A CONSTRAINT-BASED ANALYSIS OF THE SYLLABLE STRUCTURE OF IKHIN

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Abstract:

This study investigates the syllable structure of Ikhin, an Edoid language in South-South, Nigeria. Being a phonological study, it is the first full-length investigation and analysis of Ikhin syllable structure which hitherto had not been studied to this depth. The previous study mainly dwells on the phonetics of the language. I examine the syllable structure of Ikhin at the phonetic and phonemic levels. The study observes that the Ikhin syllable structure types are CV and V at the phonemic level. Further reviews show that Ikhin does not have syllabic nasal as is found in some other Edoid languages. This paper observes that these phonemic syllable structure types, CV and V, sometimes have surface CCV structures. The study reveals that the C2, in CCV syllable is due to the creation of approximants and the possible C2 is [j] or [w]. As in the case of related Edoid languages that have been previously described, the study confirms that the created approximants are a result of the glide formation rule. In the case of [Cj], previous study on Ikhin language observes an assimilatory process known as palatalization. Therefore, this study undertakes some analyses of these suspicious segments [Cj] and [Cw] in Ikhin with a view to confirming that it is a sequence of a consonant and a glide, not a single segment. Thus, using a descriptive approach, the paper presents syllable structure processes such as glide formation, vowel elision and vowel insertion in Ikhin. Optimality theory is used in analyzing and presenting the data.

Keywords: syllable structure, Ikhin, Edoid language, phonological study, optimality theory

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1. Introduction

Within a few thousand years, two languages can develop from a common source and become so different that it takes considerable ingenuity to discern their common origin. Yet no matter how different in detail, they remain basically the same kind of system.

Ikhin and Ghotuo are Edoid languages spoken in the same Owan East Local Government area of Edo State, South-South Nigeria, but Ikhin is yet to be fully studied. None of the previous studies on Edoid languages has made reference to the analysis of the syllable structure of Ikhin.

This study, therefore, investigates the syllable structure and syllable structure processes in Ikhin with a view to establishing the syllable structure types in Ikhin.

2. Methodology

The analysis presented in this study is based on the quality of tape-recorded text materials (traditional stories, conversations, descriptions and collection of words). The methodology adopted is both descriptive and analytical. Data were obtained from seven purposely selected native speakers in Ikhin town and one from Ibadan using the 1000-word list of the Summer Institute of Linguistics and the Ibadan word list of 400 basic items. The data were analysed using the speech filing system of the computerised speech laboratory (Oladimeji, 2013). Optimality theory is used in analysing and presenting the data.

3. Previous Studies / Related Works

The most widely recognized comparative and historical analysis of the Edoid group is a *Comparative Edoid Phonology and Lexicon* (Elugbe, 1989). Also showing an exclusive interest in Edoid phonology is a *Tonal Grammar of Etsako*(Elimelech 1979*)*. In Edoid languages "*most roots (verb or noun) are monosyllabic, consisting in CV*" (Westernmann and Bryan, 1952). Other linguistic studies on Edoid speech varieties tend to be descriptive. Oladimeji (2010) provides an overview of selected phonological issues in Ikhin. Besides, Egbokhare (1990) presents a descriptive analysis of Emai Phonology. In most of these works, Edoid syllable is discussed at two levels-the phonetic and phonemic level. However, linguistic investigation of individual languages within the Edoid group is extremely limited. Other than the "*Noun Class System in Ikhin"* (Oladimeji and Opoola, 2021) no descriptive phonological treatment of Ikhin syllable has appeared in any work on Edoid. This study, therefore, investigates the phonology of Ikhin with a view to determining the typology of its syllable structure.

At the phonemic level, the present analysis confirms the postulation of a CV and V syllable structure as a common feature of Edoid languages. It also confirms that "*only consonants may occur at C, while only vowel may occur at V*" (Elugbe, 1989).

4. Theoretical Framework

Optimality theory is used in analysing and presenting the data. In (1968), Noam Chomsky and Halle published the *Sound Pattern of English* (SPE), the basis for generative phonology. An important consequence of the influence of SPE on phonological theory was the downplaying of the syllable and the emphasis on segments.

In 1976, John Goldsmith introduced Autosegmental phonology. Phonological phenomena are no longer seen as one linear sequence of segments called phonemes or feature combinations, but rather as some parallel sequences of features which reside on multiple tiers.

In a course at the LSA Summer Institute in 1991, Alan Prince and Paul Smolensky developed Optimality theory – an overall architecture for phonology, according to which languages choose a pronunciation of a word that best satisfies a list of constraints which are ordered by importance: a lower-ranked constraint can be violated when the violation is necessary in order to obey a higher-ranked constraint. Optimality theory is usually considered a development of generative grammar, which shares its focus on the investigation of universal principles, linguistic typology and language acquisition. The main idea of OT is that the observed surface forms of the language arise from the resolution of conflicts between grammatical constraints. These constraints are minimally violated by optimal candidates in that form that surfaces are the ones which incur the least serious violations, compared to a set of possible candidates. In optimality theory, rules are abandoned and the explanatory burden is placed entirely on constraints of Universal Grammar. OT assumes that grammars are a means to resolve conflicts between universal constraints (Kager 1999).

4.1 Principles of OT
Optimality theory is based on the following five fundamental principles which are presented in McCarthy and Prince (1994: 336).
   a) Universality: The central goal of a linguistic theory is to shed light on the core of grammatical principles that are common to all languages.
   b) Violability: Constraints are violable; but the violation is minimal.
   c) Ranking: Universal constraints are ranked on a particular language basis; the notion of minimal violation is defined in terms of this ranking.
   d) Inclusiveness: The constraint hierarchy evaluates a set of candidate analyses that are admitted by very general considerations of structural well-formedness.
   e) Parallelism: Best satisfaction of the constraint hierarchy is computed over the whole hierarchy and the whole candidate set. There is no serial derivation and therefore, the output candidate is considered optimal.
   Syllable structure constraints are a family of constraints borne out of the syllable structure preference of a natural language. These include:
   a) ONS: Every syllable must have an onset (except phrase-initially)
   b) NO CODA: It prohibits close syllables while maximising open syllables. It stipulates that syllables do not have Codas.

c) HNUC: It stipulates that a higher sonority nucleus is more harmonic than one of lower sonority.

d) NUC: Syllables have nuclei.

