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Prevalence of malocclusion in Rwandan people in a hospital-based study

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ABSTRACT:

Introduction: Dental appearance and alignment is an important feature in determining the attractiveness of the face and plays a key role in social interaction.
Methodology: A descriptive, cross-sectional study involving 171 randomly selected participants of both genders in a 12-40-year age range was conducted to determine the prevalence of malocclusion and the associated risk factors among the people of Rwanda attending the dental department of King Faisal Hospital, Kigali. Various malocclusion traits and associated risk factors were evaluated by direct clinical examination.
Results: A high prevalence rate of malocclusion (93%) was found. Crowding (45–51%) was the most common malocclusion trait present, followed by abnormal overjet relations, spacing in upper arch, abnormal overbite and cross bite traits in that order. A high prevalence of open bite (14%) and midline diastema (24.6%) was found in Rwandese patients as compared to other races.
Conclusion: Malocclusion comprised of a combination of more than one trait which were found to be present in different combinations. In most of the participants, the malocclusion was associated with multiple risk factors.

Keywords (MeSH): malocclusion; prevalence; open bite; diastema

INTRODUCTION

Dental appearance and alignment is an important feature in determining the attractiveness of the face and plays a key role in social interaction. People seek orthodontic treatment due to the negative esthetic, physical, functional, psychological and social impacts of malalignment of teeth. Occlusion is the relationship of maxillary and mandibular teeth as they are brought into functional contact, while malocclusion is the state of any deviation from the normal or ideal occlusion, as defined in the Glossary of Orthodontic Terms (Daskalogiannakis, 2000). Malocclusion is a common oral disorder of teeth characterized by their irregular arrangement. Malocclusion features as the third highest prevalent condition among the oral diseases after dental caries and periodontal disease, and therefore ranks third among worldwide Public Health dental disease priorities (Brito, Dias & Gleiser, 2009). Malocclusion also leads to dental caries and gum problems because irregularly arranged teeth are commonly not cleaned properly thus leading to an increased need for dental visits compared to those without malocclusion. Per the World Health Organization, the main oral diseases should be subject to periodic epidemiological surveys to plan and provide preventive, interceptive and treatment services.

Dental malocclusion is present in all societies with variable prevalence. Malocclusion is a multi-factorial disorder and develops due to interaction of many risk factors which are broadly divided into two categories, hereditary and environmental factors. Hereditary factors are non-controllable while some environmental factors can be controlled. The common risk factors are proximal dental caries and associated loss of space, abnormal shape, size and number of teeth; abnormal size of the jaws, parafunctional habits, nasal allergy and mouth breathing habits, traumatic injuries, early loss of milk teeth and ensuing space loss, prolonged retention of milk teeth, extraction of permanent tooth with no prosthetic replacement, abnormal attachment of frenum, and impacted tooth (Proffit, Fields & Sarver,2007). Knowledge of these factors can help the clinicians to plan the preventive and corrective strategies to prevent the development of malocclusion and thus improve quality of life.

Dental malocclusion is also present in the population of Rwanda, but there is no published data on its prevalence and the associated factors. Thus, this study was conducted to evaluate the prevalence of dental malocclusion and various associated factors within the Rwandan population.

