

Comparison of Orthodontic Treatment Complexity of Adolescents from Three Major Nigerian Ethnic Groups

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Abstract

Objective: The study was carried out to assess and compare the orthodontic treatment complexity of adolescents aged 12-16 years from Yoruba, Hausa and Igbo Nigerian ethnic tribes

Methods: The study population comprised one thousand, four hundred and forty-nine (1449) adolescents selected from nine public schools within nine Local Government Areas from three (3) selected states (Lagos, Kano, Imo) in Nigeria. Multistage stage sampling technique was used with randomization at each stage to determine selected participants. Consent and assent forms were duly completed and signed by parents and participants, respectively. Participants' parents were from the same ethnic group. Oral examination of the participants was done and their orthodontic treatment complexity assessed following the standard protocols of Index of Complexity, Outcome and Need (ICON) Descriptive, as well as parametric (ANOVA) and non-parametric (Chi-square) statistical analyses were conducted in the data.

Results: The prevalence of orthodontic treatment complexity grades within the entire study population were 47%, 39%, 9%, 4%, 1%, for easy, mild, moderate, difficult and very difficult grades respectively. There were statistically inter-ethnic differences ($p < 0.0001$) across the tribes. Igbo adolescents had most (57.0%) in easy orthodontic treatment complexity grade followed by Hausa, Yoruba with 50.2% and 37.4%, respectively. In the very difficult orthodontic treatment complexity grade, Yoruba had highest frequency with 1.4% followed by Hausa with 1.0% and Igbo least with 0.6%. Male adolescents had more very difficult grade than the females in all but the Hausa tribes.

Conclusion: Igbo adolescents would require less effort to correct their malocclusion compared to the Yoruba while the Hausa tribe was found in-between.

Keywords: Nigerian major ethnic tribes, Adolescents, Orthodontic treatment complexity, Index of Complexity, Outcome and Need.

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I. Introduction

Complexity in orthodontics depicts severity and can be defined as a measure of skills and effort required to successfully effect treatment of orthodontic difficulties.^[1] It is also said to be synonymous with the term difficulty.^[2]

Orthodontic treatment complexity has been known to vary with age and race, however there is insufficient information about how this variation play out among individuals of different age and tribe in the Nigerian population. The study focused on Nigerian adolescents from the three major ethnic groups. Adolescence is a period of life from ages 10 to 19 characterized by marked psychological changes, development of sexual feelings, efforts toward the construction of identity and a progression from concrete to abstract thoughts.^[3] It is generally regarded as an emotionally intense and often a stress period^[3], when teenagers experience various mood swings.^[4] Adolescence is also the period when the canines and premolars erupt and most orthodontic problems become obvious.^[5] These changes make adolescents get concerned about their appearance and are easily affected by peer influence.^[5]

In Nigeria, there are three major ethnic groups namely Yoruba, Hausa and Igbo. Each of these three ethnic groups claim distinct ancestral origin and so are expected to present different dentofacial configuration with varied orthodontic complexity. Index of Complexity, Outcome and Need (ICON) is the orthodontic tool developed by multinational group of orthodontists for the purpose of assessing orthodontic treatment complexity. It is a complex index consisting of five score intervals which defined different grades of orthodontic treatment complexity which include; <29 as being easy, 29-50 mild, 51-63 moderate, 64-77 difficult, >77 very difficult. Index of Complexity, Outcome and Need has been validated for the Nigerian population and is shown to be useful in assessing orthodontic treatment complexity.^[6]

Although there are some studies^[6-10] from Nigeria on orthodontic treatment need and complexity, none has specifically assessed orthodontic treatment complexity of potential orthodontic patients from the three major ethnic groups in Nigeria. This study was undertaken to assess and compare the inter-ethnic variations in the orthodontic treatment complexity among adolescents from the three major ethnic groups in Nigeria using ICON as the index of measurement. It was hypothesized that there would be no statistically significant difference in the orthodontic treatment complexity among adolescents from the three major ethnic groups in Nigeria.

II. Materials And Method

This was a comparative, cross-sectional study carried out among 12-16 years old adolescents from the three major ethnic groups in Nigeria consisting of Hausa, Yoruba and Igbo. Nigeria is a multi-ethnic country with over 400 ethnic groups of which these three are considered the major groups.^[11] The country is divided into six geo-political zones which are South-South, South-West, South-East, North-East, North-West, North-Central^[11]. Yoruba ethnic group is found majorly in the South-Western zone, Igbo ethnic group in the South-Eastern zone and Hausa ethnic group, found predominantly in the Northern zones.