4.2 An OT Treatment of the Central Properties of Syllable

The following are the typical properties of syllable:

a) Syllables begin with a consonant (ONSET),

b) Syllables have one vowel (PEAK),

c) Syllables end with a vowel (NO CODA),

d) Syllables have at most only one consonant at an edge (Consonant Complex),

e) Syllables are composed of consonants and vowels (ONSET and PEAK).

The above statements are general tendencies, not absolute laws. This is because there are syllables in some languages that violate some of these properties, a point that optimality theory exploits. Besides, the standard definition of a syllable, a constituent composed of a least one consonant followed by a vowel, results from combining (a) and (b) above: If a syllable starts with a consonant, it satisfies ONSET and if it has a vowel, it satisfies PEAK.

5. The Syllable

Based on their linearity assumption in SPE (1968), Chomsky and Halle defined words as segment sequences delimited by consecutive occurrences of word boundaries, and morphemes "*as segment sequences delimited by the consecutive occurrence of formative boundaries.*" Thus, syllable was not included in SPE's list of theoretical units.

However, Kahn (1976) revealed that syllables could be delimited without recourse to boundary markers. Goldsmith (1976) had shown that to deal with tonal facts of the Bantu languages, it was necessary to set up representations with at least two parallel sequences of the segment — tones and phones and that the widely accepted assumption shared by SPE that a phonological representation is a linear sequence of phonemes and boundaries was therefore untenable.

Kenstowicz (1994) puts it succinctly:

"*Three kinds of justification have been offered for the syllable. First, the syllable is a natural domain for the statement of many phonotactic constraints. Second, phonological rules are often more simple and insightfully expressed if they explicitly refer to the syllable. Finally, several phonological processes are best interpreted as methods to ensure that the string of phonological segments is parsable into syllables.*"

These views are equally tenable for the analysis of the syllable structure of Edoid languages where some of the phonological rules are meant for capturing syllable structure processes. Though a recognised and relevant phonological unit, a syllable has no precise and satisfactory definition. A syllable is the amount of utterance that you can produce with a single breath force or chest pulse.

6. Syllable Structure of Ikhin

Syllable structure refers to the combination of allowable segments and typical sound sequences. Below is a diagram of a syllable:
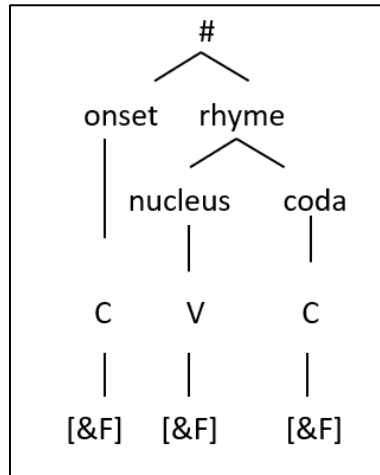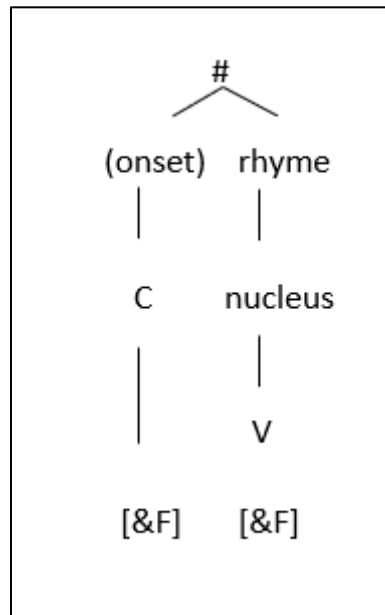

Figure 1

The syllable 'nucleus' is typically a sonorant, usually a vowel sound, in the form of a monothong, diphthong or triphthong, but sometimes sonorant consonants like [1] or [r]. The syllable 'onset' is the sound or sounds occurring before the nucleus, and the syllable coda (literally 'tail') is the sound or sounds that follow the nucleus. The term 'rhyme' covers the nucleus plus coda. In the one-syllable English word 'cat', the nucleus is a, the onset c, the coda t, and the rhyme 'at'. Thus, a syllable can be abstracted as a consonant-vowel-consonant syllable, abbreviated as CVC.

Generally, every syllable requires a nucleus. Onsets are extremely common, and some languages require all syllables to have an onset. In a language such as English, a consonant may be analysed as acting simultaneously as the coda of one syllable and the onset of the following syllable, a phenomenon known as ambisyllabicity. Ikhin is a tone language and tone is seen as a fundamental unit that defines a syllable. Each time a tone or a sequence of tones associates to a tone bearing unit, a syllable is formed (Njwe 2005).

At the phonemic level, Ikhin has the following structure:

Figure 2

The above template shows that at the phonemic level, Ikhin has a simple syllable structure. The onset and the rhyme are non-branching. The onset is optional because of vowel prefixes in the class of nouns and their absence in the class of verbs. Both the optional onset (consonant) and the (nucleus) vowel have their own distinctive features represented by the letter 'F'.

Phonemically, Ikhin has two prominent syllable structures:

(i)   T
        V

(ii)   T
        CV

Note: T stands for tone; C stands for consonant; V stands for vowel.

6.1 V Syllable Structure
A syllable of this type consists only of a tone bearing unit, that is, a vowel. The vowel may occur in isolation or before a consonant, i.e. at the word's initial position. The v syllable structure type may also be found in the medial and final position of the word.

  a) **Word Initial Position**
Nouns in Ikhin have vowels as their prefix, thus the V type is found at the initial position.

    i)   /è-tò/ 'hair'
            V-CV

 ii) /ù-dò /'stone'
    V-CV

 iii) /ù-nù/ 'mouth'
    V-CV

b) **Word Medial Position**

When words are joined together to form a compound word, especially in the numerals, the V type is found between them.

 i) /xɔ-kpá-ɔ-sù-è/ 'nineteen'
   CV-CV-V-CV-V

 ii) /xɔ̀- ì- và- ɔ- sù - è/ 'eighteen'
   CV-V-CV-V-CV-V

c) **Word Final Position**

 i) /à-ɣa- ɛ̀/ 'knife'
   V-CV-V

 ii) /ɔ̀- pì- à/ 'matchet'
   V-CV-V

6.2 CV Syllabe Structure

The CV syllable structure appears to be the most common syllable structure, which is evident in mono-syllabic verbs. Examples:

 i) /dɛ̀/ 'buy'

 ii) /là/ 'run'

 iii) /lɛ̀/ 'go'

 iv) /dè/ 'fall'