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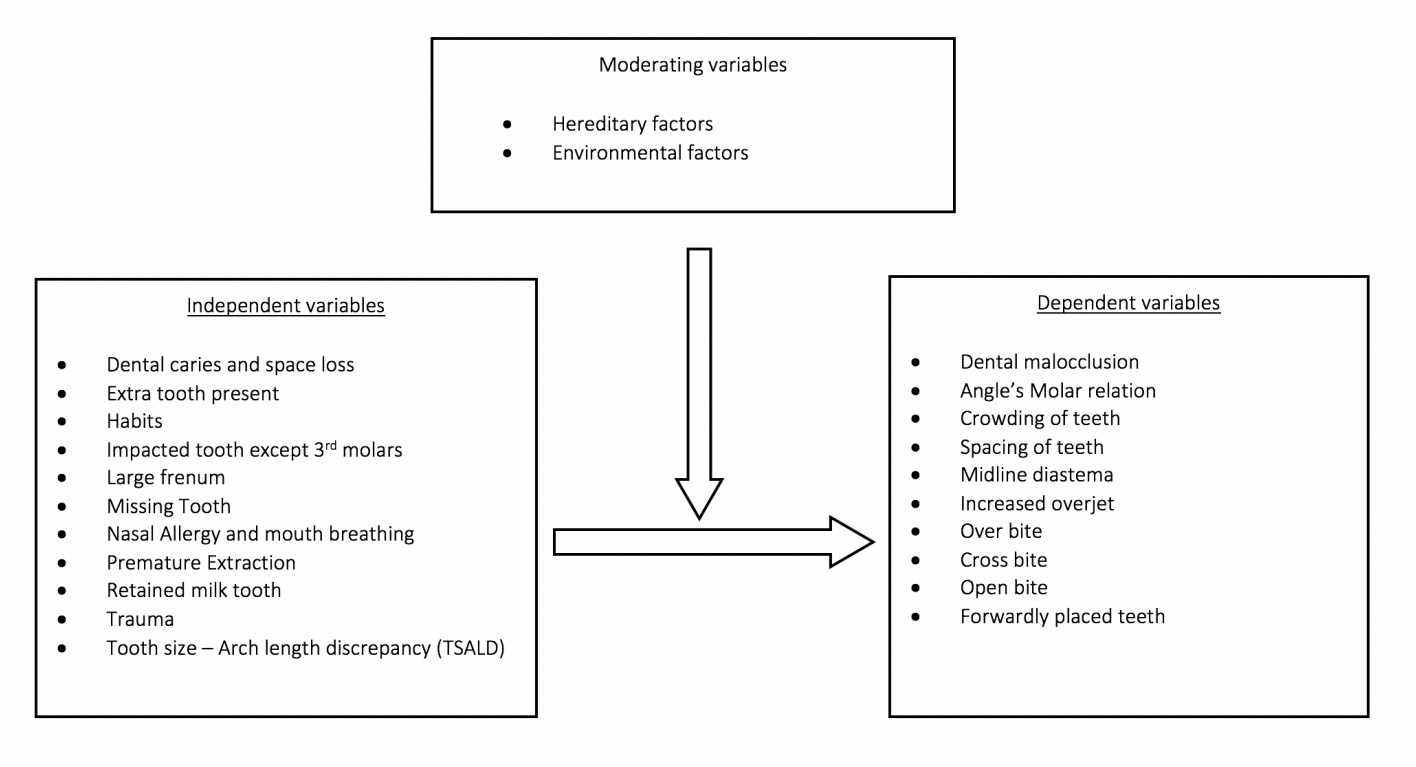
Figure 1: Conceptual framework



Explanation of conceptual framework:

Dental malocclusion develops due to many risk factors which are broadly divided into heredity and environmental risk factors. These risk factors interact with each other during the development of dentition and lead to the appearance of malocclusion. Hereditary factors cannot be controlled while environmental factors can be modified to prevent or minimize the severity of malocclusion. Certain common risk factors associated with development of malocclusion (Figure 1) are dental caries and the ensuing space loss which leads to the appearance of teeth crowding within the mouth cavity. Abnormal oral habits such as thumb sucking, tongue thrusting, mouth breathing and others, lead to the shifting of the front teeth into a forward position, increasing overjet, open bite and abnormal molar relation, while an abnormal attachment of the maxillary labial frenum leads to midline diastema. Premature extraction of deciduous teeth can lead to space loss and thus the abnormal eruption or impaction of a permanent tooth. Small size of the jaws can also lead to crowding, while larger jaw size may lead to appearance of spacing among the teeth due to the space discrepancy. Tooth Size-Arch Length Discrepancy (TSALD) is the quantitative difference between total tooth material and the available space present in each dental arch. It occurs due to a discrepancy between jaw size and teeth size, it may occur due to smaller than average arches or larger than average teeth or vice versa in different combinations. An early identification and control of risk factor(s) can help in prevention of the development of malocclusion.