A multistage sampling technique was employed in this study. First stage, one state each from South-Eastern Zone, South-Western Zone and North-Western Zones was randomly selected using table of random numbers. Lagos state was randomly selected from all the six (6) states of the South-Western zone of Nigeria. Imo state, selected from five (5) states of the South-Eastern zone and Kano states from the seven (7) states of the North-Western zone using table of random numbers. The states in each of the three geopolitical zones served as the sampling frame. In the second stage, nine local Government areas, three from each of the three states were randomly selected through balloting. The local Government areas in the selected states served as the sampling frame. In the third stage, a list of schools in each of the selected Local government areas was obtained from each State Ministry of Education. One school was then randomly selected from the list of schools from each of three Local Government Areas using the table of random numbers. The list of schools here serving as the sampling frame. The classes of the students were stratified based on the age to identify students, 12 – 16 years according to school records. The stratification allowed equal chance of a participant to be selected. The class register was checked to confirm the tribe of the students. For those that adequate information was not provided since mothers' tribe were not stated apart from state of origin, the students were asked to write their parents' tribes and from those eligible, a list was made and the participants were randomly selected using table of random number. Only adolescents aged 12-16 years, a Nigerian of Yoruba, Hausa or Igbo ethnicity in permanent dentition stage with both parents from same ethnic origin were included in the study.

Participants were examined using hand instruments under natural light by the lead researcher who was well calibrated on the use of ICON.

Intra-examiner reliability: during the research exercise, 10% of the sample subjects were randomly re-examined by the lead researcher after 4 weeks of initial assessment to ensure intra-examiner reliability. The two examinations were analyzed for reliability using Kronbach alpha reliability test and the two results had good Kappa value. ($r = 0.73$)

Statistical Analysis: was done using Statistical Package for Social Science Version (SPSS) 22 to analyze the final data. Descriptive, parametric (ANOVA), non-parametric (Chi-square) statistics were used in the analysis of the data and testing of the null hypothesis. Test for significance was set at a p-value of 0.05.

Ethical clearance: was sought and obtained from the Ethical Committee of University of Port Harcourt Teaching hospital. Permission was sought and obtained from the Principals/Heads of the schools that were involved in the study. Informed consent was obtained from the parents of the participants while assent was obtained from the participants.

III. Results

Socio-demographic data of participants

A total of one thousand, four hundred and forty-nine (1449) adolescents were enrolled into this study comprising 808 (55.76%) males and 641(44.24%) females with a mean age of 14.20 ± 1.37 (SD) years. Six hundred and twelve (42.24%) were Hausa (male = 50.2%, female = 49.8%) with a mean age of 14.2 ± 1.2 (SD) years. Five hundred and sixteen (35.16%) were Yoruba (male = 67.8%, female = 32.2%) with a mean age of 14.1 ± 1.5 (SD) years and 321 (22.15%) were Igbo (male = 47.0%, female = 32.2%) with a mean age of 14.1 ± 1.3 (SD) years. (Table 1)

Prevalence of orthodontic treatment complexity

The prevalence of orthodontic treatment complexity in the combined study population were 47%, 39%, 9%, 4%, 1% for easy, mild, moderate, difficult and very difficult grades, respectively. (figure 1)

Orthodontic treatment complexity among adolescents from the three tribes

Out of 612 Hausas, three hundred and seven (50.2%) had easy orthodontic complexity grade and was followed by 235 (38.4%), 47 (7.7%), 7 (2.8%) and 6 (1.0%) for mild, moderate, difficult and very difficult grades of orthodontic treatment complexity respectively. In the Yoruba tribe, two hundred and twelve (41.1%) adolescents had mild orthodontic treatment complexity grade. This was followed by 193 (37.4%), 73 (14.2%), 31 (6.0%) and 7(1.4%) for easy, moderate, difficult and very difficult grades of orthodontic treatment complexity respectively. One hundred and eighty-three (57.0%) of the 321 adolescents of Igbo extraction had easy orthodontic treatment complexity grade, other grades were 112 (34.9%), 17 (5.3%), 7 (2.2%) and 2 (0.6%) for mild, moderate, difficult and very difficult respectively. In all the tribes, there was a statistically significant difference ($p= 0.0001$) in the orthodontic treatment complexity grades. (Table 2)

