(REVIEW ARTICLE)

Prevalence of malocclusion in Africa: A systematic review and meta-analysis

Tolulase Abosede Yemitan [1, *] and Afolabi Ola Oyapero [2]

[1] Department of Child Dental Health, Faculty of Dentistry, Lagos State University College of Medicine/Lagos State University Teaching Hospital, Ikeja, Lagos, Nigeria.
[2] Department of Preventive Dentistry, Faculty of Dentistry, Lagos State University College of Medicine/Lagos State University Teaching Hospital, Ikeja, Lagos, Nigeria.

Abstract

Objective: Data available on prevalence of malocclusions are mostly local or national-based, therefore this study aimed to pool data to determine the distribution of malocclusion traits in the permanent dentition across the African continent.

Methods: Recent studies published between 1990 and 2021 in PubMed, AJOL, PMC and Scopus on malocclusion prevalence in permanent dentition were reviewed. The methodological quality of the included studies was assessed using STROBE criteria.

Results: Out of 82,474 retrieved studies, 11 were included. In permanent dentition, the African prevalence of malocclusion was 76.1% (45 – 95.6%). The distributions of Class I, Class II, and Class III malocclusion were 76.7% [50–96%], 9.7% [1.6–25.4%] and 4.0% [1–12%], respectively. Regarding vertical malocclusions, the observed deep overbite and open bite were 10.9% and 6.5%, respectively. Crossbites affected 9.8% of the sample.

Conclusion: In Africa, Angle Class I malocclusion is more prevalent in permanent dentition, the least prevalent was Class III. This information should advice policymakers, dentists, and orthodontists across Africa on policies and clinical strategies on prevention of malocclusion.

Keywords: Prevalence; Malocclusion; Africa; Population; Dentition

1. Introduction

Worldwide, malocclusion is ranked as third highest among oral pathologies and public health disease priorities [1]. Malocclusion was defined as an imperfect alignment of the teeth or a mal-relationship of the dental arches beyond the range of what is accepted as normal [2]. This misalignment impacts dentofacial aesthetics, psychosocial wellbeing, and daily living [3].

There are many aetiological factors proposed for malocclusion, including genetic, environmental, and ethnic factors [4]. The heritability of certain types of malocclusions, such as Class III relationship, suggests a strong relationship between genetics and malocclusion [5]. Likewise, the ethnic factor was supported with the tendency for bimaxillary protrusion to affect the African origin more frequently than other ethnicities [6]. Furthermore, the adaptation of dentitions, bone, and soft tissue to environmental factors may result in different malocclusions [7].

[*] Corresponding author: Tolulase Abosede Yemitan
Department of Child Dental Health, Faculty of Dentistry, Lagos State University College of Medicine/Lagos State University Teaching Hospital, Ikeja, Lagos, Nigeria.

Epidemiological studies provide data on the size of the health problems, analysing presence or absence of hypotheses of associations, and information upon which priorities are set and health policies are developed [8]. Therefore, there is a need to pool results and critically evaluate the quality of these epidemiological studies.

Systematic reviews about this topic revealed more of worldwide prevalence with limited data from African countries. Therefore, the aim of this systematic review was to present a comprehensive estimation on the prevalence of malocclusion in different populations across the African continent.

2. Material and methods

A designed protocol recommended for systematic reviews and meta-analyses was used for this review [9]. Electronic search of relevant databases such as AJOL, PMC, PubMed and Scopus was done in February, 2022, using a combination of MeSH terms including 'Prevalence', 'Malocclusion', and 'Africa'. In addition, records were taken from a hand search of the list of references of selected full texts (studies and/or review) and relevant textbooks.

2.1. Inclusion criteria

- Publications from year 1990 till resent
- Studies performed on children and adolescents between 7 and 20 years of age
- Studies that evaluated malocclusion prevalence using Angle's classification of malocclusion
- Studies that specified the settings where the presence of malocclusion was evaluated
- Studies published in English
- Studies that considered the following specified malocclusion traits: Angle's malocclusion (Class I / II / III), increased overjet, overbite (deep bite / open bite), posterior crossbite; spacing and crowding.

