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Profile of cleft lip and palate patients at Wits Oral Health Centre Cleft Clinic

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PROFILE OF CLEFT LIP AND PALATE PATIENTS AT WITS ORAL HEALTH CENTRE CLEFT CLINIC

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A research report submitted in partial fulfilment of the requirements for the degree of Master of Science in Dentistry, in the Department of Orthodontics, School of Oral Health Sciences, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg.

2021

Declaration

I, Fatima Carrim, declare that this research report is my original work. It is being submitted for the degree of Master of Science in Dentistry, in the Department of Orthodontics, School of Oral Health Sciences, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other university.

I am aware that plagiarism (the use of someone else's work without their permission and/or without acknowledging the original source) is wrong. I confirm that the work submitted for assessment for the above degree is my own unaided work except where I have explicitly indicated otherwise. I have read the sections on referencing and plagiarism in the Wits Plagiarism Policy and I have followed the required conventions in referencing the thoughts and ideas of others.



_____

Fatima Carrim

23 August 2021

Dedication

For my father, Dr Ismail Carrim.
Thank you for being the lighthouse in my life, a guiding beacon of light,
my source of hope, strength, safety and inspiration

For my mother, Mrs Sufieya Carrim
Thank you for being the anchor in my life and for keeping me grounded,
yet always keeping me afloat

I cannot thank God, The Almighty enough
for every blessed moment with both of you in my life.

Abstract

Objectives: To determine the clinical profile of patients with orofacial clefts (OFC) who presented at the Wits Oral Health Centre (WOHC) Cleft Clinic from 1 January 2013 to 31 December 2019.

Materials and Methods: A cross-sectional, retrospective record review of OFC data was conducted. Demographic and clinical information of patients with OFC was collected. STATA version 15 was used to analyse the data and statistical tests were conducted at 5% significance level.

Results: 133 records were analysed. The median age at the first consultation was 6 years (IQR = 3-11 years). The majority were males (n=68, 51.13%), whilst 48.87% (n=65) were females. Most patients were South Africans 91.73% (n=122,), and the majority were African blacks (67.67%). A statistically significant difference ($p<0.05$) was found in gender and racial distribution of OFC.

Conclusions: WOHC Cleft Clinic is providing services to a growing number of patients with OFC. The study findings should assist in planning service for these patients.

Acknowledgements

I am eternally grateful to my supervisor, Professor Phumzile Hlongwa, for her time, guidance and support from the very beginning. She is an exemplary professional, clinician, academic and I take great inspiration from her.

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For my family, Dr M.Ikhwaan Osman and my children Muhammed Hassan and Zahra, for their unconditional love, patience and understanding.

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List of Abbreviations and Acronyms

CFA	Cranio Facial Anomalies
CL	Cleft Lip
CLA	Cleft Lip and Alveolar
CLP	Cleft Lip and Palate
CP	Cleft Palate
DOD	Department of Defence
DOJ	Department of Justice
FC	Fatima Carrim
HIC	High Income Countries
HPCSA	Health Professions Council of South Africa
IOD	Injury on Duty
L	Left
LIC	Low Income Countries
LMIC	Low-and-Middle Income Countries
MED	Medical aid members
MIC	Middle Income Countries
MVA	Motor Vehicle Accident
OFC	Orofacial Cleft
PI	Principal Investigator
R	Right
SAPS	South African Police Service
WOHC	Wits Oral Health Centre

CHAPTER 1
Introduction and Literature Review

1.1 Background

Congenital malformations are defined as non-progressive, morphologic anomalies of a single organ or body part due to an alteration or interruption of the primary developmental program (1). They are abnormalities of structure and function usually present at birth as they occur during the embryonic period. These malformations are life threatening and have the potential to result in disability or death; thus they are a major public health concern (2). Orofacial clefts (OFC) are the most common congenital craniofacial malformation with a global prevalence of 1 in 700 live births (3).

The early existence of clefts has been well documented in the literature. Some Egyptian mummies are reported to have been discovered with clefts (4). In ancient Greece, a statue portraying a complete cleft was discovered dating back to 700 BC (5). Clefts have been long associated with superstitious speculations. The Chinese believed that eating a rabbit whilst pregnant resulted in a child with “hare lip” (6). In Greece and Rome, children born with clefts were considered evil omens and were either drowned or abandoned (4).

Africa is clouded by a number of traditional folk beliefs and myths that frequently accompany the birth of a child with deformities (7). Some healers say that individuals with clefts have been cursed with witchcraft, whilst others suggest the cleft is evidence of the mothers attempt at ending the pregnancy prematurely. With this, traditional healers tend to dissuade cleft patients from seeking help early as it may disrupt the wishes of the supernatural spirits or ancestors (8). The study found that these healers eventually referred patients with clefts to a health care facility only when antibiotics or surgery was needed.

OFC can present clinically as typical clefts; which are clefts of the lip (CL), clefts of the lip and alveolar (CLA), clefts of the palate (CP) and clefts of the lip and palate (CLP). OFC can occur unilaterally on either the right side or the left side of the face, or bilaterally. Atypical clefts are rare craniofacial clefts with severe deformities of the face and head affecting both hard and soft tissues. These clefts can extend through the centre of the face, or laterally, affecting the eyes, nose and mouth. Figure 1 shows the clinical appearance of OFC. Typical and atypical clefts can arise as a single, isolated, non-syndromic anomaly, or as a result of a sequence of a primary defect, or as a multiple congenital anomaly which can be syndromic, chromosomal or can be idiopathic (9).