In comparison, adolescents from Igbo tribe had highest frequency of easy orthodontic treatment complexity with 183 (57.0%) while Yoruba adolescents had the least frequency of easy orthodontic treatment complexity grade (193, 37.4%). For the mild orthodontic treatment complexity, Yoruba adolescents had the highest frequency with 212 (41.1%) while Igbo adolescents had the least with 112 (34.9%). For moderate, difficult and very difficult orthodontic complexity grades, Yoruba adolescents had the highest frequency with 73 (14.2%), 31 (6.0%) and 7 (1.4%) while Igbo adolescents had the least with 17 (5.3%), 7 (2.2%) and 2 (0.6%). There was a significant statistical difference (Table 2) among the three tribes in terms of the distribution of orthodontic treatment complexity grades.

Age as it relates to orthodontic treatment complexity among the tribes

Mild orthodontic complexity grades were mostly observed among the 12-year old Yoruba adolescents closely followed by the Igbos. On the other hand, easy grade was found mostly with Igbo tribe (54.8%) followed by Hausa (42.6%) and Yoruba (29.4%). Very difficult orthodontic complexity grade was generally rare as observed in 2.9% of the 12 years old Yoruba participants (Table 3). Statistically significant difference was only seen in the easy orthodontic treatment complexity grade across the tribes. ($P<0.0001$)

In the thirteen years old adolescents, those from Hausa tribe had the least very difficult orthodontic complexity grade. Those, from Igbo ethnic group had highest easy orthodontic complexity grade with 59.3% followed by Hausa with 44% and Yoruba with 31.7%. The highest mild orthodontic treatment complexity grade of 48.5% was seen with Yoruba adolescents. (Table 3)

For the 14-years- old adolescents, Hausa and Igbo tribes had the proportion of easy orthodontic treatment complexity grade being 52.4% each while Yoruba adolescents had highest mild orthodontic treatment complexity grade with 40.2%. There was a statistically significant difference ($p<0.0001$), in the easy orthodontic treatment complexity grade across the three tribes. (Table 3)

Within the 15 years old, Igbo adolescents had the highest easy orthodontic treatment complexity grade with 60.0% followed by Hausa with 53.4% and Yoruba with 7.25%. There was no statistically significant difference in all the orthodontic treatment complexity grades across the three tribes. (Table 3)

Among the sixteen years old, Igbo adolescents had the highest easy orthodontic treatment complexity grade with 60.8% followed by Hausa 52.2% and Yoruba 40.2%. Yoruba adolescents had highest moderate orthodontic treatment complexity grade with 11.5% which was followed by Hausa, 6.1% and Igbo, 5.9%. (Table 3)

Gender and its relationship to orthodontic treatment complexity among the tribes

Hausa females had 52.8%, 35.4%, 8.9%, 1.6%, 1.3% for easy, mild, moderate, difficult and very difficult orthodontic treatment complexity grades respectively while the males had 47.6%, 41.4%, 6.5%, 3.9%, 0.7% for easy, mild, moderate, difficult and very difficult grades, respectively. In case of the Yoruba tribe, the females had 43.4%, 38.0%, 12.1%, 6.0%, 0.6% for easy, mild, moderate, difficult and very difficult orthodontic treatment complexity grade respectively while their male counterparts had 34.6%, 42.6%, 15.1%, 6.0%, 1.7% for easy, mild, moderate, difficult and very difficult orthodontic treatment complexity grades, respectively. For the Igbos, the female adolescents had 61.2%, 31.2%, 7.1%, 0.6%, 0.0% for easy, mild, moderate, difficult and very difficult orthodontic treatment complexity grades, respectively while the males had 52.3%, 39.1%, 3.3%, 4.0%, 1.3% for easy, mild, moderate, difficult and very difficult orthodontic treatment complexity grades, respectively. In comparing gender across the tribes, there was an inverse relationship between mild and difficult orthodontic treatment complexity; for mild cases the order of tribal prevalence was Igbo, Yoruba and Hausa while for difficult grades the order was in the reverse direction. The differences in complexity according to gender was statistically significant ($p=0.025$) only among Igbo adolescents. (Table 4)

IV. Discussion

This epidemiological study involving the three major ethnic groups in Nigeria, has provided useful information on the association between ethnicity and orthodontic treatment complexity and the variation in the orthodontic treatment complexity among adolescents in these ethnic groups. The orthodontic treatment complexity of most of the adolescents in this study was found to be of the easy grade. This is comparable to a previous study^[10] in South- South, Nigeria where ICON was also used as the assessment tool for the adolescents studied, but in contrast to another Nigerian study^[8] and a European study^[12] where most of the study participants were found to be of the mild orthodontic treatment complexity and ICON was similarly used. This contrast could be due to the fact that this study had a higher sample size than those studies.

