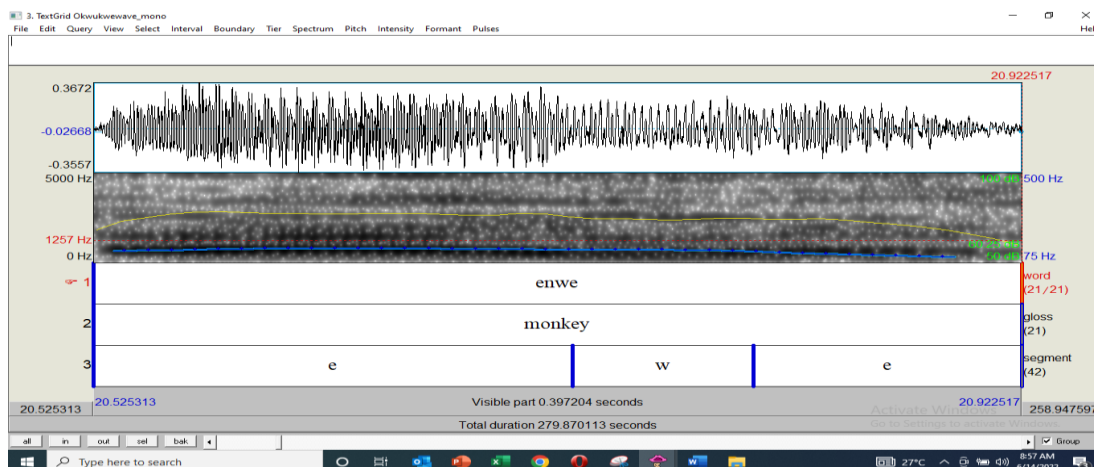


The respondents properly articulated the /a/ sound in all phonetic environments- initial, medial and final, and none of the respondents encountered any difficulty, as shown in three of the spectrograms shown above.

The spectrograms in Figure 2. present the realization of /e/ in word initial, medial and final positions.

Figure 2: Spectrograms showing the realization of /e/ in word initial, medial and final positions.

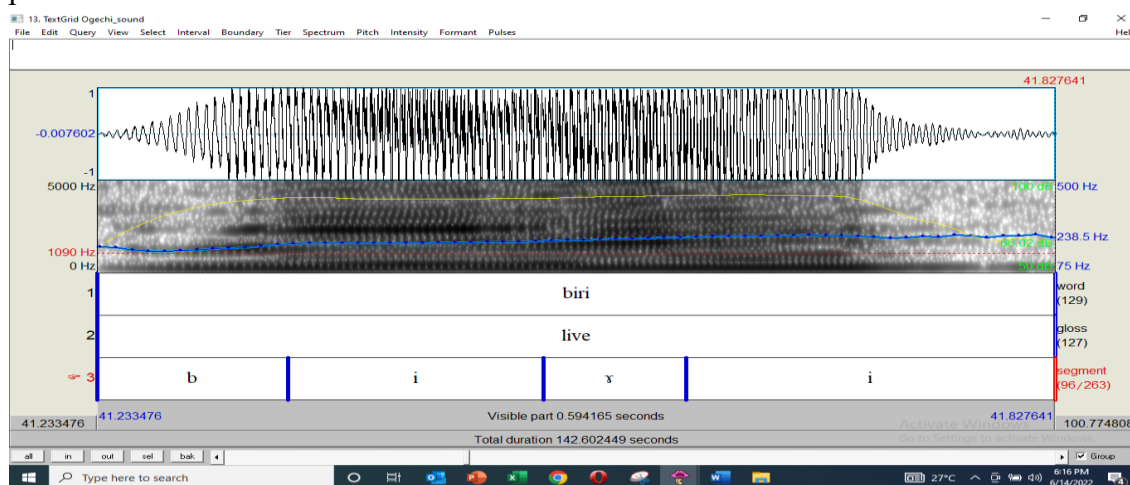


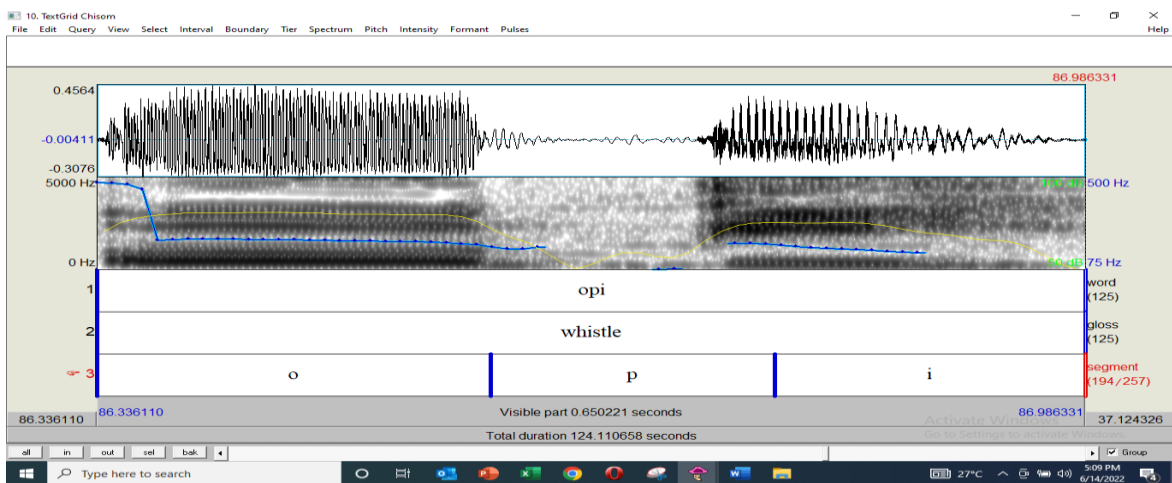
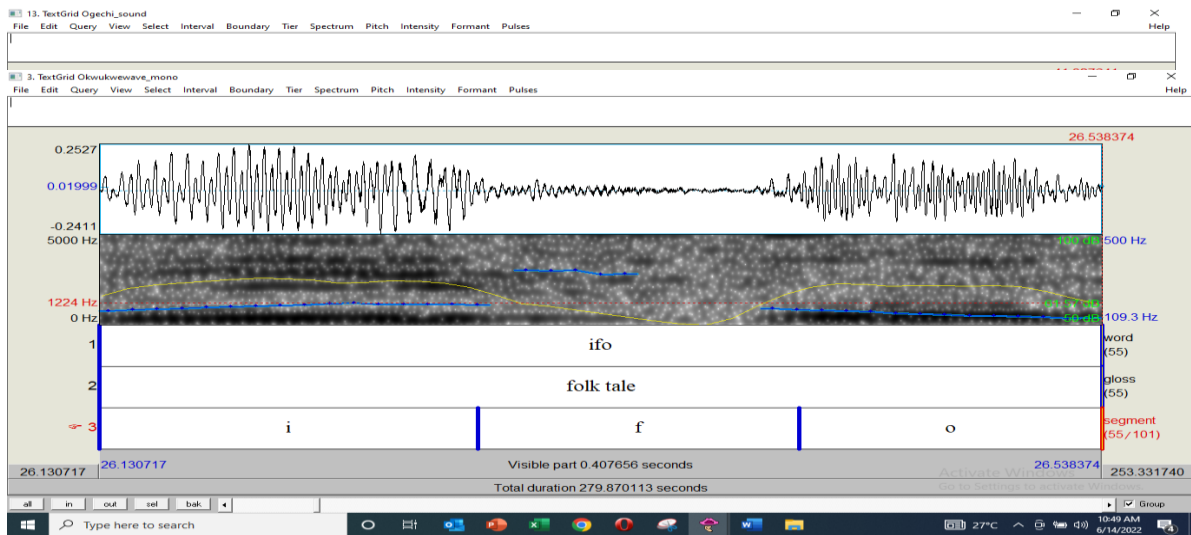


The spectrograms above in figure 2 show the respondents properly articulated the /e/ sound in all phonetic environment- initial, medial and final, and none of the respondents encountered any difficulty. This is due to the fact that, in the production of /e/, the tongue doesn't need much height, it relaxes, and not affected by the tongue being tied.