A. Phonetic Syllable Structure Sequences

The syllable structures discussed are the underlying syllable structures. We can, however, postulate phonetic syllable structures of type [cj] and [cw]

  The [cj] type occurs when the vowel /i/, a close front unrounded vowel becomes [j], a palatal glide, between a consonant and another unidentical vowel. Examples:

i)   /ìβíà/ ⇢ [ìβjâ] 'children'

ii)   /ɔ̀sìè/ ⇢ [ɔ̀ʃje] 'friend'

iii)   /àrìɔ/ ⇢ [àrjɔ] 'juju'

iv)   /vìɛ̀/ ⇢ [vjɛ̂] 'weep'

The [cw] type also occurs when the vowel /u/ a close back rounded vowel changes to [w] a labial-velar glide whenever it occurs between a consonant and another unidentical vowel. Examples:

v)   /ísàgùɔ/   ⇢   [ísàgwɔ]   'groundnut'

vi)   /ògùà/   ⇢   [ògwà]   'farm'

7. Interpretation of [cw] and [cj] Sequences

Although we pointed out that there are underlying CV and V syllable structures, however, some phonological processes give rise to surface structure clusters, [cw] and [cj] are phonetically complex segments; it, therefore, suffices to undertake some analyses of these suspicious sequences in the language. These sequences can be interpreted in either of the following ways:

a) Interpreting them as a sequence of a consonant followed by an underlying vowel /i/ or /u/.

b) Interpreting them as a sequence of two consonants i.e consonant cluster where the second consonant is a palatal approximant /j/ or a labial approximant /w/ e.g.

i)   [vjɛ]   /v-j - ɛ/
        C_1C_1V

c) Interpreting the CW/CJ as being in complementary distribution with a plain C. That is, as the case of labialization and palatalization.

d) Interpreting them as part of a complex vowel i.e the beginning of diphthongs formed with the vowel they precede. e.g.

ii)   [vjɛ]   /v-jɛ/
        C V

e) Interpreting J/W as forming a single consonant phoneme with the preceding consonant, e.g.

iii)   [vjɛ]   /vj-ɛ/

C V

The first of the above interpretations is the most plausible, that is, deriving the CW/CJ from an underlying sequence of CuV and CiV respectively. This is evident from the following examples:

iv)   [miɛ̃] ⇢   [mjɛ̂]   'to sleep'

v)   [tìè]   ⇢   [tjè]   'to abuse'

vi)   [vìɛ̀]   ⇢   [vjɛ̀]   'to weep'

The above examples support the fact that consonant and glide sequence have an alternative pronunciation at the phonetic level which has the high vowels /i, u/ in place of the glides. Therefore, a glide rule would be applied to account for the CW/J sequences. This rule applies within a word or across word boundary changing /CIV/ and /CUV/ sequences into [CJV] and [CWV] respectively. This is because the following vowel is unidentical with any of [i] or [u]. Examples illustrating this are shown below:

vii)   /fí /   /ùdò/ ⇢   [fjúdò]
        throw'   stone'   'throw a stone'

viii)   /ɔ̀pià/   ⇢   [ɔ̀pjà]
                                  'matchet'

ix)   /xí/   / ɔ̀bà/ ⇢   [xjɔ̀bà]
        'make'   'king'   'become king'

A glide rule applies to URs on the left side and changes them to SRs on the right side. The second option which interprets [CW] and [CJ] as consonant clusters would lead to an untenable opinion that consonant clusters are a widespread feature in Ikhin and this would be uneconomical since only a few words in this language have this structure and only [W] and [J] occur in this position.

Also, interpreting [CW] arid [CJ] as being in complementary distribution with their plain [C] is considered too abstract because it is unmotivating as it claims that they are allophones of their plain consonants.

The last two interpretations can be handled by the vowel elision process in that it has the effect of eliding either $v\backslash$ or v_2 when they are in an adjacent position at the word boundary. Thus, if the glide forms a phoneme with a preceding sound unit, then the glide will not elide leaving such a sound unit behind.

The diphthong interpretation also has to be set aside because a diphthong is said to be a utilization of two otherwise different vowels of a language. Thus, if the glide forms a diphthong with the following vowel in a CW/JW sequence, vowel elision would affect

the diphthong as a single syllabic unit. However, the effect of vowel elision suggests that there are two sound units rather than a diphthong. Elision will elide the V of a CW/JV sequence leaving the glides behind. Example:

x) tje   ɔ̀kpòsò   ⇢   tjɔ̀kpòsò
    'abuse'   'woman'   'abuse woman'

As indicated earlier, the first interpretation which sees the suspicious sequence as sequences of consonants followed by vowels is acceptable.

This interpretation does not in any way affect or temper with the syllable structures of the CV and V patterns that have already been established for Ikhin. It also does not add more segments to the phonemic inventory of Ikhin vowels. The palatal and labial glides that are now interpreted as underlying vowels are formed through the glide formation process as in:

xi)   /àkiè/   ⇢   [àkjè]   'toad'

xii) /ìβíà/   ⇢   [ìβjâ]   'children'

xiii) /ibiɣua/   ⇢   [ibìɣwà]   'wing'

xiv) /óxúà/   ⇢   [óxwâ]   'heavy' (Oladimeji, 2010).

8. Ikhin Consonant and Vowel Distribution within Syllables

The figure below indicates how the general tendencies of syllables given above are realized in Ikhin. Only two of these tendencies do not hold absolutely in Ikhin. These are ONSET and *COMPLEX.

8.1 Properties of Ikhin Syllables

Figure 3

General tendency	Ikhin
a) PEAK: syllables have one vowel	Always
b) ONSET: syllables begin with a consonant	Sometimes
c) *COMPLEX: syllables have at most one consonant at an edge	Sometimes
d) NO CODA: syllables end with a vowel	Always

Two types of syllables result from the above properties, a V syllable and a CV syllable as shown in (a) and (b) of the tableau below. A language which allows no violations of syllable constraints whatsoever has only CV syllables as in (b) below.

8.2 How the Ikhin Syllable Properties Give Rise to Syllables

Figure 4

	PEAK	ONSET	NO CODA	"COMPLEX
a) V	OK		OK	
b) CV	OK	OK	OK	OK
c) *CVC	OK	OK		OK
d) *CC		OK		OK

Constraints interacting in generating specific syllabic patterns are language specific. The constraints of OT are however universal and those which compete in the realm of syllabification are the following:

a) Faithfulness: No changes in mapping from input to output. It abhors deletion or insertion.
b) Onset: Syllables must begin with a consonant.
c) *Coda: Syllables end with a vowel. Only open syllables are permitted.
d) Peak: There must be a vowel in each syllable.
e) *Peak/C: A consonant cannot be a syllable peak.
f) *Margin/V: A vowel cannot be an onset or a Coda.
g) Sonority: Onsets must increase and Codas must decrease in sonority.
h) *Complex: Syllable margins cannot contain more than one segment.
i) Licensing: Words are made of syllables.