Orthodontic treatment complexity, said to be the effort required to establish normal tooth relationship may be perceived to be difficult as the age of a person increases or more intense for males than females.^[2,13] It has been revealed in this study that orthodontic treatment complexity is not dependent on these criteria (increase age and gender).

The orthodontic treatment complexity of the studied participants revealed that in all the three major ethnic groups, easy grade was most prevalent. There was a downward trend from easy orthodontic treatment complexity grade to very difficult in all the ethnic groups except the 12-years-old Hausa adolescents and 12, 13,14, and 15-years-old Yoruba adolescents where the mild orthodontic treatment complexity was higher than easy. In a similar study^[10] in Rivers state, the easy orthodontic treatment complexity grade was also more than mild but the very difficult grade was higher than the difficult grade which is in contrast with this study where there was downward flow in the orthodontic treatment complexity from easy to very difficult grade. Igbo adolescents had highest easy orthodontic treatment complexity grade while Yoruba participants had the least in this study. Yoruba adolescents were found to have highest mild and moderate orthodontic treatment complexity grade while adolescents from Igbo extraction had the least in these grades. Difficult and very difficult orthodontic treatment complexity grades were found least among Igbo adolescents.

More Hausa females were found to have easy orthodontic treatment complexity grade than the male adolescents though among the male, very difficult grade, ranked least. This finding was similar to findings in a previous study.^[13] The males had more difficult and very difficult orthodontic treatment complexity grade than the females except among Yoruba adolescents where there was no difference in the difficult grade. However, the difference was not statistically significant. Similarly, in a hospital-based study^[14] in Lagos, there was no gender difference in the orthodontic treatment complexity. In European studies^[12,15] there was a gender difference in the orthodontic treatment complexity grade. The difference however can be as a result of more people of different ethnic groups being involved in this study.

Among the Hausa adolescents, the 12-year-olds recorded the highest frequency in mild orthodontic treatment complexity grade but least in the easy grade. Thirteen-year-old were seen to have highest in difficult orthodontic treatment complexity grade while 16-year-old had the least in this grade. None of the 12-year-old adolescents was found to have very difficult orthodontic treatment complexity grade while the 16-year-olds had the highest in this grade. Yoruba 16 year old adolescents were seen to have highest in number belonging to the easy orthodontic treatment complexity grade, 13-year-old had highest in the mild grade, and 14-year-old had highest in the moderate and 12-year-old had the highest in the very difficult grade while the 15-year-old had the least in the easy, mild, moderate and very difficult orthodontic treatment complexity grade.

Among the Igbo tribe, 16-year-old adolescents were found to have the highest number belonging to the easy orthodontic treatment complexity grade while 14-year-old participants had the least in this grade. The 12-year-old participants however had the highest number belonging to the mild orthodontic treatment complexity grade while the 15-year-olds had the least in this grade. Fourteen years old were found to have the highest in the moderate orthodontic treatment complexity grade while the 13-year old participants had the least in this grade. Fourteen-year old and 13-year-old participants had the highest in number belonging to the difficult and very difficult orthodontic treatment complexity grade respectively. Interestingly there was no difficult orthodontic treatment complexity grade among the 12 and 16-year-old participants and also no very difficult orthodontic treatment complexity grade seen in 12, 14 and 16 year old participants.

Among the 12-year-old Igbo adolescents in this study, there was no difficult or very difficult orthodontic treatment complexity grade. Also discovered in this study was that the Igbo 16-year old adolescents had no difficult or very difficult orthodontic treatment complexity. This is in contrast with a Canadian study^[16], where the 16-18 years had highest ICON scores showing difficult and very difficult grades. This study however revealed a difference in the orthodontic treatment complexity grade among the ages studied. This finding is in contrast to a Nigerian based study^[14] in Lagos where there was no difference in the orthodontic treatment complexity grade among the ages involved in the study. There was a statistically significant difference in the orthodontic treatment complexity of the 16-year-old adolescents from the three major ethnic groups with $p=0.018, 0.019$ and 0.0001 for Hausa, Igbo and Yoruba, respectively.