The Spectrograms in Figure 3 show the realization of /i/ in word initial, medial and final positions.

Figure 3: Spectrograms showing the realization of /i/ in word initial, medial and final positions

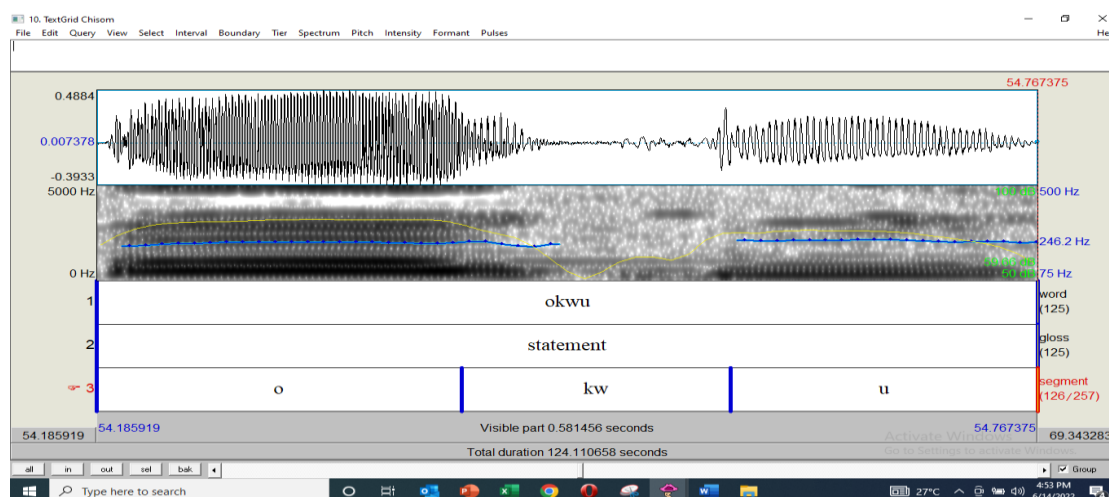


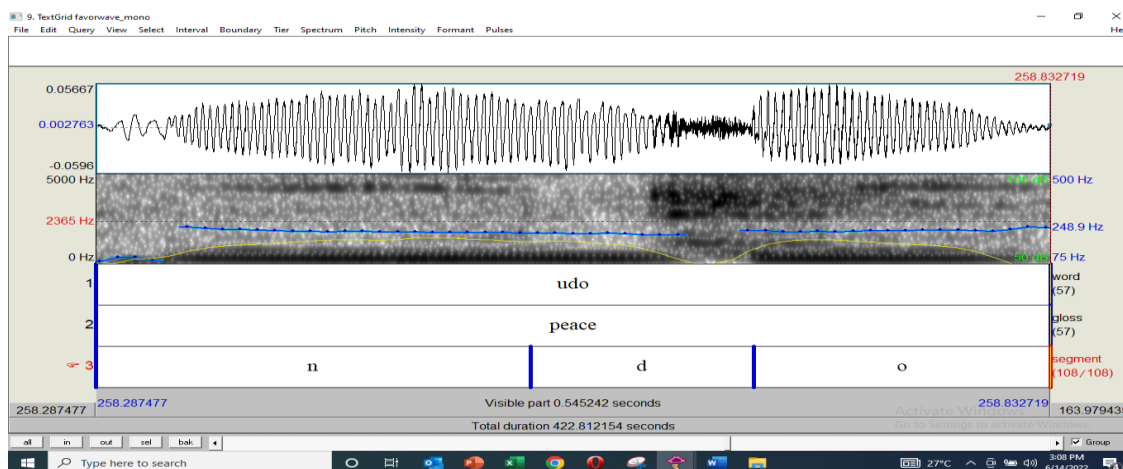
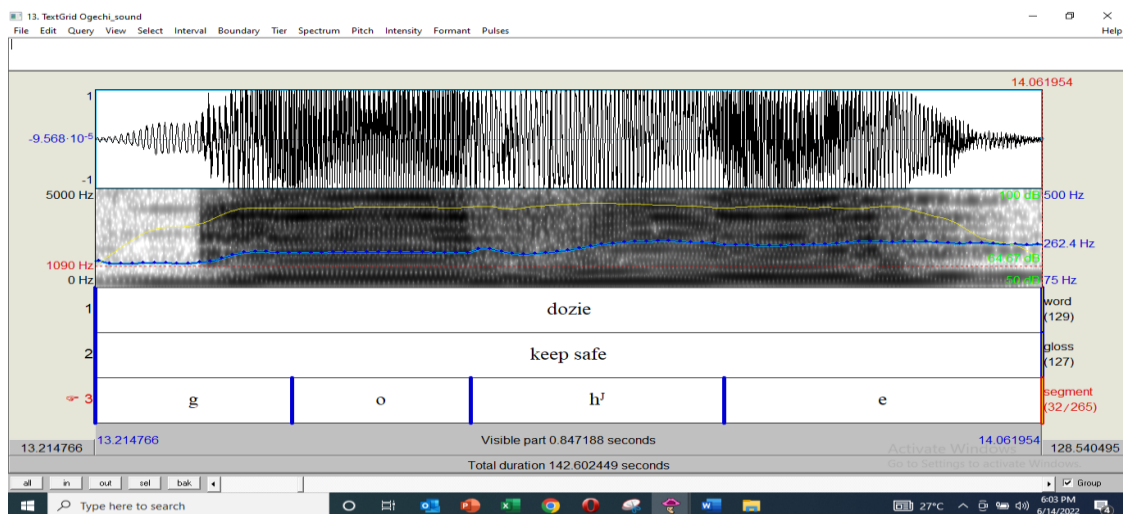


The spectrograms above in figure 3 shows that the respondents properly articulated the /i/ sound in all phonetic environment- initial, medial and final, without any difficulty, because the sound is a front vowel which needs the tip of the tongue, and whether the tip is tied or not, it does not affect the entire articulation process, despite the environment wherein /i/ occurs.

In Figure 4, we present the spectrograms showing the realization of /o/ in word initial, medial and final positions.

Figure 4: Spectrograms showing the realization of /o/ in word initial, medial and final positions.