METHODS

A descriptive, cross–sectional study was carried out through clinical examination of the Rwandese people of both genders, ages 12 – 40 years old, who were selected opportunistically through the dental department at King Faisal Hospital, Kigali. This age group was chosen because most of the patients requiring the orthodontic treatment belonged to this age group. Participants having only their permanent teeth were selected. However, the participants having any deciduous teeth present beyond its natural age of exfoliation were included because it is a risk factor for development of malocclusion. The participants were chosen to be having only permanent dentition because certain malocclusion features such as, spacing, deep bite, mild crowding and midline spacing in upper jaw due to ugly duckling stage are present in the mixed dentition. These are self – correcting anomalies of the occlusion during development of dentition and tend to resolve during transition from mixed to permanent dentition. Involving the patients of mixed dentition period would have confounded the results. There was no history of any past orthodontic treatment and no skeletal malformation of cranio-facial structures of the participants. The participants in the study were explained the purpose of the study and a written informed consent was obtained. The names of the participants were not recorded on data collection sheet to maintain their confidentiality.

Various parameters of malocclusion and risk factors were recorded by a direct visual examination. The collected data was analyzed with the use of descriptive statistical analysis using SPSS (Statistical Package for Social Sciences) to evaluate the percentage prevalence of malocclusion. Mean, range and standard deviation were calculated for the age of the participants. The distribution of the different traits of malocclusion was evaluated by applying descriptive statistics. The percentage distribution of the associated risk factors was also evaluated.

Ethical clearance for the study was obtained from the Ethics Research Committee, King Faisal Hospital, Kigali.

RESULTS

A high rate of prevalence of malocclusion (93%) was found in the present study (Table 1).

Angle's Class I molar relation is a feature of normal occlusion and any deviation from this relation is considered as malocclusion. Angle's Class I molar relation was the most common molar relationship (75.5%) (Figure 2).

Cross bite was found to be present in 26% of the total sample (Figure 3). Upper and lower front teeth were found to be normally positioned in 68.4% (Table 2). Crowding in the upper arch was present in 45.6% of cases (Table 3). The spacing was more common in the upper arch (39%) than the lower arch (17.5%) (Table 4). An abnormal overjet relationship was found in 44% of cases while increased overjet was found in 28% of the total sample (Table 5). There was a variable prevalence of different malocclusion traits evaluated in this study. Crowding in the dental arches was the most common problem (51% and 45.6%) (Figure 4).

Table 1: Distribution of participants by age, sex, and prevalence of malocclusion

	Males	Females	Total
Number	75	96	171
Percentage	43.9	56.1	100 %
Mean age±SD (years)	25.12±9.93	22.34±6.91	23.56±8.4
Age range (years)	12 – 40	12 – 35	12 – 40
Malocclusion present	96 %	91%	93%
Malocclusion absent	4 %	9 %	7 %