In OT, the moment the competing constraints in a given context are established they can be interacted with using all the possible rankings such that all possible output forms are known. The possible interactions of the three major constraints which have stakes in the structure of syllables were proposed by Alan Prince and Paul Smolensky (1993).

Figure 5

Rankings	Types
a) Faithfulness >> Onset, No Coda	(O) V (C)
b) Onset, No Coda >> Faithfulness	OV
c) Onset >> Faithfulness >> Coda	OV(C)
d) No Coda >> Faithfulness >> Onset	(O)V

9. Hierarchy of Syllable Structure Constraints in Ikhin

Putting faithfulness and sonority in the tableau of constraint ranking in Ikhin will be redundant since they are not violated in any way and therefore not useful in determining which candidate is optimal. The hierarchy of syllable structure constraints in Ikhin is given below:

Peak >> Onset >> No Coda >> *Complex

10. The Syllable Structure Processes

In this language, all syllables are open, and nouns begin and end with vowels. This is why vowel processes discussed are many. This paper examines the syllable structure processes in Ikhin. The syllable structure processes investigated include vowel elision, vowel insertion and glide formation. Having established the syllable structure types, we deem it necessary to address the maintenance of these structures in vowel elision, vowel insertion and glide formation.

11. Vowel Elision

Among the common strategies for eliminating vowel, hiatus is vowel elision. In some cases, it is the first vowel (v_1) that elides, while in others it is the second (v_2). Analyses of elision have simply stipulated which vowel is elided, for example by encoding this information directly in a language-specific rule. This implies that the targeted position is not predictable, but simply a matter of which of two equally available options is selected by the language. A cross-linguistic study suggests, however, that this is not strictly the case, but that in some environments the choice of target is universally determined (Oladimeji, 2010).

Vowel elision is a common syllable structure process in African languages in general and in Edoid languages in particular (Elugbe, 1973). Vowel elision is found commonly in Kwa languages and that in such languages the syllable structure of verbs and nouns makes it possible for vowel sequences to occur across morpheme boundaries. (Welmers, 1973).

In Ikhin and in such other Edoid languages like Urhobo, Emai etc. any of the vowel (V_1 V_2) can elide at boundary depending on construction type.

Our concern here is to layout basic factors that come into force in determining whether or not vowel will elide and which of the V_1 and V_2 in a sequence should disappear in any environment and to explain the phonological,' morphological or syntactic reasons behind such a process (Oladimeji, O. & Opoola, B. 2021). We begin by showing how vowel elision works in Ikhin and the problems arising from its analysis, also by explaining factors such as boundary, morpheme structure and vowel quality which actually determine whether or not elision should take place. An understanding of the following situations would go a long way in assisting us to appreciate the various explanations later provided as solutions to the problems of vowel elision in Ikhin.

a) V_1 + V_2 sequence, the V_1 is sometimes elided

òkɔ̀	+	ɛ́dá	⟶	okɔ ɛda	⟶	okɛ̆da
V_1		V_2		V_1 V_2		
'motor'		'river'				'canoe or boat'

b) V₂ may be elided in V₁ + V₂ sequence

ɛ́wɛ̀	+	ɔ̀nà	⟶	ɛ́wɛ̀ ɔna	⟶	ɛ́wènă
V₁		V₂		V₁V₂		
'goat'		'this'				'this goat'

c) Sometimes, no elision of either Vj or V₂ when occurring in sequence across morpheme boundary.

ɔ̀mɔ́hèni+éhù + ódè	⟶	ɔ̀mɔ́hènì niéhù ódɛ	⟶	ɔ̀mɔ́hènì éhùódè
V₁ V₂				V₁V₂
'man die yesterday'				'the man died yesterday'

d) When high vowels /i/ and /u/ occur at V₁ position and are followed by an unidentical vowel across the morpheme boundary, glide formation rather than vowel elision takes place (this situation also applies to /o/)

i)	fi	+	ákà	⟶	fj + ǎkà	⟶	fjǎkà
	V₁		V₂		C V₂		
	'throw'		'basket '				'throw a basket'

ii)	rò	+	ɔkpòsò	⟶	rw + ɔkposo ⟶ rwɔkpòsò
	V₁		V₂		C V₂
	'take'		'woman'		'marry'

iii)	ètò	+	àgbă	⟶	etw + agba	⟶	ètwàgbă
	V₁		V₂		C V₂		
	'hair'		'jaw'				'bear'

There are however, situation when these high vowels are deleted in this same environment:

iv)	oūrù + àgbède	⟶ ouru + agbede	⟶	oūrágbèdè
	V₁ V₂	V₁ V₂		
	'thread' 'needle'			'needle's thread'

e) The final vowel of a verb may be deleted in a construction and retained in another construction despite the fact that it is followed by the same vowel across the word boundary.

i)	mɛ́ + dɛ + ɔ̀pìa	⟶	mɛ́ + dɛ + ɔ̀pìa	⟶	mɛ́ dɔ̀pjà
	V₁ V₂		V₁ V₂		
	I buy matchet				1 bought matchet

ii)   mέ + dɛ + ɔ̀   ⇢   mέ + dɛ + ɔ̀   ⇢   mέdὲɔ̀
         I   buy   it   V₁   V₂   I bought it

Besides, in a verb-noun object sequence, the final vowel of the verb sometimes stays and at other times it goes even when it is followed by the same object. This is more so when the main verb is preceded by the auxiliary.

"*Whenever there is a seeming contradiction in the operation of two rules, it is almost certain that the language will carefully delineate the kind of area in which the one or the other can operate*" (Oyebade, 1998). Some of the above situations can be explained not only phonologically but also syntactically.

Though, in Ikliin, vowel elision does not take place at the boundary between syntactic categories such as auxiliary and (the main verb, noun and the following verb, verb and adverb, noun and article, however, when these items occur in an adjacent position to other lexical items e.g verb-noun, verb-numeral, verb-qualifier elision takes place.