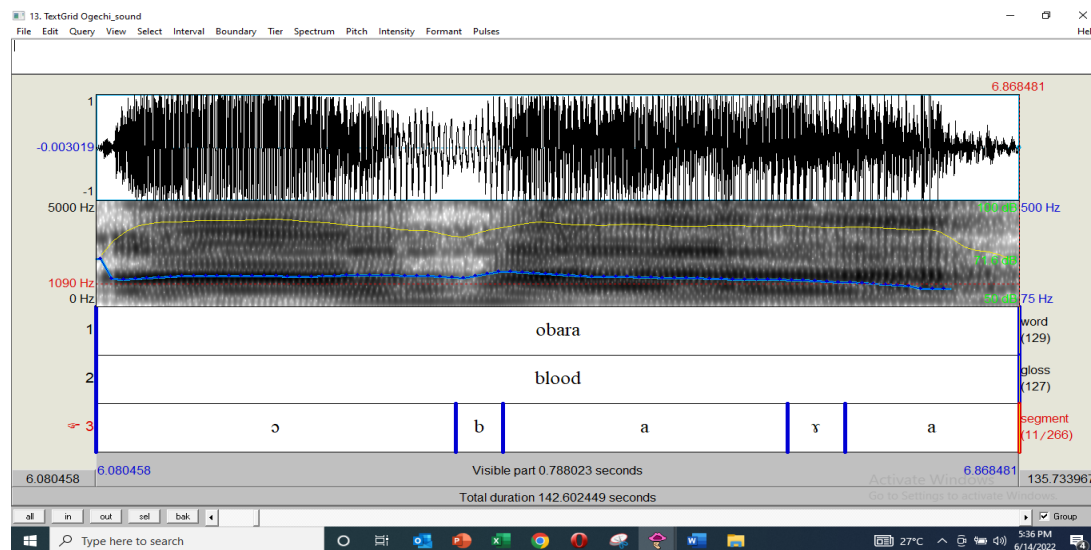
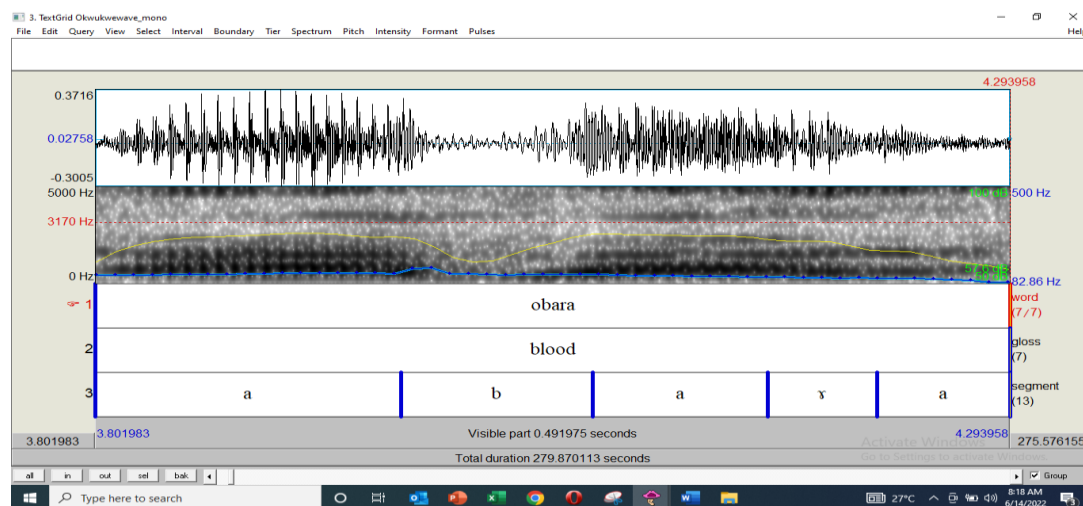




The spectrograms above show that the respondents properly articulated the /o/ sound in all phonetic environment- initial, medial and final, without any difficulty, because the sound is a back vowel that needs just the lip rounding, and whether the tip is tied or not, it does not affect the entire articulation or lip rounding process, despite the environment wherein it occurs.

In Figure 5a we present the spectrograms showing the realization of /ɔ/ in word initial position (two variant realizations)

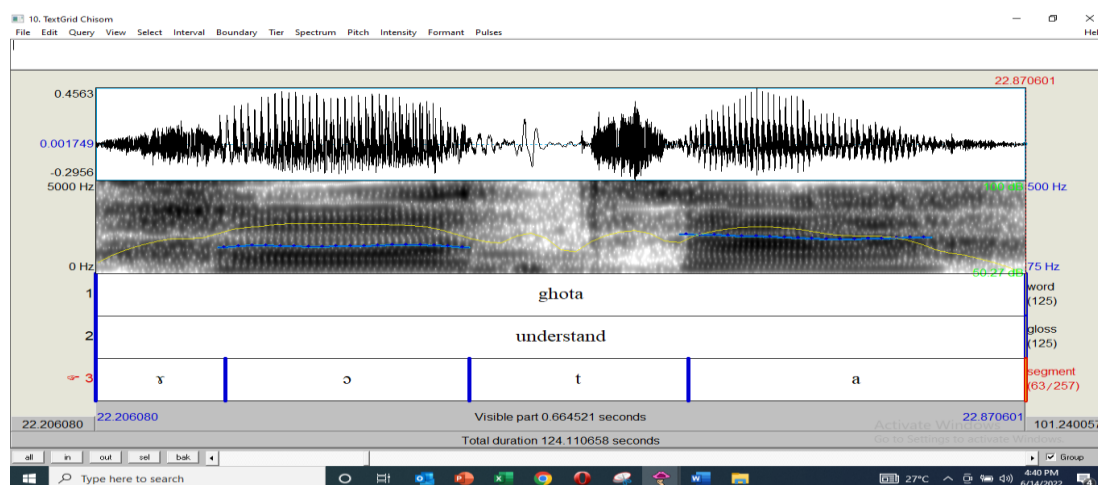
Figure 5a: Spectrograms showing the realization of /ɔ/ in word initial position (two variant realizations)