Figure2: Prevalence of Angle's molar relationship

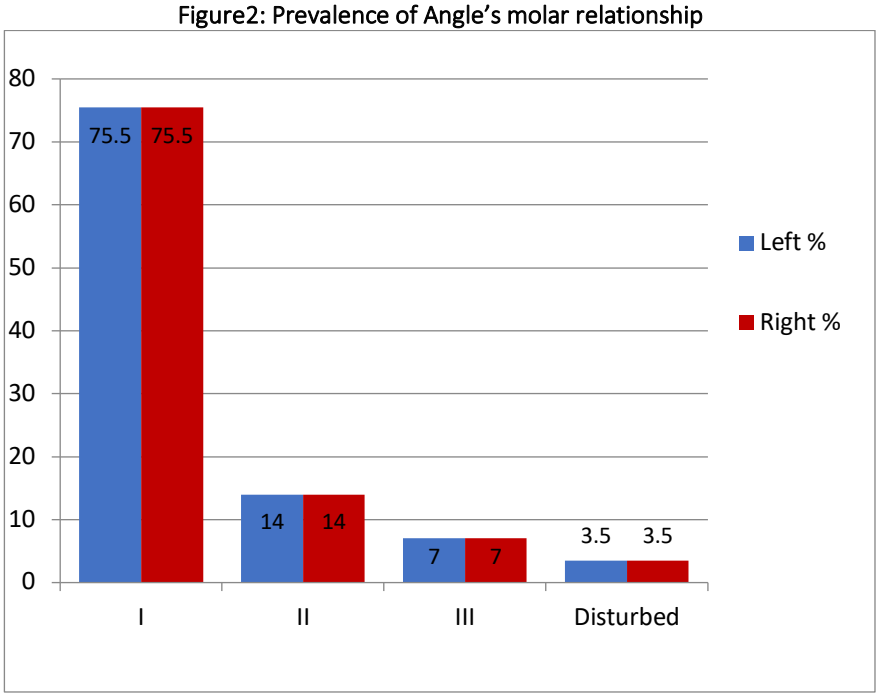


Fig 3: Prevalence of cross bites

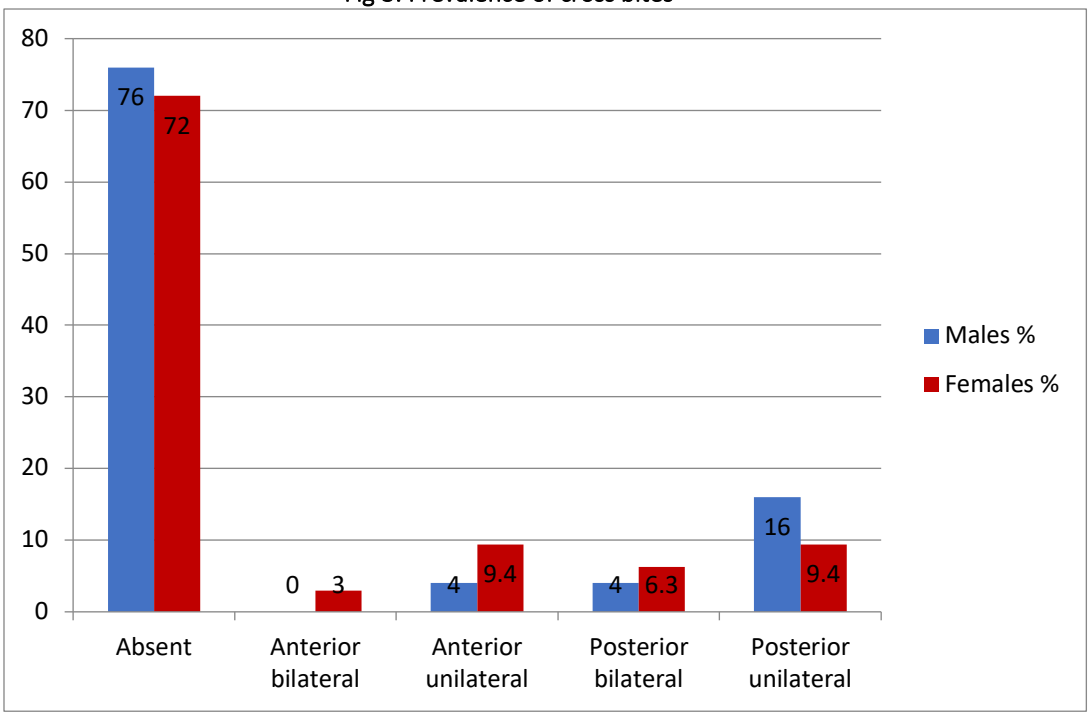


Table 2: Prevalence of forward positioning of front teeth

Forward placed teeth	Males %	Females %	Total %
Both upper and lower	8	12.5	10.5
Normal	60	75	68.4
Upper	32	12.5	21.1
Lower	0	0	0