2.2. Exclusion criteria

- Sample less than 80 participants
- Studies on population with specific medical problem
- Studies on participants undergoing orthodontic treatment
- Studies done in the same geographical location with overlapping results
- Abstracts presented at conferences.

2.3. Data extraction and management

Characteristics of all studies [10-20] analyzed were tabulated (Table 1) similar to that used in analysis of epidemiological studies [1]. Critical appraisal of the included studies was done based on a modified version of STROBE checklist [21] comprising seven items related to study design, study settings, participants criteria, sample size, variable description, outcome measurements and statistical analysis. The quality of the studies was categorized into weak (≤ 3), moderate (4 or 5) and high quality (≥ 6), as described in Table 2.

2.4. Statistical analysis

Prevalence rates, by different variables, were presented. Statistical analysis was performed with IBM SPSS Statistics for Windows software, version 21 (Armonk, NY: IBM Corp).

3. Results

Search of databases yielded 89,601 records after which 7,127 were removed as duplicates. After the titles and abstracts screening, 82,438 were excluded for not meeting inclusion criteria. Overall. 36 records were selected and after obtaining their full-text articles, twenty-five of them were excluded because did not meet the inclusion criteria established for this review, while 11 were selected and included (Table 1). The flowchart reported in Figure 1 shows the entire study selection process. Year of publication of selected studies ranged from 1991 to 2021.

The level of evidence obtained from results reported in this review is good due to fact that 2 studies (18.2%) were considered of high quality (with a STROBE's score by ≥ 6) and 8(72.7%) of moderate quality (with a STROBE's score of 4 or 5) (Table 2).

The prevalence of malocclusion among children and young adults in Africa was 76.1% (45 – 95.6%). A subgroup analysis for single traits of malocclusion, including Angle's classes, overjet, overbite, crossbite, crowding, spacing, was also carried out in this review. The complete panel of results is reported in Tables 3.
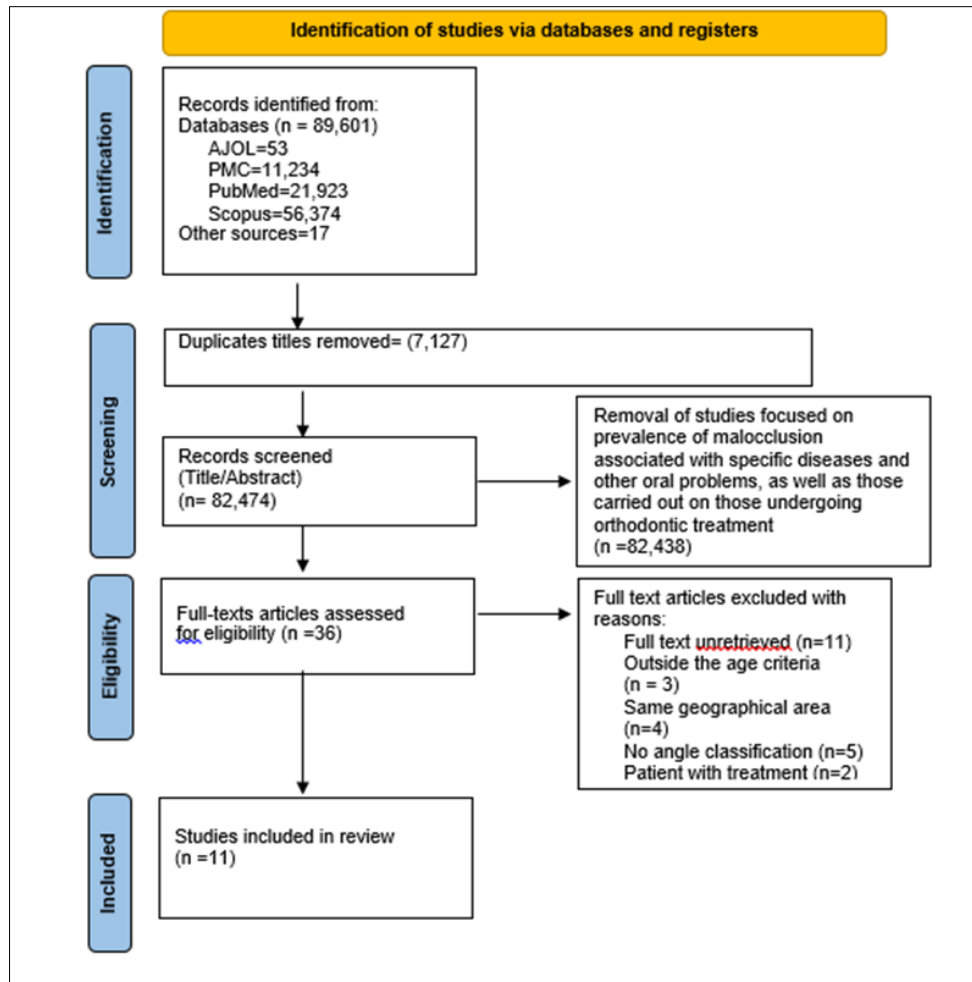