All that we have said so far is to generalise by describing the mode of vowel elision in Ikhin. Any factor or reason that may have been advanced for being responsible for vowel elision in this language must also account for why elision takes place in a certain environment but is blocked in another environment, not only that it must also account for the reason why it is V₁that elides in one environment and V₂ in another environment. It is at this level that explanations of phonological and syntactic factors in addition to vowel quality and morpheme structure conditions are offered. The factors that really determine whether or not elision should take place are a boundary, vowel quality and syllable structure.

One other factor with respect to elision or glide formation is the syllable structure of the verbs and nouns in Ikhin. Ikhin nouns are either disyllabic i.e. V(C)V or trisyllabic etc. The operation of vowel elision is blocked in disyllabic nouns as /i/, /o/and /u/ form glides when either of them occurs as V₁ whereas vowel elision rather than glide formation takes place in trisyllabic nouns.

On the other hand, the minimal syllable structure of verbs in Ikhin is (C)V. A verb can either be monosyllabic or disyllabic, a situation that is true of most Edoid languages. Vowel elision takes place in disyllabic verbs, while monosyllabic verb having /i/, /u/, /o/ as V₁, has its V₁ turned to glide when it is followed by a stronger V₂.

The strength hierarchy presupposes that the pronoun and verb categories would lose their vowels when in near adjacency to qualifier and noun categories.

Having understood the foundation for the application or otherwise of vowel elision in Ikhin, we will now provide construction types where elision takes place and its effects on tones and nasality.

11.1 V₁ Elision

a. Compound Words

Vowel elision takes place in the formation of compound words. When two words are juxtaposed to form a compound word, the final vowel of the first word is lost or dropped, provided the following word begins with another vowel.

(i) òkɔ̀ + ɛ́dá ⟶ okɔ ɛda ⟶ okɛ́da
     V₁   V₂   V₁ V₂
     'motor'   'river'   'boat (canoe)'

(ii) ɔmɔ òkpòsò ⟶ ɔ̀mɔ̀ òkpòsò ⟶ ɔ̀mòkpòsò
      V₁ V₂   V₁ V₂
      'child' 'female'   'female child'

b. Transitive Verb — Object

V₁ elision occurs at the boundary between a transitive verb and its object:

i) gbè áwà ⟶ gbe awa ⟶ gbáwà
    V₁ V₂   V₁ V₂   'kill dog'
    'kill' 'dog'

ii) gbè òfè ⟶ gbe awa ⟶ gbòfè
     V₁ V₂   V₁ V₂   'kill rat'
     'kill 'rat'

iii) dɛ̀ órúmà ⟶ dɛ̀ órúmà ⟶ dǒrúmà
      V₁ V₂   V₁ V₂   'buy sheep'
      'buy' 'sheep'

c. Numeral Construction

V₁elision has equally been observed in the numeral constructions as shown below:

i) ìgbè ɔkpá ⟶ igbe ɔkpa ⟶ ìgbɔ̀kpá
       V₁ V₂   V₁ V₂   'eleven'
    'ten' 'one'

ii) ìgbè éhà ⟶ igbe eha ⟶ ìgbèhà
        V₁ V₂   V₁ V₂   'thirteen'
     'ten' 'three'

11.2 V₂ Elision

a. Noun — Demonstrative Construction

In Ikhin and perhaps in most African languages, the word order in the noun phrase is for the demonstratives to follow the nouns they qualify. In this case, the prefix vowel of this demonstrative (V₂) is dropped when it is in an adjacent position to the V₁ of a head noun e.g. the vowel of the modifier is dropped because the demonstrative is a modifier. It is a concord marker prefix, not a class prefix.

i)   àβè +ɔ̀nà   ⟶   aβe ɔ́na   ⟶   áβènà
       V₁ V₂   V₁ V₂   'this house'
       'house' 'this'

ii)   òfè +ɔni   ⟶   ofe ɔ́ni   ⟶   ófènǐ
       V₁ V₂   V₁ V₂   'that rat'
       'rat' 'that'

iii)   ɛwé +ɔ̀nà   ⟶   ɛwe ɔ́na   ⟶   ɛ̀wénǎ
       V₁ V₂   V₁ V₂   'this goat'
       'goat' 'this'

iv)   áwà +ɔni   ⟶   awa ɔ́ni   ⟶   áwànǐ
       V₁ V₂   V₁ V₂   'that dog'
       'dog' 'that'

b. Noun Associative Construction

In the noun-associative constructions, however, the associative marker /isɛ̀/which intervenes -between the two nominals has its two vowels (prefix and suffix) deleted. In this elision process, the prefix vowel /i/ is V₂ elision while the suffix vowel /ɛ/ is Vi elision. Examples:

i)   ɛ́kpà ísɛ̀ ɔbà   ⟶   ɛ́kpà ísɛ̀ ɔbà   ⟶   ɛ́kpàsɔbà
       V₁ V₂ V₁ V₂   V₁V₂V₁V₂   'king's bag'
       'bag' 'am' 'king'

ii)   áwà ísɛ̀ òhùà   ⟶   áwà ísɛ̀ òhùà   ⟶   áwàsɔhwà
       V₁ V₂ V₁ V₂   V₁V₂V₁V₂   'hunter's dog'
       'dog' 'am' 'hunter'

iii)   úsó ísɛ̀ òkpòsò   ⟶   úsó ísɛ̀ òkpòsò   ⟶   úsósòkpòsò
       V₁ V₂ V₁ V₂   V₁ V V₁V₂   'head of woman'
       'head' 'am' 'woman'

In the above examples, the associative marker /isɛ/ (V- CV) has its initial and final vowels dropped while the vowels of the nouns being fused together are retained. This is borne out of the fact that the marker is weaker in strength than the nouns and as such loses its vowels when in juxtaposition with the stronger constituents such as nouns. Though in fast speech, the whole associative marker may go.

However, this process does not occur as claimed earlier if V_1 is a close vowel i.e. /i/ and /u/ therefore, it is blocked by another process called glide formation. Also, syntactic rules such as word order rule block vowel elision within primary constituents because such constituents have undergone verb movement as in the following examples:

i)   N   Aux   V   Adv
        ɔmɔ̃hè   è   hu̱   ó̱dɛ̀
        man   die   yesterday
        The man died yesterday

ii)   ìjã̱xé lùmɔ̱̀   á̱kùɛ̀
        mother will   travel   tomorrow
        The mother will travel tomorrow

iii)   áwà   gbè   ófȇ̱   ó̱dɛ̀
        dog   kill   rat   yesterday
        The dog killed rat yesterday

Following faithfulness constraint, languages would willingly avoid deletion of segments which are provided in the input structure. However, being that constraints are violable, many languages attest to some form of deletion or another.