Table 3: Prevalence of crowding in the dental arches

	Total %	Males %	Females %
Upper crowding			
Absent		44	63
Present	45.6	56	37
Lower crowding			
Absent		40	56
Present	51	60	44

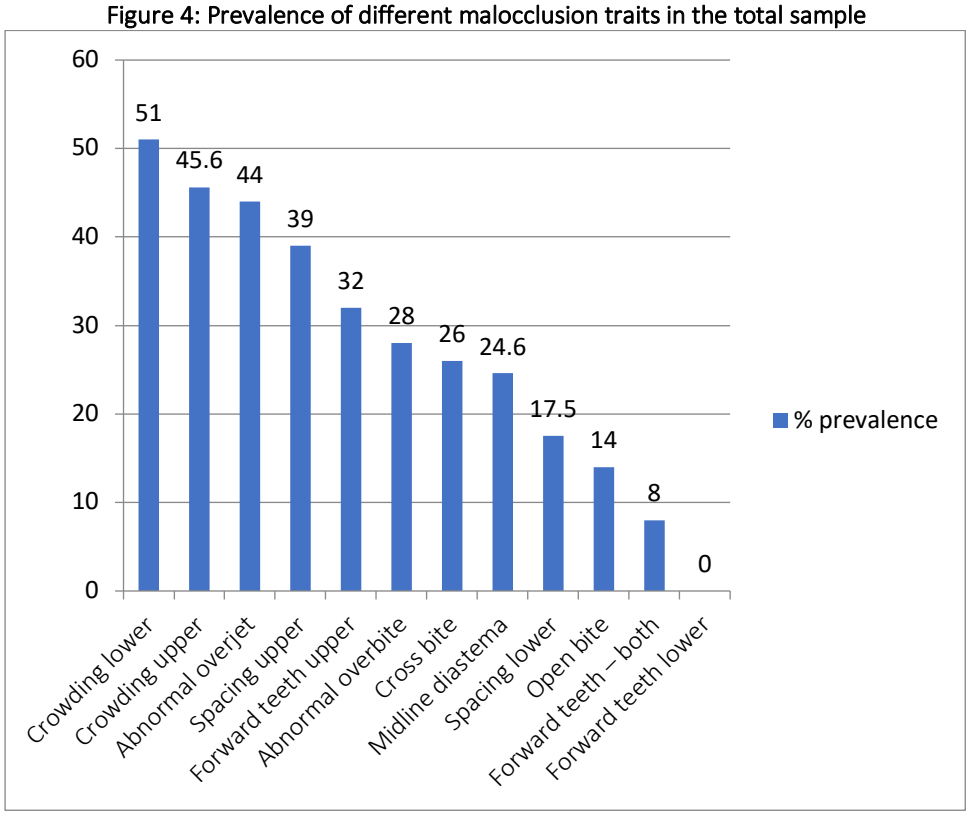
Table 4: Prevalence of spacing and midline diastema in the dental arches

	Males %			Females %		
Spacing	Upper	Lower	Total %	Upper	Lower	Total %
Absent	56	84		66	81	
Present	44	16	39	34	19	17.5
Midline diastema						
Absent	76	100		75	100	
Present	24	0		25	0	24.6