V. Conclusion

Orthodontic treatment complexity, differ significantly among adolescents from the three major Nigerian ethnic groups. While the Igbo group presented most of the easy orthodontic treatment complexity grades, the Yoruba presented most of the very difficult grades. This observation suggests that Igbo adolescents would require less effort to correct their malocclusion compared to the Yoruba while the Hausa tribe was found in-between.

VI. Recommendation

The findings of this study will be useful to ministry of Education and Health in the teaching and planning of orthodontic care for Nigerians. Furthermore, the results of this study will be useful in the formulation of oral health policies.

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TABLES

Table 1: Socio-demographic data of participants (n = 1449)

Age (years)	Hausa n (%)		Igbo n (%)		Yoruba n (%)	
	Male	Female	Male	Female	Male	Female
12	41 (13.4)	8 (2.6)	15 (9.9)	16 (9.4)	41 (11.7)	27 (16.3)
13	81 (26.4)	44 (14.4)	29 (19.2)	30 (17.6)	78 (22.3)	23 (13.9)
14	92 (30.0)	72 (23.6)	45 (29.8)	60 (35.3)	86 (24.6)	36 (21.9)
15	57 (18.6)	104 (34.1)	32 (21.2)	43 (25.3)	84 (24.0)	54 (32.5)
16	36 (11.7)	77 (25.2)	30 (19.9)	21 (12.4)	61 (17.4)	26 (15.7)
Total	307(50.2)	305(49.8)	151(47.0)	170 (53.0)	350(67.8)	166(32.2)
Mean age	14.2 ±1.2 (SD)		14.1 ±1.3 (SD)		14.1 ±1.5 (SD)	

Table 2: Orthodontic treatment complexity in the three major ethnic groups.

Orthodontic treatment complexity	Yoruba	Igbo	Hausa	X ² (p-value)
Easy	193 (37.4)	183 (57.0)	307 (50.2)	
Mild	212 (41.1)	112 (34.9)	235 (38.4)	
Moderate	73 (14.2)	17 (5.3)	47 (7.7)	
Difficult	31 (6.0)	7 (2.2)	17 (2.8)	52.43 (.0001)
Very Difficult	7 (1.4)	2 (0.6)	6 (1.0)	
Total	516 (100.00)	321 (100.00)	612 (100.00)	

Table 3: Distribution of orthodontic treatment complexity in 12-16 years old across the different tribes

Age	Orthodontic Treatment Complexity	Hausa	Igbo	Yoruba	χ^2 (p-value)
12	Easy	21 (42.6)	17 (54.8)	20 (29.4)	38.39 (<0.0001)*
	Mild	23 (46.4)	13 (41.9)	30 (44.1)	0.20 (0.9030)
	Moderate	4 (8.1)	1 (3.2)	11 (16.1)	4.23 (0.1203)
	Difficult	1 (2.4)	0 (0.0)	5 (7.3)	3.72 (0.1554)
	Very difficult	0 (0.0)	0 (0.0)	2 (2.9)	2.38 (0.3034)
Total		49 (100.0)	31 (100.0)	68(100.0)	
13	Easy	55 (44.0)	35 (59.3)	32 (31.7)	11.75 (0.0028)
	Mild	52 (41.6)	20 (33.9)	49 (48.5)	3.32 (0.1898)
	Moderate	10 (8.0)	1 (1.7)	13 (12.8)	6.08 (0.0477)
	Difficult	7 (5.6)	2 (3.4)	5 (4.9)	0.41 (0.8107)
	Very difficult	1 (0.8)	1 (1.7)	2 (1.9)	0.61 (0.7379)
Total		125 (100.0)	59 (100.0)	101 (100.0)	
14	Easy	86 (52.4)	55 (52.4)	44 (36.1)	41.80 (<0.0001)*
	Mild	62 (37.8)	39 (37.1)	49 (40.2)	0.26 (0.8803)
	Moderate	9 (5.5)	7 (6.7)	24 (19.7)	8.61 (0.0135)
	Difficult	5 (3.1)	4 (3.8)	4 (3.3)	0.11 (0.9434)
	Very difficult	2 (1.2)	0 (0.0)	1 (0.8)	1.25 (0.5334)
Total		164 (100.0)	105 (100.0)	122 (100.0)	
15	Easy	86 (53.4)	45 (60.0)	62 (7.3)	4.79 (0.0911)
	Mild	54 (33.5)	23 (30.7)	50 (36.2)	0.69 (0.7072)
	Moderate	17 (10.6)	5 (6.6)	15 (10.9)	1.10 (0.5759)
	Difficult	3 (1.8)	1 (1.3)	10 (7.3)	7.48 (0.0237)
	Very difficult	1 (0.6)	1 (1.3)	1 (0.7)	0.34 (0.8425)
Total		161 (100.0)	75 (100.0)	138 (100.0)	
16	Easy	59 (52.2)	31 (60.8)	35 (40.2)	5.91 (0.0520)
	Mild	44 (38.9)	17 (33.3)	34 (39.1)	0.55 (0.7576)
	Moderate	7 (6.1)	3 (5.9)	10 (11.5)	2.26 (0.3227)
	Difficult	1 (0.9)	0 (0.0)	7 (8.1)	10.28 (0.0059)
	Very difficult	2 (1.7)	0 (0.0)	1 (1.2)	0.93 (0.6267)
Total		113 (100.0)	51 (100.0)	87 (100.0)	