A cross-linguistic investigation has shown that any of the vowels across morpheme boundary could elide and it is sometimes language-specific and based on grammatical information. Although elision of the leftmost of two adjacent vowels (i.e. Vi) is more common linguistically, elision of the rightmost vowel (i.e. V_2) is also attested. He further observed that... although both V_1 and V_2 elisions are attested, the choice of which vowel is elided is not random but is subject to interesting restrictions. These restrictions are based on a family of constraints in optimality theory. Before formalizing the patterns of elision in Ikhin, within this constraint-based theory, we will provide a summary of the rules of vowel elision in Ikhin.

c. A Summary of the Rules

Figure 6

	Conditions	Effects
1	When V₂ is grammatically functional.	V₁ is elided.
2	When V₁ is grammatically functional.	V₂ is elided.
3	Whenever V₂ and V₁ are markers of two nominals.	Elide both.
4	When a vowel becomes redundant via morpho-syntactic relations.	Elide it.
5	When neither of the vowels is grammatical.	Either is elided based on height.
6	When V, and Vj are equal in saliency.	No elision but contraction.
7	Monosyllabic verb plus pronoun.	No elision.

11.3 Constraints on Vowel Elision

Of all constraints, the faithfulness family is the only one that competes during vowel elision in Ikhin.

a) MAX-GFV: Every grammatically functional vowel in the input must have a corresponding segment in the output (constraint requiring onset)

b) *MAX-CF: Delete concord prefixes of construction markers and qualifiers when they are immediately preceded by their head nouns

c) MAX-1⁶ + pron: verbs' final vowels followed by pronouns are not elided.

d) MAX-10: Every input segment has a corresponding segment in the output.
The following tableau shows how the constraints are ranked in Ikhin.

Figure 7

/…CV₁##V₂C…/	Candidates	MAX-1⁶ + pron	MAX-GFV	*MAX-CF	MAX-10
a) /òkɔ̀ ɛ́dá/ motor river ⇢	òkɔ̆da		*!		
	okɛ̆da				*
b) /dɛ̀ órúmà/ buy sheep ⇢	dɛrúmà		*!		
	dŏrúmà			*	*

Figure 8

/…CV₁##V₂C…/					
a) /áwà ísɛ̀/ ⇢ dog am	áwásɛ̀				*
	áwísè		*!	*	*
b) /òfè ɔni/ ⇢ rat that	ófènĩ			*	*
	ofɔ̀nì		*!	*	*
c) /dɛ̀ ɔ/ ⇢ buy it	dɔ	*!			*
	dɛ̀ɔ̀				

The hierarchy of the constraints is as follows: MAX-1[6] + pron>> MAX-GFV *MAX-CF, >> MAX-10. This ranking shows that MAX-1[6] + pron and MAX-GFV are the most fatally violated.

12. Vowel Insertion

Again, depending on the kind of sound that is inserted, we can have consonant or vowel insertion. This is a process that also takes place because in a certain environment, a phonetic sequence is either difficult to pronounce or violates the phonetic rules of the language and then a vowel is introduced to break up the unacceptable consonant clusters while a glide or a consonant can be inserted to separate sequences of vowels that would be difficult to pronounce in succession with hiatus.

Below is the formalised representation of an epenthetic process:

$$\text{ø} \quad \longrightarrow \quad X/A - B$$

Vowel insertion is found in the processes of nativisation of loan words into languages where clusters are not allowed. This is the case in most Bantu languages (which do not normally allow consonant clusters), as is shown below:

i)	terekere	<	[træktə]	'tractor' (setswana)
ii)	sukulu	<	[skul]	'school (chichewa)
iii)	peteroli	<	[petril]	'petrol' (luganda)
iv)	isikolo	<	[skul]	'school' (isizulu)
v)	basikeli	<	[baisikl]	'bicycle' (Nyamwezi)

Oyebade (1998) claims that vowel insertion is a very common phenomenon in the loan-word phonology of many African languages. He provides the following examples from Yoruba.

a.	i)	brɛd	⟶	búrɛ́dì	'bread'
	ii)	sleit	⟶	síléètì	'slate'
	iii)	breik	⟶	búréèkì	'brake'
	iv)	bɛlt	⟶	bɛ́líìtì	'belt'
	v)	brʌs	⟶	búrɔ́ɔ̀sì	'brush'

b.   i)   krein ⇝   kérénì   'crane'

     ii)   freim ⇝   férémù   'frame'

     iii)   treilə ⇝   térélà   'trailer'

     iv)   frans ⇝   faransé   'france'

With the above examples, he says sometimes Yoruba breaks the cluster by the introduction of an -U-epenthetic vowel, sometimes the cluster is broken with an epenthesis. Then again, under some particular condition, the cluster is broken by a vowel identical to the vowel after the cluster (Oyebade 1998:68). As is shown in the above languages, vowel insertion in Ikhin is triggered by the asymmetry between the morpheme and the syllable structures of Ikhin and English (where the words are burrowed).

In Ikhin, nouns begin with a vowel while this morpheme structure condition is optional in English. Also, the consonant cluster is not allowed in Ikhin at the phonemic level while English allows a sequence of at most four consonants without any intervening vowel. Thus, in Ikhin, vowel insertion takes place to break up clusters of consonants for ease of pronunciation and to rectify unacceptable syllable structures represented by words loaned from English.

Prothesis, insertion at the beginning of words, is motivated strictly by morpheme structure considerations while epenthesis insertion elsewhere, is motivated by a violation of syllabic structure (Egbkohare, 1990).

12.1 The Inserted Vowel
High vowels [i] and [u] are the inserted vowels in Ikhin as is the case in Esan and Emai. Below are a few examples:

     (a)   (i)   itísà   'teacher'

           (ii)   ìgíresì   'grace'

           (iii) ìréľùwè   'railway'

           (iv)   ìdíráívà   'driver'

           (v)   ísìlétì   'slate'

           (vi)   ìgàràwà   'pail'

           (vii) ítɛlìfónu   'telephone'

(b) (i)   ìbúrɛ́dì   'bread'

     (ii)   ísíkûʔ   'school'

     (iii) ìbúlú   'blue'

     (iv)   ìbɔ̂lù   'ball'

     (v)   ìʃɔ̂bù   'shop'

The above examples show that [u] occurs as the epenthetic vowel after labial consonants, and after other consonants in the environment of a rounded vowel while [i] occurs as the prothetic vowel and as the epenthetic vowel in a non-labial environment. This process is not limited to Edoid languages alone, it has also been observed in Yomba (PuIleyblank, l988). At this juncture, we must identify which of the two vowels is actually inserted and which one is a variant of the other.