Table 5: Prevalence of overjet, overbite, and open bite

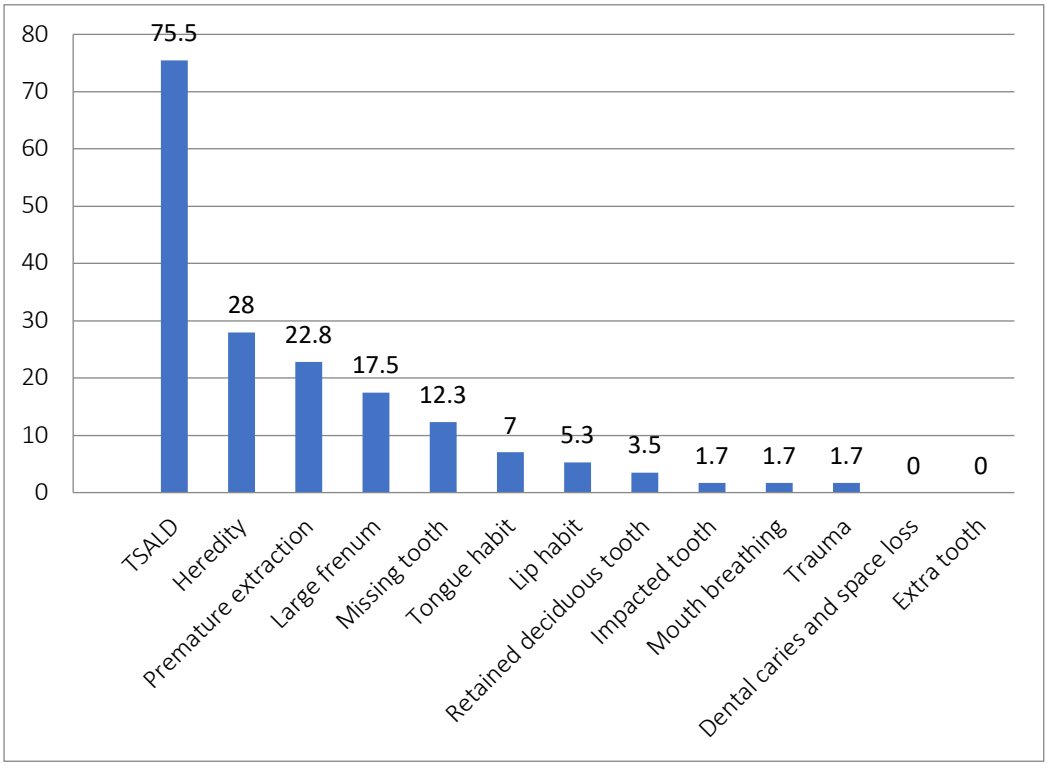
	Total %	Males %	Females %
Overjet			
Normal	56	48	62.5
Decreased	14	12	15.6
Increased	28	40	18.8
Reverse	2	0	3.1
Overbite			
Absent	10.5	4	15.6
Deep traumatic	3.5	8	0
Edge bite	3.5	4	3
Increased	10.5	16	6.4
Normal	72	68	75
Open bite			
Absent	86	96	78
Anterior	12	4	19
Posterior	2	0	3

Figure 4: Prevalence of different malocclusion traits in the total sample



The most common prevalent risk factor associated with malocclusion was TSALD (75.5%) (Figure 5).

Figure 5: Prevalence and distribution of different risk factors in the total sample



DISCUSSION

Prevalence of malocclusion: A high rate of prevalence of malocclusion (93%) was found in the present study (Table 1). In African countries, Ng'ang'a (1991), and Ng'ang'a et al (1996) reported a 72% prevalence rate in Kenyan children; Drummond (2003) found a 52% prevalence in South Africa; Koleoso et al (2004) reported a 32% prevalence in Lagos, Nigeria, and Ajayi (2008) reported a 85% prevalence in Benin, Nigerian children, while Rwakatema et al (2006) reported a prevalence of 97.6% of malocclusion in Moshi, Tanzania. Thus, the prevalence of malocclusion varies in different countries and is higher in Rwanda as compared to many other countries.

Prevalence of Angle's Molar Relationship: Disturbed molar relation occurs due to space loss after extraction of adjacent teeth, thus a proper Angle's relation cannot be defined in such cases. Disturbed molar relation was also found to exist in 3.5% cases. These findings agree with the findings of Nainani and Relan (2011) on Indian sample, and Rwakatema, Ng'ang'a and Kemoli (2006) on Tanzanian children, where Angle's class I relation was 78% and 82% respectively. However, no study had previously evaluated the disturbed molar relationship. In this study, 3.5% of the sample had disturbed molar relation, which is important to be described for preventative treatment planning.