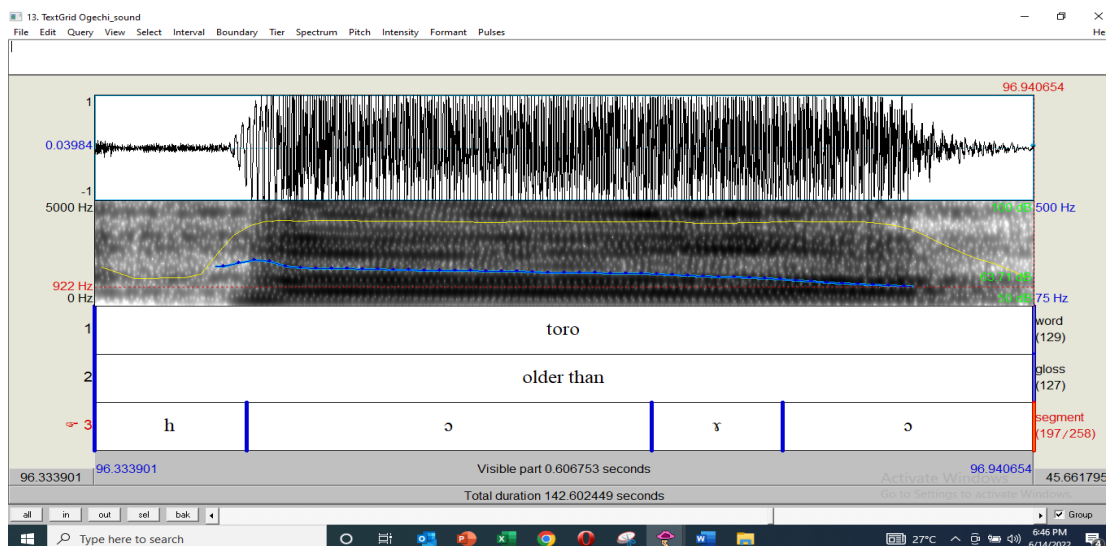


The spectrograms above in figure 5a show that there were two different realizations of the sound /ɔ/ in word initial position, which are /a/ and /ɔ/. The first and fifth respondent realized the sound as /a/ while the second, third and fourth respondents realized it accurately as /ɔ/. Back vowels are often produced with the back of the tongue, so sometimes, when the back of the tongue is tightly plunged to the floor of the mouth, the back vowel produced may or may not come out accurately, thus the discrepancy between the two articulations.

In Figure 5b, we show the spectrograms showing the realization of /ɔ/ in word medial and final positions.

Figure 5b: Spectrograms showing the realization of /ɔ/ in word medial and final positions.

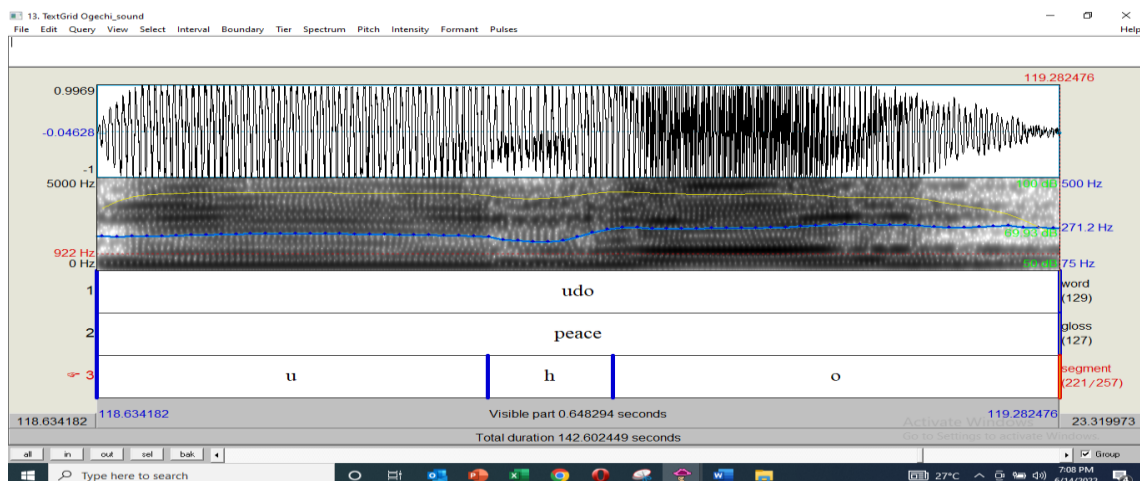
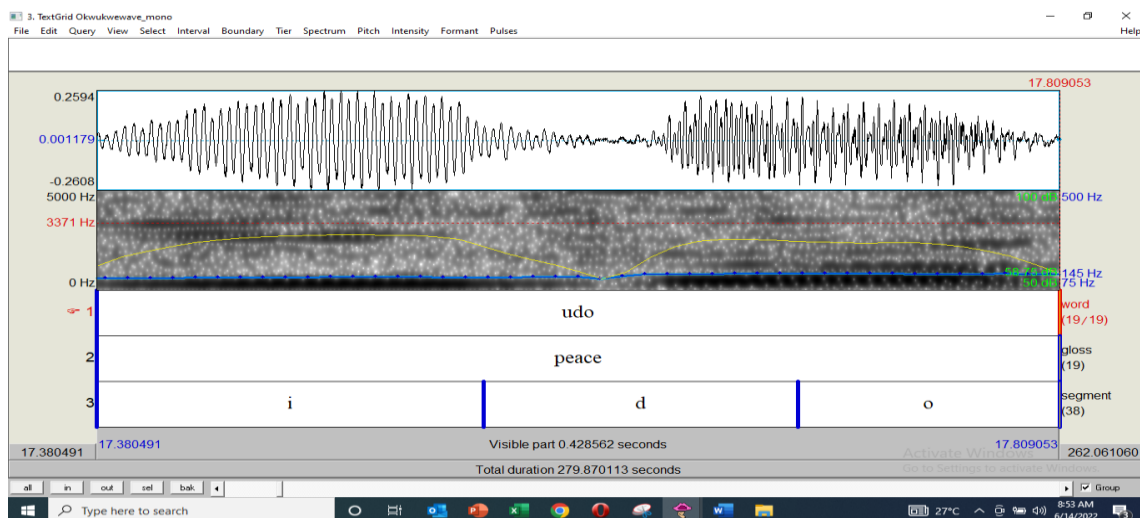


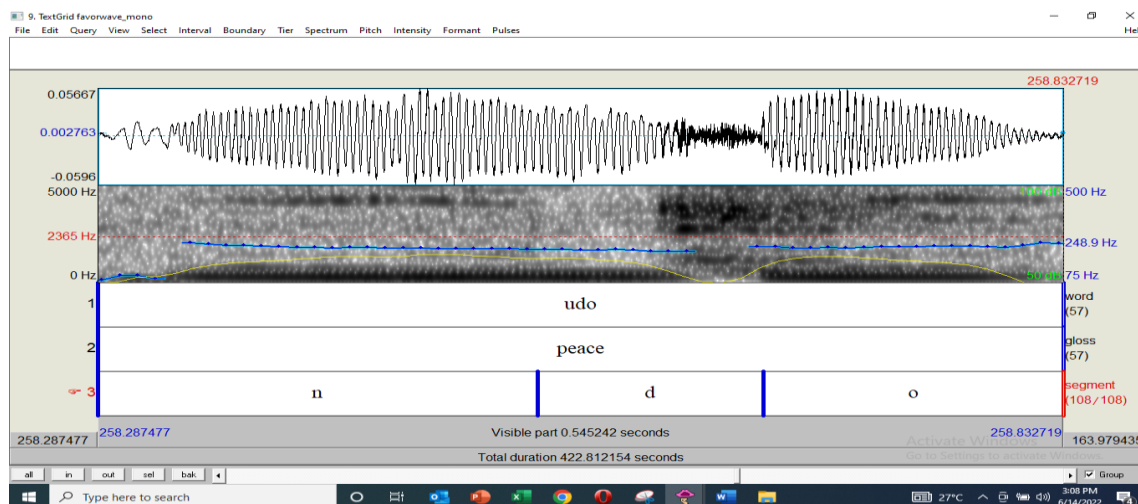


The spectrograms above in 5b show that the respondents properly articulated the /o/ sound in word medial and final positions without any difficulty, unlike the production at the initial position which had two variant realizations.