Examining the word /ísìkúʔ/ 'school' we will observe that [i] rather than [u] isinserted at the medial position while in languages such as Esan and Emai [u] rather than [i] is inserted at the medial position to avoid consonant clusters. Also, the occurrence of [u] in the environment of labial is as a result of the assimilation rule which spreads the labial feature of a tautosyllabic consonant or a vowel occurring in an adjacent syllable onto the inserted vowel [i].

Other evidence of postulating [i] as the inserted vowel in Ikhin is found in partial reduplication as shown below:

i)   /bà/   'plait'   /bíbá/ 'always planting'

ii)   /kù/   'pour'   /kìkù/ 'always pouring'

In the above, the inputs are monosyllabic verbs. In the disyllabic forms, the consonant is reduplicated and vowel [i] is inserted between the reduplicated consonant and the- verb stem. Stated in optimality theoretic terms, vowel insertion involves a violation of faithfulness: the inserted vowel has no counterpart in the input. This violation of faithfulness is due to dominant syllable well-formedness constraints. The epenthetic output [búrɛ́dì] 'bread' contains vowels [u] and [i] that have no input counterparts, a violation of faithfulness.

In summary, epenthesis involves a resolution of conflict at the expense of faithfulness: the costs of inserting a (non-underlying) segment are less than those of imperfect syllable structure.
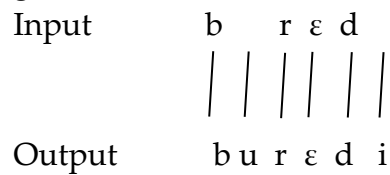
In optimality theory, vowel insertion is driven by an imperfect match between input segments and the syllable template. Vowel insertion involves a violation of faithfulness: the output diverges from the input by the presence of an epenthetic segment,

one that is not triggered by lexical representation. The faithfulness constraint militating against epenthesis is DEPENDENCY - 10 (or DEP: 10)

DEP: 10

Output segments must have input correspondents (no epenthesis).

This constraint is violated by an output segment that has no correspondent in the input. Such a violation is incurred by inserted vowels [u] and [i] in the examples from Yoruba. This violation is shown in a diagram below. It indicates corresponding segments through vertical lines.

Figure 9: Violation of DEP: 10 in [burɛdi]

Input   b   r   ɛ   d

| | | | | |

Output   b u r ɛ d i

The above shows that the input contains no segments corresponding to [u] and [i].

12.2 Constraints of Vowel Insertion

Following from our discussion of vowel insertion in Ikhin and stated in optimality theoretic terms, we follow Lewis (2000) though with some modifications, in our account of the relevant constraints of vowel insertion.

     a) HV: For syllable well-formedness, high vowels are inserted,
     b) DEP: Output segments must have input correspondents (All segments   must be underlying),
     c) If, THEN: If [u] then labial and round vowel environment, If [i] then non- labial environment,
     d) Prot S: The universal prothetic segment is [i].
     This tableau reveals the interactions of these constraints in Ikhin.

Figure 10

	Candidates	HV	Prots	If then	DEP
Tableau	i) à.gá.rê.sǐ	*!	*	*	*
	ii) ì.gú.rê.sì			*!	*
/greis/ →	iii) ì.gí.rê.sì				*
Tableau	i) è.ʃá.bà	*!			
	ii) ì.ʃɔ̂.bà			*!	*
/ʃap/ →	iii) i.ʃɔ.bu				*

13. Obligatory Contour Principle (OCP) in Syllable Structure Maintenance

The elision and insertion processes discussed above can equally be captured by the Obligatory Contour Principle (OCP) which prohibits adjacent identical segments. In Ikhin, vowel hiatus is prohibited at morpheme boundary under certain grammatical and

phonological conditions as earlier stated. Also, under no condition should a consonant occur adjacent to another consonant. These two constraints account for vowel elision and vowel insertion respectively in order to maintain the syllable structure's well-formedness.

In our account of OCP's effects on vowels and consonants, we will not restrict ourselves to the absolute identity of segments. Our intent is to apply the OCP to the cluster of vowels and cluster of consonants based on faithfulness constraints and markedness constraints respectively.

Using this principle implies that there is an additional constraint. That additional constraint is OCP.

OCP - Two vowels cannot be adjacent. The competing constraints are shown hierarchically in the following table.

Tableau MAX-1⁶ + pro >> MAX-GFV >>*MAX-CF >> OCP >> MAX-IO

Figure 11

	Candidates	MAX-1⁶ + pron	MAX-GFV	*MAX-CF	OCP	MAX-10
a) /dɛ̀ órúmà/	i) dɛrúmà		*!			*
buy sheep ⇢	ii) dǒrúmà					
b) /òfè ɔni/	i) ófènǐ					*
rat that ⇢	ii) ofɔ̀nì	*!				*
c) /dɛ̀ ɔ/ ⇢	i) dɔ	*!				
buy it	ii) dɛ̀ɔ̀				*	

Apart from the relevant constraints on the insertion of vowels, we need another constraint that actually forbids the sequence of two consonants. Invoking OCP to explain reasons for vowel insertion, therefore, presupposes another tableau showing the hierarchy of the competing constraints of diverse nature.

Given the fact that the inserted vowels have no input features to be faithful to, their future content is delegated to markedness constraints. As an output constraint, the OCP, in vowel insertion, triggers the change because the input itself violates the OCP.

Tableau OCP >> HV>>Prot-s >> If then >> DEP

Figure 12

	Candidates	OCP	HV	Prot-s	If then	DEP
/greis/	i) à.g .rɛ́.sǐ	*!	*	*	*	*
	ii) ì.gà.rê.sì		*!			*
⇢	iii) ì.gí.rê.sì					*
/brɛd/	i) ì.br.ɛ́.dì	*!				
	ii) ì.bà.rɛ́.dì		*!			
⇢	iii) ì.bú.rɛ́.dì					*

The above tableau shows that the obligatory contour principle is the most fatally violated. The hierarchy of the constraints is as follows: OCP » HV » Prots »If then »DEP.

a) OCP: Two consonants cannot occur in sequence. (It is awkward to pronounce two consonants next to each other in Ikhin. Inserting a vowel is a way of keeping the two consonants apart,

b) HV: Only high vowels are inserted,

c) Prots: The Universal Prothelic Segment is [i],

d) If then: If |u| then labial and round vowel environment. If |i| then non-labial environment,

e) DEP: ALL segments must be underlying.