Prevalence of Cross Bites: Cross bite was present in 26% of the total sample (Figure 3). In males, posterior unilateral cross bite showed maximum prevalence, while in females the crossbite distribution was found to be scattered. Drummond (2003) had reported 10.4% prevalence in South African population, while Nainani and Relan (2011) had found 5.5% prevalence in Indian population. Thus, a high rate of cross bite is present in the Rwandan population.

Prevalence of forward positioning of front teeth: Upper and lower front teeth were found to be normally positioned in 68.4% of the sample (Table 2). Upper teeth were positioned forward in 21% of the sample. Forward positioning of upper teeth was more prevalent in males (32%) as compared to females (12.5%). 10.5% of the sample had both upper and lower teeth in the forward position i.e. bimaxillary proclination, while proclination of only the lower teeth was not found in the study sample. No study however could be found in the literature describing the prevalence of this trait.

Prevalence of crowding in the dental arches: Crowding in the upper arch was present in 45.6% of cases (Table 3) and in the lower arch in 51% cases. Prevalence of crowding in both the arches was higher in males. Crowding in the upper and lower dental arches was the most frequent of all the malocclusion traits recorded in this study, with prevalence rates of 46% and 51% respectively. Thilander et al (2001) in Bogota, Columbia; Gelgor et al (2007) in Anatolia; and Brito et al (2009) in a Brazilian sample (45.5%) also reported that dental crowding was the most frequent of all anomalies. Drummond (2003) had shown that more than 50% of South African children had crowding of dental arches. Celikoglu et al (2010) in Turkey had a reported prevalence of crowding at 70% and 48% in upper and lower arches respectively, but in the present study a higher prevalence of crowding in the lower arch was observed. Thus, the dental crowding was a highly prevalent trait, and lower arch crowding was more prevalent than the upper arch crowding in the Rwandan population. On the contrary, Ajayi (2008) in his study in children in Benin, Nigeria

found lower rates of prevalence of crowding in the upper (11.1%) and lower arches (12%).

Prevalence of spacing and midline diastema in the dental arches: The spacing was more common in the upper arch (39%) than the lower arch (17.5%) (Table 4). Prevalence of spacing and midline diastema were high as compared to previous studies. Nainani and Relan (2011) in an Indian sample found a 40.36% prevalence of spacing while the midline diastema was 9.86%. They found that the associated risk factor for midline diastema (2.06%) was an abnormal frenum attachment in upper dental arch. In the present study, there was a 100% association observed between maxillary frenum and midline diastema, meaning that all cases of low attachment of maxillary frenum showed the midline diastema (Figure 4). But the opposite was not found to be true.

Brito et al (2009) reported a 16.2% prevalence of diastema in Brazilian children, while only 4.5% of children in Turkey reported by Celikoglu (2010). Spacing in upper arch was 6.4% while in lower arch was 12.5% in the study by Celikoglu (2010).

Drummond (2003) reported a 28% spacing and a 17% prevalence of midline diastema in South Africa, which was more common in the Black race. Ajayi (2008) reported that spacing to be more frequent in the upper (29.9%) than in the lower anterior segment (10.7%), and the midline diastema was present in 19.5%. These findings indicate that the midline diastema prevalence was highest among Rwandese as compared to other African races.

Prevalence of overjet, overbite, and open bite: An abnormal overjet relationship was found in 44% of cases while increased overjet was found in 28% of the total sample (Table 5). Males showed more increased overjet (40%) as compared to females (18.8 %).