In Figure 6a, we show spectrograms showing the realization of /u/ in word initial position (three variant realizations).

Figure 6a: Spectrograms showing the realization of /u/ in word initial position (three variant realizations).

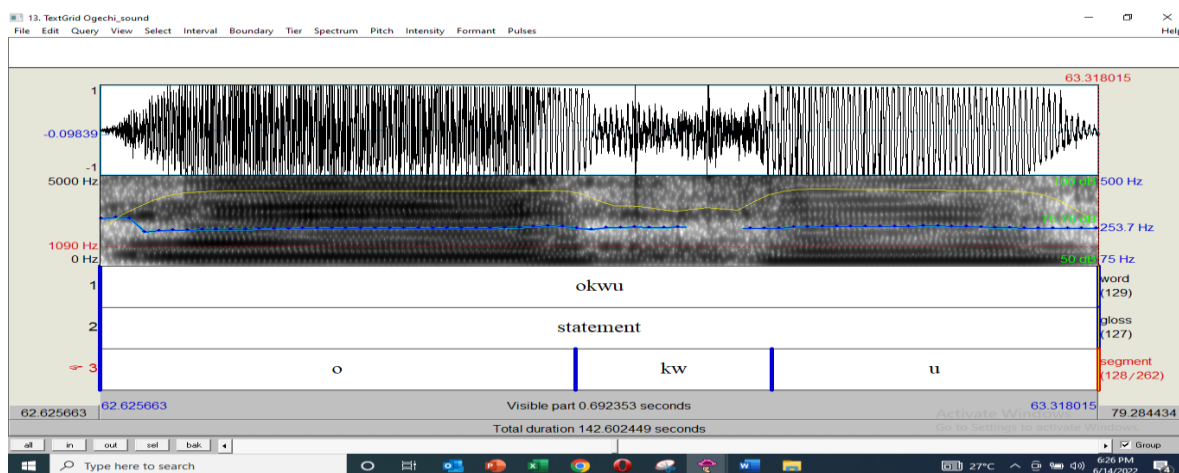
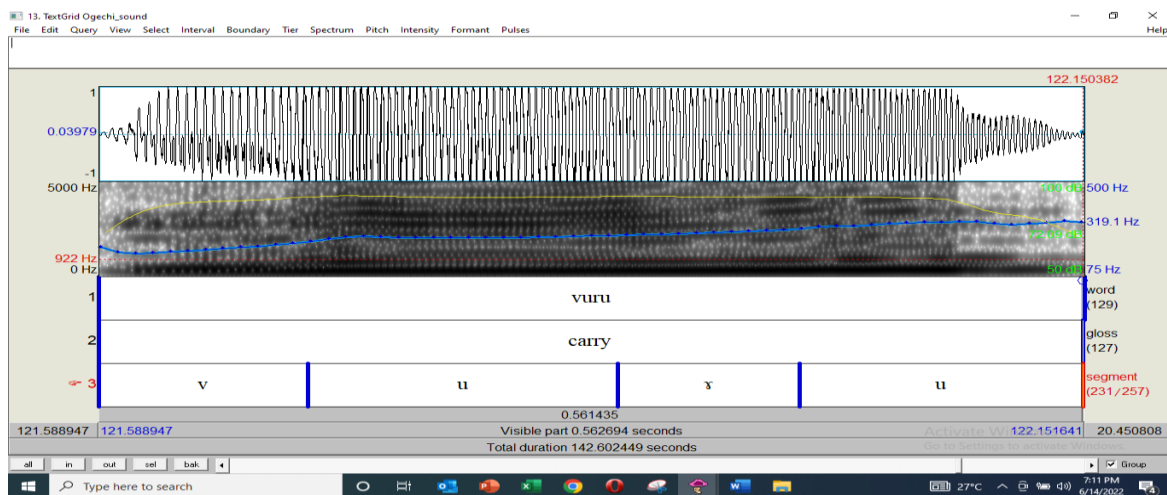




The spectrograms above in 6a show the articulation of /u/ by the respondents, it was quite challenging, as there were three varying realizations of the sound /u/. Two of the respondents realized the sound as /ɔ/, another two realized it as /i/ and one respondent realized it as /n/. Back vowels are often produced with the back of the tongue, so sometimes, when the back of the tongue is tightly plunged to the floor of the mouth, the back vowel produced may or may not come out accurately, thus the discrepancy between the three realizations.

Figure 6b shows spectrograms showing the realization of /u/ in word medial and final position

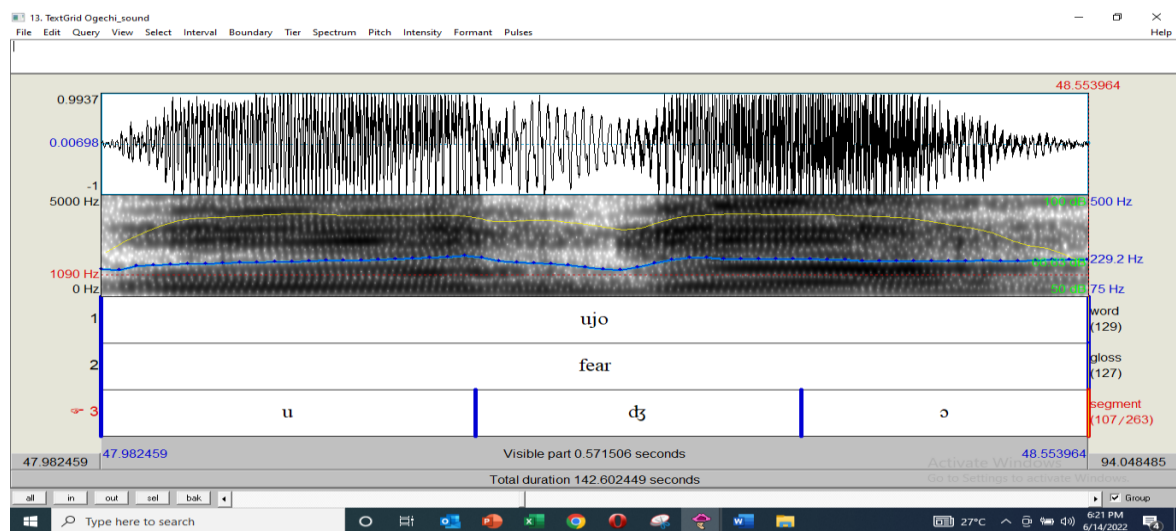
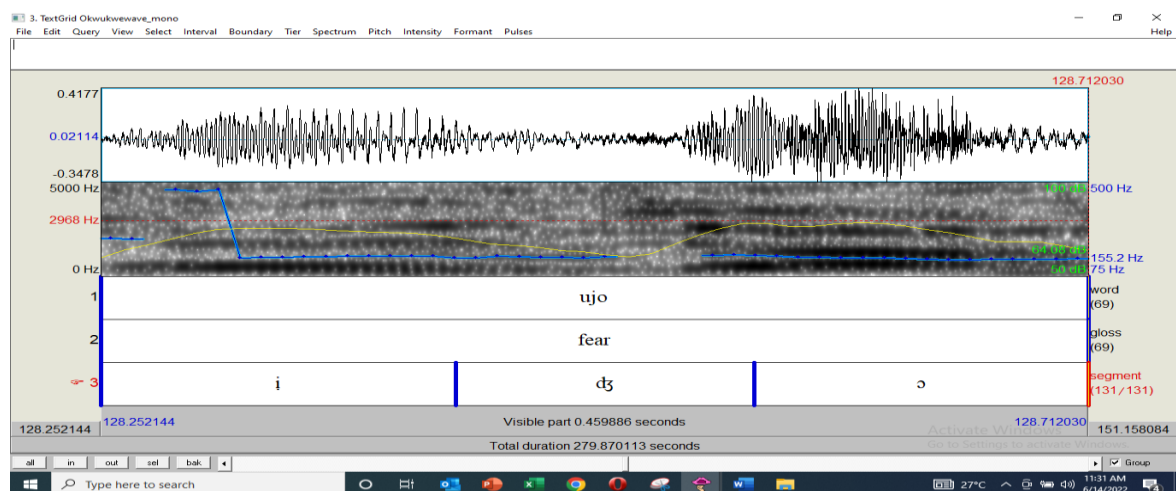
Figure 6b: Spectrograms showing the realization of /u/ in word medial and final position