Figure 1 Flowchart of the literature selection process [9]

Table 1 Characteristics of Studies included in the review

No.	Author	Year	Sample	Age range	African Country	Population
1.	Ng'ang'a et al [10]	1996	919	13-15	Kenya	Schoolchildren
2.	Mtaya et al [11]	2008	1601	12-14	Tanzania	Schoolchildren
3.	Ajayi EO [12]	2009	441	11-18	Nigeria	Schoolchildren
4.	Bourzgui et al [13]	2012	1000	8-12	Morocco	Schoolchildren
5.	daCosta OO [14]	1999	1028	11-18	Nigeria	Schoolchildren
6.	Bataringaya A [15]	2004	402	14	Uganda	Schoolchildren
7.	Kerosuo et al [16]	1991	642	11-18	Tanzania	Schoolchildren
8.	Onyeaso CO [17]	2004	636	12-17	Nigeria	Schoolchildren
9.	Aikins et al [18]	2014	620	13-20	Nigeria	Schoolchildren
10.	Adekoya et al [19]	2021	437	10-15	Nigeria	Schoolchildren
11	Bugaighis et al [20]	2013	343	12-17	Libya	Schoolchildren

Table 2 STROBE -based quality analysis of the included studies

No	Author/Year	Study Design	Participants	Sample Size	Variables Description	Potential Confounders	Outcome Measurement	Statistical Analysis	Total Score
1.	Ng'ang'a et al., 1996	0	1	0	0	0	1	0	2
2.	Mtaya et al., 2008	1	1	1	1	1	1	1	7
3.	Ajayi EO, 2009	0	1	0	1	0	1	1	4
4.	Bourzgui et al., 2012	0	1	0	1	0	1	1	4
5.	Dacosta OO, 1999	0	1	0	1	0	1	1	4
6.	Bataringaya A, 2004	1	1	1	1	0	1	1	6
7.	Kerosuo et al., 1991	0	1	0	1	1	1	1	5
8.	Onyeaso CO, 2004	0	1	0	1	0	1	1	4
9.	Aikins et al., 2014	1	1	0	1	0	1	1	5
10.	Adekoya et al., 2021	1	1	0	1	0	1	1	5
11.	Bugaighis et al., 2013	0	1	0	1	0	1	1	4

Table 3 Different malocclusion traits with their percentage prevalence scores

Malocclusion traits	Min (%)	Max (%)	Mean (%)	SD
Class I	50.0	96.0	76.7	16.2
Class II	1.5	25.4	9.7	8.4
Class III	1.0	12.0	4.0	3.6
Increased overjet	8.3	48.4	18.4	12.3
Crossbite	5.1	17.1	9.8	3.7
Openbite	2.3	15.0	6.5	3.8
Deepbite	0.9	34.3	10.9	10.4
Crowding	14.1	49.2	22.7	11.0
Spacing	6.0	59.5	26.6	17.0

4. Discussion

The knowledge of epidemiological data on malocclusion across Africa can be relevant for educational purposes, help in determining priorities about orthodontic treatment need, and assist in the rational planning of preventive and therapeutic orthodontic treatment. In addition, assessment of malocclusion prevalence across different populations

may reveal the existence of genetic and environmental aetiological factors. Genetic control over the condylar cartilage and condylar growth may influence the prevalence of Class II malocclusion [22].