*= p<0.05 statistically significant

Table 4: Distribution of orthodontic treatment complexity by gender in the three ethnic groups

Orthodontic Treatment Complexity	Hausa		Igbo		Yoruba	
	Male	Female	Male	Female	Male	Female

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Easy	146 (47.6)	161 (52.8)	79 (52.3)	104 (61.2)	121 (34.6)	72 (43.4)
Mild	127 (41.4)	108 (35.4)	59 (39.1)	53 (31.2)	149 (42.6)	63 (38.0)
Moderate	20 (6.5)	27 (8.9)	5 (3.3)	12 (7.1)	53 (15.1)	20 (12.1)
Difficult	12 (3.9)	5 (1.6)	6 (4.0)	1 (0.6)	21 (6.0)	10 (6.0)
Very Difficult	2 (0.7)	4 (1.3)	2 (1.3)	0 (0.0)	6 (1.7)	1 (0.6)
Total	307 (100.00)	305 (100.00)	151 (100.00)	170 (100.00)	350 (100.00)	166 (100.00)
	6.85 (0.144)		11.10 (0.025)*		4.70 (0.319)	

*= **p<0.05 statistically significant**

FIGURE

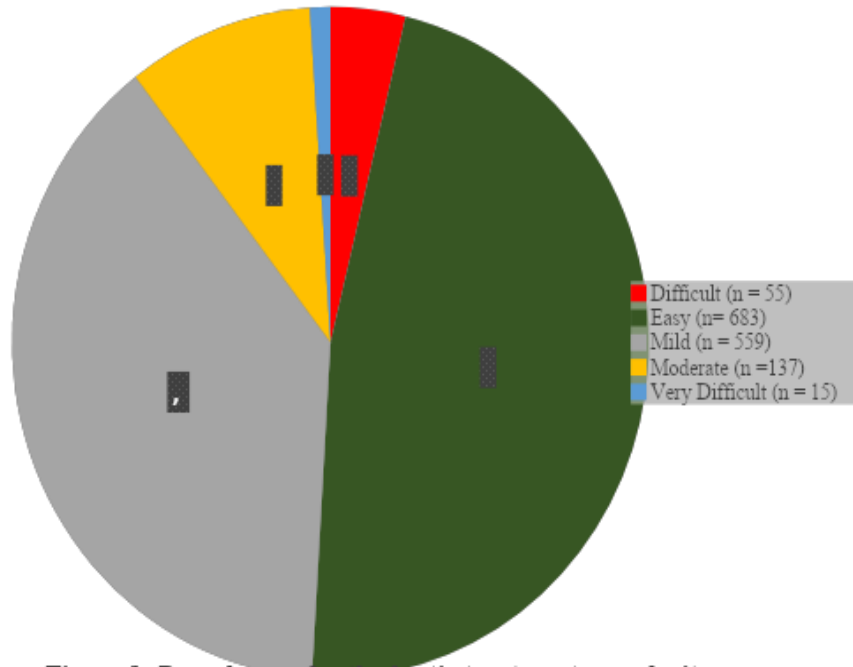


Figure 1: Prevalence of orthodontic treatment complexity.

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