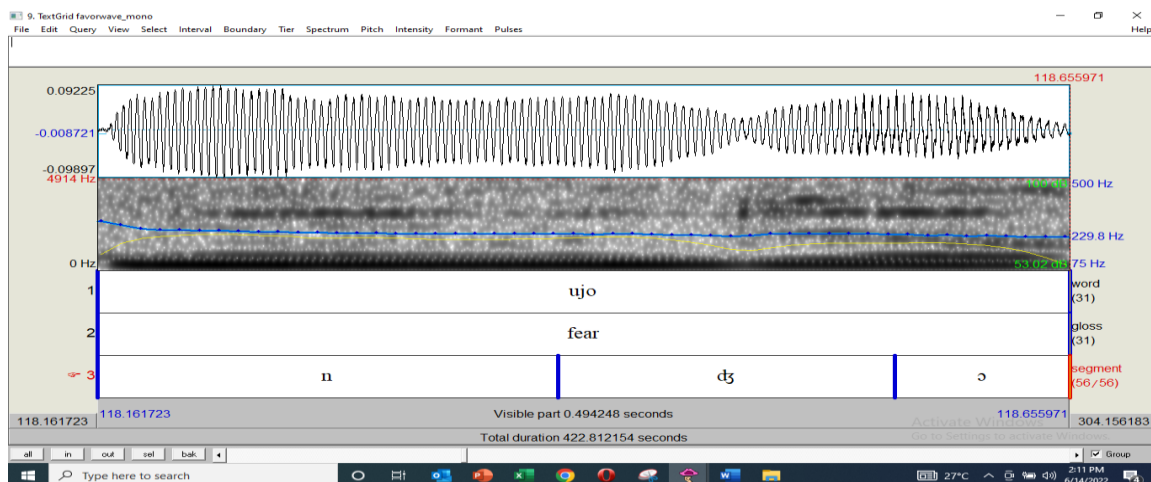


The spectrograms above in figure 6b prove that all the five respondents properly articulated the /u/ sound in the medial and final, without any difficulty.

In Figure 7a, we present spectrograms showing the realization of /u/ in word initial position (three different realizations)

Figure 7a: Spectrograms showing the realization of /u/ in word initial position (three different realizations)

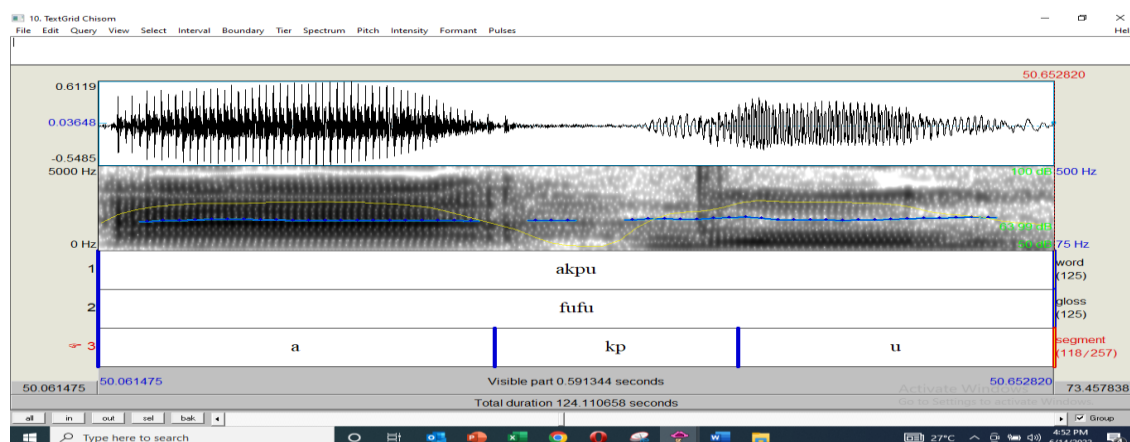
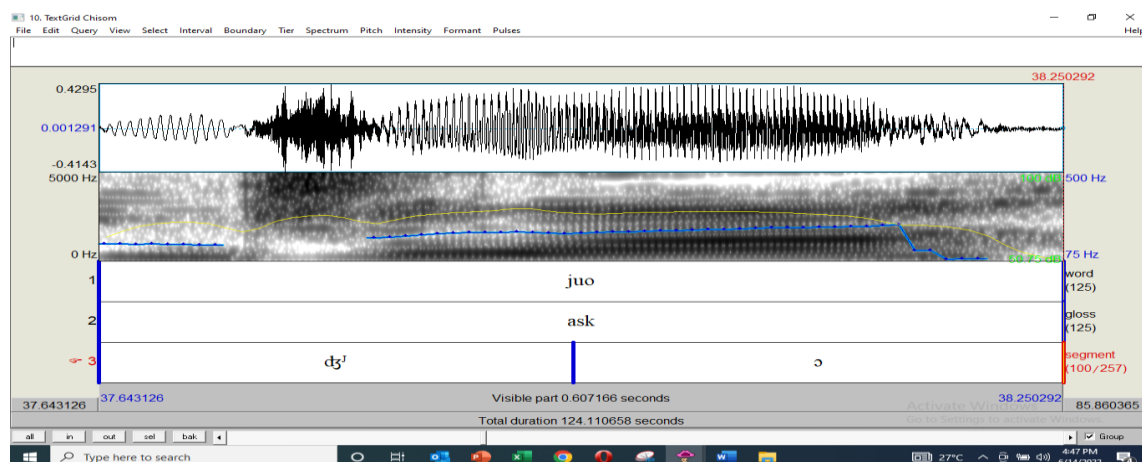




The spectrograms above in figure 7a show that there were three different realizations of the sound /u/ in word initial position, which are /u/, /i/ and /n/. The first, and third respondent realized the sound as /u/ and /n/, while the second realized it as /i/ and the fourth and fifth respondent realized it as /n/. Back vowels are often produced with the back of the tongue, so sometimes, when the back of the tongue is tightly plunged to the floor of the mouth, the back vowel produced may or may not come out accurately, thus the discrepancy between the two articulations.