According to this review data, about three-quarter of adolescents and young adults in Africa have at least one form of malocclusion suggesting that malocclusion represents an important oral health problem and may cause an economic burden for either family of affected children or dental health public services.

The pooled prevalence of Class I malocclusion was the highest (76.7%), ranging from 50% (Nigeria) to 96% (Tanzania). The pooled prevalence of Class II was 9.7% with a wide range from 1.6% (Nigeria) to 25.4% (Libya). The pooled prevalence of Class III was the lowest among all Angle's classes of malocclusion (4.0%).

In agreement with previous studies had reported a high prevalence of bimaxillary proclination in African populations, characterized by reduced inter-incisal angle and reduced overjet and overbite [6], the pooled prevalence of increased overjet and deep overbite in this review was 18.4% and 10.9% respectively.

This systematic review revealed a high pooled prevalence of malocclusion in Africa (76.1%), therefore, health policy makers, paediatricians and dentists should develop methods for preventive strategies such as early cessation of oral habits and caries control; as well as early diagnosis of malocclusion, with development of appropriate treatment strategies [23-25]. However, across the continent, the economic burden of orthodontic treatment currently rests on the family, therefore, the probability of starting orthodontic treatment is dependent on the cultural and socio-economic levels of the family, rather than by the severity of the patient's malocclusion [26].

The most relevant methodological limit of this study could be the use of data generated from different populations with heterogeneous characteristics, with a tendency to generate a certain degree of bias. Another study limitation was a very high heterogeneity of prevalence among studies likely due to differences of age and ethnic population groups, measurement methods and, environmental and genetic factors. Furthermore, this was a review of prevalence of malocclusion and malocclusion traits, however, a future review of orthodontic treatment needs across the continent of Africa will be beneficial.

5. Conclusion

Malocclusion is a highly prevalent condition in Africa, affecting more than two-thirds of adolescents and young adults. Therefore, strategies to prevent and manage this health condition should be adopted by clinicians and policy makers across the African continent.

Compliance with ethical standards

Disclosure of conflict of interest

The authors, Yemitan Tolulase and Oyapero Afolabi, declare that this review did not receive any specific grant from any funding agency in the public, commercial or not-for-profit sector and there is no relationship with any party that may present a potential conflict of interest.

References

[1]   Alhammadi MS, Halboub E, Fayed MS, Labib A, and El-Saaidi C. (2018). Global distribution of malocclusion traits: A systematic review. Dental Press J Orthod, 23(6), 40.e1-10.

[2]   Cenzato N, Nobili A and Maspero C. (2021). Prevalence of Dental Malocclusions in Different Geographical Areas: Scoping Review. Dentistry Journal, 9(10), 117.

[3]   Akpasa I, Yemitan TA, Aikins E and Popoola B. (2022). Does Malocclusion Severity affect the Psychosocial Impact of Dental Aesthetics among Nigerian Adolescents? International Journal of Biological and Pharmaceutical Sciences Archive, 3(1), 40–47.

[4]   Saghiri MA, Eid J, Tang CK and Freag P. (2021). Factors influencing different types of malocclusion and arch form-A review. J Stomatol Oral Maxillofac Surg, 122(2), 185-191.

[5]   Zere E, Chaudhari PK, Sharan J, Dhingra K and Tiwari N. (2018). Developing Class III malocclusions: challenges and solutions. Clin Cosmet Investig Dent, 10, 99-116.

[6]   Otuyemi OD and Abidoye RO. (1993). Malocclusion in 12-year-old suburban and rural Nigerian children. Community Dental Health, 10(4), 375-380.

[7]   Todor BI, Scrobota I, Todor L, Lucan AI and Vaida LL. (2019). Environmental Factors Associated with Malocclusion in Children Population from Mining Areas, Western Romania. Int J Environ Res Public Health, 16(18), 3383.

[8]   Carter-Pokras OD, Offutt-Powell TN, Kaufman JS, Giles WH and Mays VM. (2012). Epidemiology, policy, and racial/ethnic minority health disparities. Ann Epidemiol, 22(6), 446-455.