Ajayi (2008) had reported that the rate of increased overjet and overbite was 24.7% and 9.8% respectively, while the open bite was present in 4.1% iof Nigerian children. Rwakatema, Ng'ang'a and Kemoli (2006) reported deep bite in 10.7% and open bite in 6.2% of Tanzanian children, while Drummond (2003) reported prevalence rates of 33% for increased overjet and a 7.7% prevalence of open bite in South African children. Nainani and Relan (2011) found deep bite in 38% of Indian children while open bite was present in 3%. This shows that Rwandan children had an increased tendency of increased overjet, increased overbite and the open-bite conditions of malocclusion. Although not evaluated in the present study, the children have been observed to have nasal allergies, lip incompetent and mouth breathing habit, which may be the cause of increased overjet, crossbites and open bite tendency in the present study.

Prevalence of different malocclusion traits in the total sample: There was a variable prevalence of different malocclusion traits evaluated in this study. Crowding in the dental arches was the most common problem (51% and 45.6%) (Figure 4). As compared to other studies, the prevalence of abnormal overjet, cross bite, midline diastema and open bite was higher in the Rwandese people.

Prevalence of Different Malocclusion Traits: TSALD (Figure 5) was the most common risk factor (75.5%) in the present study. However, this needs to be evaluated in further studies using direct measurements of teeth size and arch size from the dental study models. Heredity was found to be second common risk factor (28%). Mostly, the conditions like skeletal discrepancies, open bite and midline diastema due to large frenum get transferred from parents to children (Proffit, 2007).

Premature extraction of a primary tooth followed by space loss in that region was another common risk factor (22.8%) which leads to development of malocclusion traits like crowding, cross bite due to deflected eruption path of teeth etc. Maxillary large frenum was a common risk factor associated with midline diastema in upper arch in the studied sample. It also has a racial and genetic predilection, and is generally found in children whose parent is also affected by the condition. However, further specific studies need to be done to explore this area. Abnormal oral habits (tongue thrusting, mouth breathing, lip habit) were found in 14% of the sample in the present study. These are also the associated risk factors for development of malocclusion because they lead to disturbed soft tissue equilibrium. It leads to development of malocclusion by applying abnormal forces on the dental arches leading to abnormal development of skeletal jaw bases and deflecting the eruption path of teeth.

More than one risk factor was present in many participants in our study. The number of associated risk factors leading to development of malocclusion ranged from 1 – 6 in many participants in the present study. It implies that malocclusion is a multi-factorial disorder. Díaz et al (2013) in their study in Brazil had reported a detailed evaluation of the risk factors associated with the development of malocclusion. They had also reported that one or multiple risk factors were associated with 98.5% of the participants. However, the most common risk factors in their study were impacted teeth (28.36%) and retained teeth (21.64%). They described many other risk factors, some of them were prolonged duration of parafunctional habits, dental caries, traumatic injuries, anomalies of number, shape and size of teeth, abnormal attachment of labial frenum, abnormal position of eruption of tooth, and retarded dental eruption. This study found that the intrinsic factors in malocclusion are very common in the general population. The present study revealed that common risk factors in Rwandese people are TSALD, heredity, extraction of tooth followed by space loss, and abnormal maxillary labial frenum attachment.

CONCLUSIONS

The following conclusions were drawn from this study:

- A high prevalence of malocclusion was found to be present in the Rwandese population.
- Malocclusion is a combination of multiple traits present in different combinations.
- Crowding was the most common malocclusion trait present, followed by abnormal overjet relations, spacing in upper arch, increased overjet, abnormal overbite and cross bite traits in that order.

- A high prevalence of open bite and midline diastema was found in Rwandese patients.
- TSALD was the most common associated risk factor causing the malocclusion. Heredity and extraction followed by space loss also played major role as risk factors for development of malocclusion.
- In most of the participants, the malocclusion was found to be associated with multiple risk factors, thus confirming a multi-factorial etiology.

RECOMMENDATIONS

The following recommendations can be enumerated in view of the above findings. Knowledge of associated risk factors should be provided to dental professionals so that they can control them in their patients during their clinical practice and thus prevent the development of malocclusion or at least can help in reducing the severity of the malocclusion during development. Other risk factors need to be evaluated in future studies. Some of the specific risk factors having association to some malocclusion traits should be evaluated in further studies involving a large sample.

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