Figure 7b shows spectrograms of the realization of /v/ in word medial and final position.

Figure 7b: Spectrograms showing the realization of /u/ in word medial and final position.



The spectrograms above in figure 7b show that the respondents articulated the sound accurately at the medial and final word positions, contrary to the challenges experienced in the word initial position, wherein there were three variant articulations of the same sound.

6. Impairment impact on the semantics of Speech

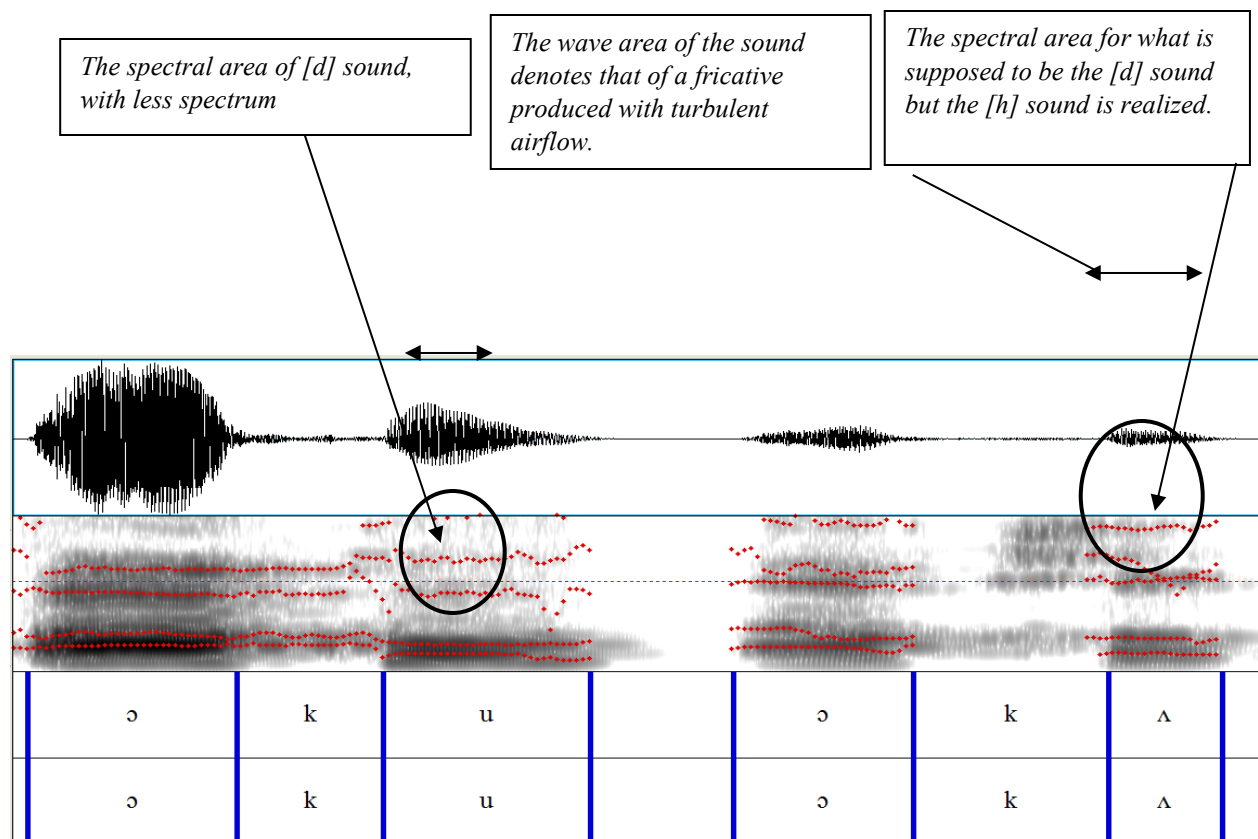
The semantic implications of tongue-tie, relies on the fact that inability to produce a given sound, would lead to substitution of that sound by another sound in that discourse. This will ultimately lead to a swapping of a sound for another, which according to phonological principles brings about a change of meaning. Thus, whenever, a sound is substituted by another in a phonological environment based on the limitations of the tongue, in a tongue-tied person, there's a high risk of semantic swap rendering the discourse incomprehensible, as the meaning intended will not be actualized.

For example, where two of the respondents in an attempt to articulate /v/ in /vdʒo/-fear, ended up articulating /n/ hence, /ndʒo/-ugly. Thus, someone can say – *I na a tu njo (you are throwing ugly)* which actually makes no sense, instead of *I na a tu ujo (you are scared)*. This then points to the fact that a substitution of loss of an intended sound can render a speech act futile.

7. Discussion of Findings

The Igbo child who has tongue-tie does not encounter any difficulty in producing any of the front and mid vowels, It is the back vowels that tend to be more challenging /ɔ, u, ʊ/ and from the data in table 7, it could be seen that of all the back vowels, /ʊ/ proved to be the most difficult as it has the least percentage of actualization by the tongue-tied child. To further clarify, figure 8 shows the production of the vowel by /ʊ/ by a tongue –tied respondent (TTR) and a non-tongue-tied respondent (NTTR)

Figure 8: Showing the production of /v/ by a TTR and a NTTR



Pronunciation of the word 'Udo' by a tongue free person and a tongue-tied person

The analysis of the NTTR depicts the actual way the word *Ókú* will be phonological realized with performance reflecting competence. However, for the TTR the case is not the same, as the TTR is able to articulate the first two phoneme /o, k/ but fails to properly articulate the high back vowel /u/ because the sound is a high vowel, that is, the tongue is raised above the mid-level towards the roof of the mouth during articulation.

This explains why a TTR has trouble in articulating the sound because the TTR's tongue is tied or restrained to the base of the mouth, raising it above the mid-level will be difficult.

From the table also, one could see that having a severe or mild TT, makes little or no difference, as in this case, all the respondents, irrespective of the severity of their deficits, could not approximate the sound.

Therefore, the sound that was realized is the /ʌ/ sound due to the following evidence;

1. The sound is a mid-level vowel and the tongue even though constrained can still realize it.
2. From the Formant evidence, the *control* formant median value for F1 and F2 are 484.93Hz and 855.47Hz respectively, while the *Respondent* formant median value for F1 and F2 are 550.95Hz and 1021.00Hz respectively.