It is for the reasons mentioned above that we intend to postulate /i/ as the inserted vowel in Ikhin and which becomes [u] in the environment of a labial consonant or a rounded vowel.

14. Glide Formation

Glide formation is a syllable structure process that allows a segment to undergo a-major class change by changing its major class features.

Glide formation and vowel elision complement each other. Glide formation in Ikhin applies within or across morpheme boundaries provided the following conditions are met:

a) In the vowel sequence, V_1 must be a close vowel (/i/ or /u/) and V_2 a non-identical vowel, provided the word that bears the V_1 has the minimal structure of its lexical category and the vowel occurring across boundary is not a grammatically redundant vowel, otherwise it is deleted before a close vowel becomes a glide (Egbokhare 1990).

b) V_1 must be preceded by a consonant. That is, the close vowel (front and back) occurs between a consonant and a non-identical vowel, as in the frames C-V, CV-. The examples below illustrate the conditions above.

14.1. Glide Formation within Morpheme Boundaries

i)	(a)	/èkùɔ̄/	→	[èkwɔ̄]	'chin'
	(b)	/ɛ́kùɛ́/	→	[ɛ́kwɛ̃]	'nail' (finger or toe)
	(c)	/ɔdìɔ́/	→	[ɔ̀djɔ̄]	'elder'
	(d)	/úgúà/	→	[úgwá]	'bone'
	(e)	/ìgúà/	→	[ìgwá]	'knee'
	(f)	/ísagùɔ́/	→	[ìságwɔ̄]	'groundnut'
	(g)	/ɛ̀gùɛ́/	→	[ɛ̀gwɛ̃]	'hoe'

(h)	/ɔ̀pìà/	→	[ɔ̀pjà]	'matchet'	
(i)	/ògùà/	→	[ògwa͡]	'village'	
(j)	/ɛ̀xàí/	→	[ɛ̀xàj]	'four head'	
(k)	/míɛ́/	→	[mjɛ]	'lie down'	
(l)	/ɔ̂ìà/	→	[ɔ̂jà]	'person'	

Examples (a – i) and (j – k) demonstrate glide formation in the following frames respectively: C-V, and CV-, V-V.

14.2. Glide Formation across Morpheme Boundaries

(ii)	(a)	áxí	àmɛ̀	→	áxjâmɛ̀
		'pot'	'water'		water pot
	(b)	ètò	àgba͡	→	étwàgba͡
		'hair'	'jaw'		beard
	(c)	òrù	àmɛ̀	→	orwàmɛ̀
		'season'	'water'		raining season
	(d)	fi	ùdò	→	fjùdò
		'throw	'stone'		throw stone
	(e)	xí	ɔ̀bà	→	xjɔ̀ba
		'make'	'king'		become king
	(f)	vù	áxí	→	vwáxí
		'cover'	'pot'		to cover pot
	(g)	rì	ètò	→	rjètò
		'cut'	'hair'		to barb hair
	(h)	mú	ɛ̀kpà	→	mwɛkpà
		'carry'	'bag'		to carry bag
	(i)	fi	èɣò	→	fjèɣò

Despite the fact that in (b) above /o/ forms a glide, it still must be raised to /u/ before undergoing the process because the production of glides begins with a close tongue position.

Note also that it is only /i/ that becomes glide in the frames CV- and V-V because [u] is blocked in those frames.

In all of the examples above, it has only been monosyllabic and bisyllabic verb and noun structures respectively that have been conditioning glide formation.

This implies that bisyllabic verbs and trisyllablic nouns do not condition glide formation as shown below:

	Input			**Output**
(a)	rómú	òkpòso	→	rómópòso'
	'lose'	'woman'		'lose wife'
(b)	ìkùkù	erǔ	→	ìkùkèrǔ
	'rubbish heap'	'yam'		'yam peeling'
(c)	óxùrù	ágbèdè	→	óxùtágbèdè
	'thread'	'needle'		'needle's thread'

In the above examples, the elision of V₁ rather than glide formation occurs. Also, glide formation does not apply in Noun + qualifier and noun + Associative marker sequences, rather elision of V₂ occurs because the concord prefixes of the qualifier and the associative marker which are V₂ at the boundary are redundant. Examples illustrating this process are shown below:

a)	ódí	ɔ̀nà	→	ódínà
	'wall'	'this'		'this wall'
b)	íkpǎmì	ènì	→	íkpǎmĩni
	'seed'	'those'		'those seeds'
c)	àkì	ɔ̀nì	→	àkìní
	'market'	that		'that market'
d)	ákà	ísì ɔbà	→	ákásɔbà
	'basket	'am king'		king's basket
e)	áwà	ísì òxwà	→	áwá sòxwà
	'dog'	am hunter		'hunter's dog

14.3 Constraints of Glide Formation
Constraints of glide formation unlike other consonants are not hierarchical. The three constraints are stated below:
   a) MAX-10: Every underlying input segment must have an output correspondent.
   b) Close + non-close V: Close and non-close vowels are allowed in near adjacency within or across the morpheme boundary.

c) Only close: Only close vowels can form glides.

Figure 13

	Candidates	Only close	MAX-10	Close + Non-Close V
/ɛkùɛ́/ 'nail 'finger' → /	i) ɛ́kùw	*!		
	ii) ɛ́kú		*!	
	iii) ɛ́kwɛ̌			
/ɔ̀pìà/ matche t →	i) ɔ̀pij	*!		
	ii) ɔ̀pj		*!	
	iii) ɔ̀pjà			

15. Conclusion

In this paper, I presented the syllable structure of Ikhin from phonetic and phonemic points of view. I established two syllable structure types; CV and V, indicating that Ikhin operates an open syllable structure. Three syllable structure processes were discussed and presented via optimality theory. I established that the language did not have palatalization but glide formation, therefore, I presented analysis of the suspicious segments to support my submission and counter previous scholar's proposal (Folarin,1982) that [Cj] is a palatalized segment and in complementary distribution with its plain counterpart [C].

Conflict of Interest Statement
The author declares no conflicts of interest.

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