[9]   Balachandran P and Janakiram C. (2021). Prevalence of malocclusion among 8-15 years old children, India - A systematic review and meta-analysis. J Oral Biol Craniofac Res, 11(2), 192-199.

[10]   Ng'ang'a PM, Ohito FA, Ogaard B and Valderhaug J. (1996). The prevalence of malocclusion in 13- to 15-year-old children in Nairobi, Kenya. Acta odontologica Scandinavica, 54(2), 126-130.

[11]   Mtaya M, Astrom AN and Brudvik P. (2008). Malocclusion, psycho-social impacts and treatment need: A cross-sectional study of Tanzanian primary school-children. BMC Oral Health, 8, 14.

[12]   Ajayi EO. (2008). Prevalence of Malocclusion among School children in Benin City, Nigeria. J Biomed Res, 7(1-2), 58–65.

[13]   Bourzgui F, Sebbar M, Hamza M, Lazrak L, Abidine Z and El Quars F. Prevalence of malocclusions and orthodontic treatment need in 8- to 12-year-old schoolchildren in Casablanca, Morocco. Prog Orthod, 13(2), 164-172.

[14]   Dacosta OO. (1999). The prevalence of malocclusion among a population of northern Nigeria school children. West Afr J Med, 18(2), 91-96.

[15]   Bataringaya A. (2004). Survey of occlusal trait in an adolescent population in Uganda. MChD (Orthodontics) Thesis, University of the Western Cape, South Africa, 1-137.

[16]   Kerosuo H, Laine T, Nyyssonen V and Honkala E. (1991). Occlusal characteristics in groups of Tanzanian and Finnish urban schoolchildren. Angle Orthod, 61(1), 49-56.

[17]   Onyeaso CO. (2004). Prevalence of malocclusion among adolescents in Ibadan, Nigeria. Am J Orthod Dentofacial Orthop, 126(5), 604-607.

[18]   Aikins EA and Onyeaso CO. (2014). Prevalence of malocclusion and occlusal traits among adolescents and young adults in Rivers State, Nigeria. Odontostomatol Trop, 37(145), 5-12.

[19]   Adekoya MN, Ayedun OS and Adeyemi TE. (2021). Prevalence of Malocclusion in Children between the Ages of 10-15 Years in Calabar Metropolis, Cross River. West Afr J Med, 38(11), 1095-1100.

[20]   Bugaighis I and Karanth D. (2013). The prevalence of malocclusion in urban Libyan schoolchildren. Journal of Orthodontic Science, 2(1), 1-6.

[21]   Vandenbroucke JP, von Elm E, Altman DG, Gotzsche PC, Mulrow CD, Pocock SJ et al. (2014). Strengthening the Reporting of Observational Studies in Epidemiology (STROBE): explanation and elaboration. Int J Surg, 12, 1500-1524.

[22]   Hinton RJ. (2014). Genes that regulate morphogenesis and growth of the temporomandibular joint: A review. Dev Dyn, 243(7), 864-874.

[23]   Grippaudo C, Paolantonio EG, Antonini G, Saulle R, La Torre G and Deli R. (2016). Association between oral habits, mouth breathing and malocclusion. Associazione fra abitudini viziate, respirazione orale e malocclusione. Acta Otorhinolaryngol Ital, 36(5), 386-394.

[24]   Góis EG, Ribeiro-Júnior HC, Vale MP, Paiva SM, Serra-Negra JM, Ramos-Jorge ML and Pordeus IA. (2008). Influence of nonnutritive sucking habits, breathing pattern and adenoid size on the development of malocclusion. Angle Orthod, 78(4), 647-654.

[25]   Kolawole KA and Folayan MO. (2019). Association between malocclusion, caries and oral hygiene in children 6 to 12 years old resident in suburban Nigeria. BMC Oral Health, 19, 262.

[26]   Germa A, Kaminski M and Nabet C. (2010). Impact of social and economic characteristics on orthodontic treatment among children and teenagers in France. Community Dent Oral Epidemiol, 38(2), 171-179.