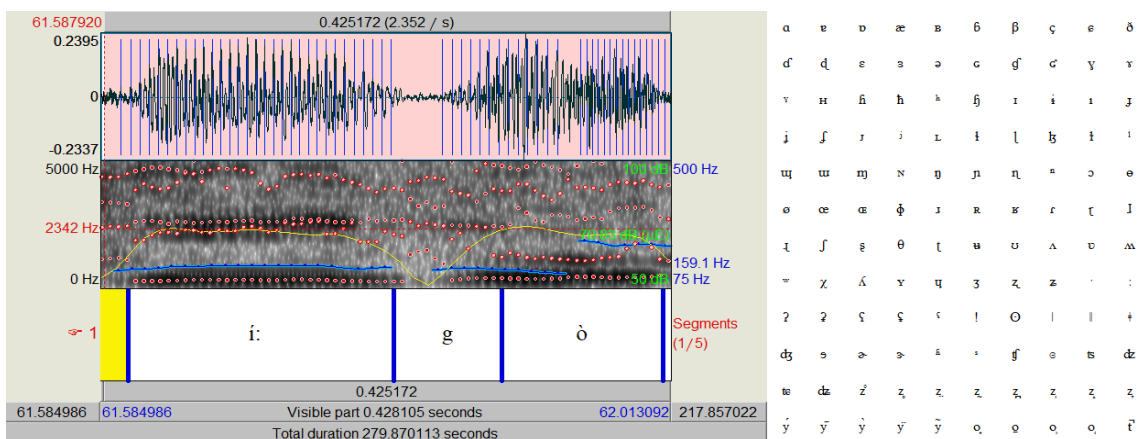
The formant descriptions befit that of mid vowel but the F1 which shows the height of the tongue is higher in NTTR proves that the tongue is raised towards the roof higher than the TTRs F1 description. Also, the F2 value of the TTR shows that the sound is a near central vowel. Hence, the / ʌ/ sound a;

/ ʌ/ -rounded central-back mid vowel.

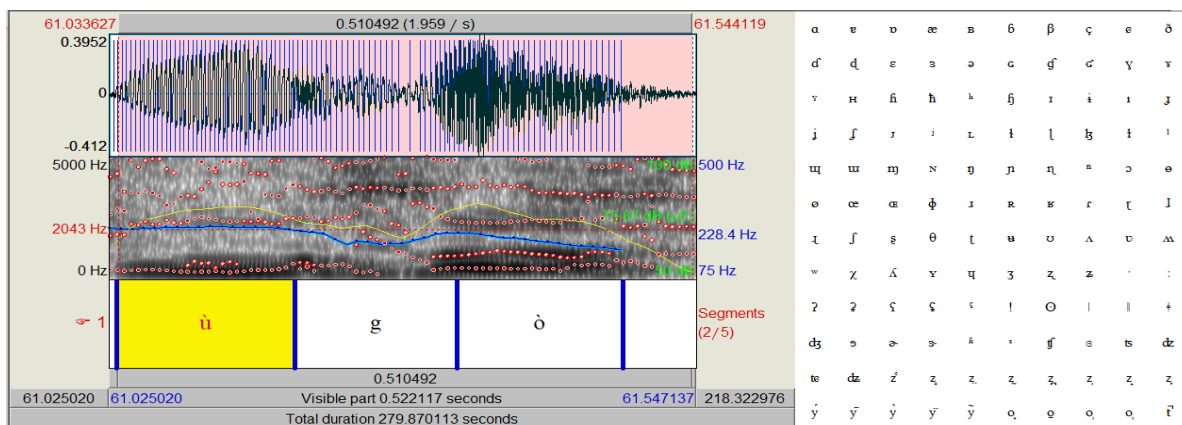
Figure 9 presents the application of the Source and Filter theory to the analysis of /u/

Figure 9: Applying the Source and Filter theory to the analysis of /u/

/ùgò / → [ígò] as produced by a TTR

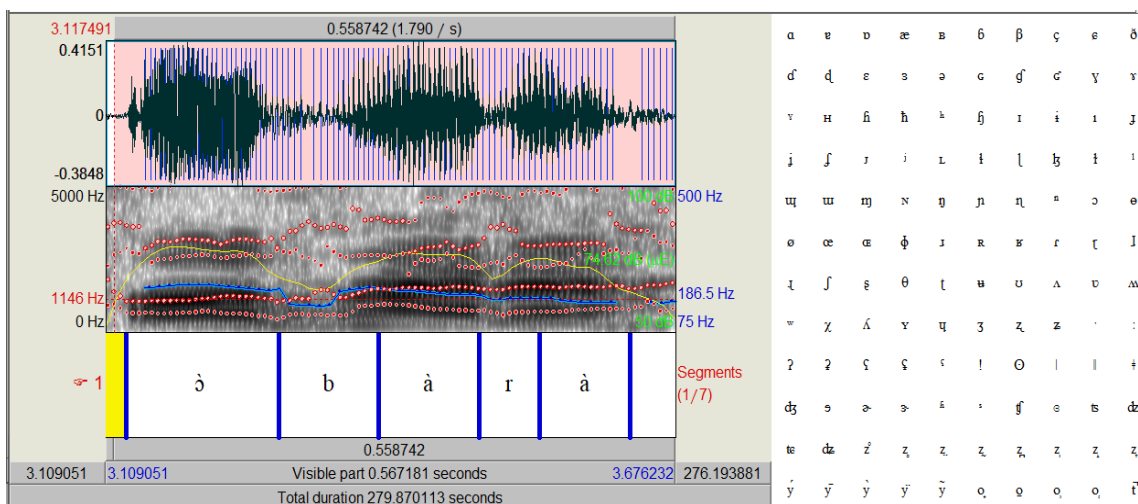


/ùgò/ → [ùgò] ‘eagle’ as produced by a NTTR



In the production of the back vowel /u/ now realized as /i/ by a TTR, the wave form is bulky, an indication of not just a vowel, but a long one. In the spectrogram, the formant structure started with dark formants at f1 which is 447.7hz, while the f2 is at 2342hz, indicating an interval of 1894hz, which is true of front vowels as the thumb rule states that ‘if a vowel is

/òbàrà/ → [òbàrà] ‘blood’ as produced by a NTTR



In the production of /ò/ in word initial position by the TTR, there was a deviation as /a/ was realized. This is proven by the wave form for the back low vowel, /a/ is realized with a bulky wave form which is long with a visible part of 0.172m/s with blue vertical straight which is marked for all vowels. The spectrogram shows concentration of formant structure on f1 and f2 which are apart, with f1 at 913hz, and f2 at 1777hz, with an interval of 864hz, which shows that the low vowel realized is a central vowel.

For the NTTR, the /ò/ at the first syllable initial position was realized evidentially as seen in the wave form. The wave form is quite bulky and dark indicating the existence of a vowel sound with blue vertical lines being that all vowels are voiced. On the spectrogram, the formant structure shows the duration of the visible part of the mid back low vowel at 0.153m/s, with the f1 at 746.8hz and f2 at 1146hz, with an interval of 400hz, proving its true status as a back vowel.

Conclusion

The study has carefully x-rayed the limitations of the average Igbo child who has tongue-tie impairment. From the findings, the outlook may be bright for some tongue-tie patients whose frenulum are not that tightly lodged. Such are privileged to make better sound productions and more comprehensible speeches compared to the others whose conditions are worse and may need more time-consuming therapies or surgery to be able to cope and adjust to these difficulties. This study has not been able to align with similar research in any other language, to compare which of the languages tend to be more problematic for the tongue-tie patient who desperately tries to communicate effectively with his peers. It should however be noted that the Igbo vowels have proved not to be as challenging as the consonants, as only three vowel sounds; the high back vowels /u, and v/ and the low back vowel /ɔ, are affected as compared to the consonant sounds.

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