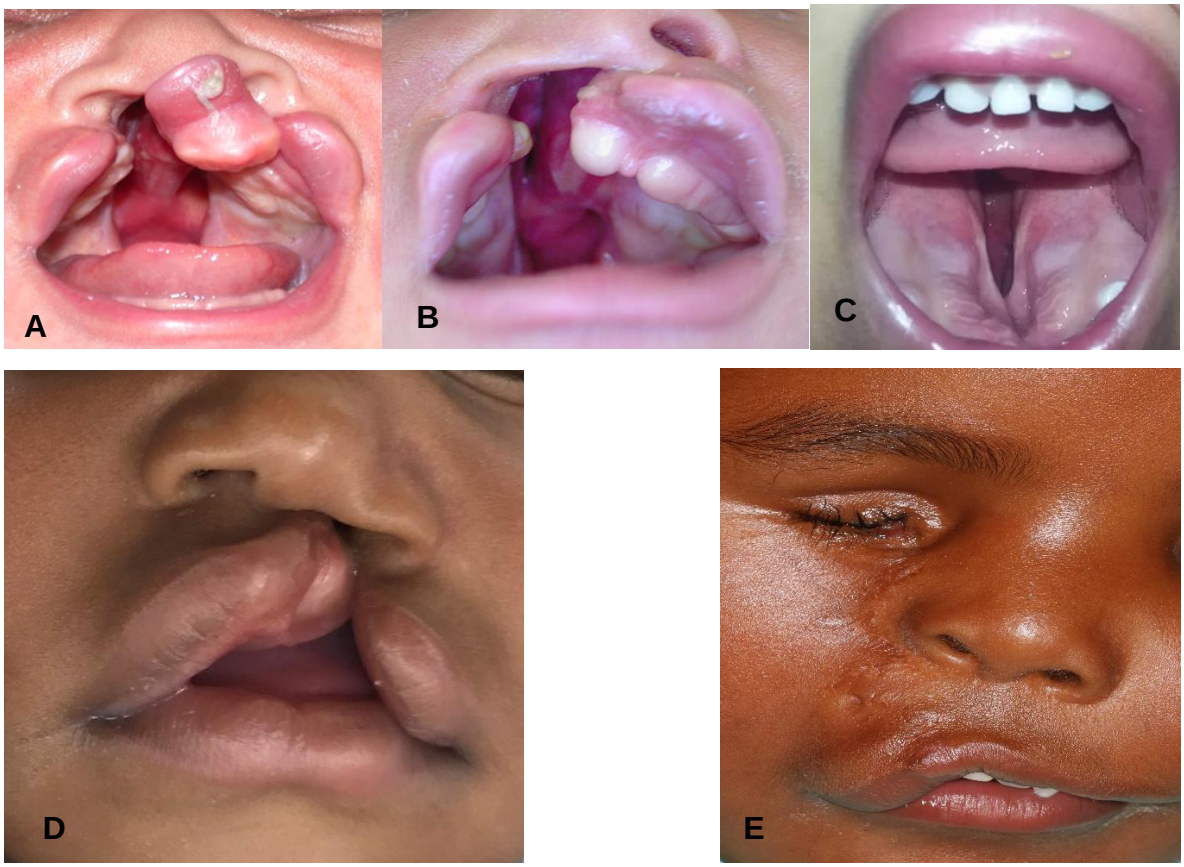


Figure 1. Clinical Appearance of OFC

A= Bilateral CLP; B= unilateral CLP occurring on the right side of the face; C= CP; D= CL occurring on the left side of the face; E= Repaired atypical facial cleft occurring on the right side of the face, resulting in right anophthalmia. (Pictures reproduced through courtesy of Professor P Hlongwa, Department of Orthodontics, School of Oral Health Sciences, Faculty of Health Sciences, University of the Witwatersrand, Johannesburg, South Africa).

The Craniofacial Anomalies Project was undertaken in 2011 by the World Health Organization (WHO) with the aim of collecting data regarding craniofacial anomalies (CFA) using a standardized protocol from different countries. WHO aimed at documenting international cleft variation and thus improving the current understanding of birth prevalence as well as associated international, geographic, cultural and ethnic variations (10). A total of 7704 cleft cases were provided from 30 different countries from the year 2000 to 2005. Isolated clefts amounted to 76.8% (5918), 15.9% (1224) had malformations in other systems and 7.3% (562) occurred as part of recognized syndromes. CL alone was found in 3.28 per 10 000 cases and CLP was found in 6.64 per 10 000 cases (11).

WHO has stressed the need for countries to address the burden of OFC as well as the importance of research in order to determine the extent of the crisis, to identify needs that are not met and to contribute to developing appropriate health policies (12).

1.2 Epidemiology of Orofacial Clefts

Birth prevalence values of OFC has considerable international variation (13); however, the generally accepted estimation of the prevalence is 1 in 700 live births (3).

Panamonta and Pradubwong conducted a global systematic review in 2015 and reported that Asia had the highest number of reported OFC while Africa had the lowest number reported (14). They found that the prevalence of OFC in Africa ranged from 0.3 to 1.65 per 1000 live births. They also reported an ethnic variation in prevalence with Asians having the highest prevalence, followed by the Japanese, Chinese, Whites and finally Blacks with the least number of OFC in Africa (14).

Prevalence studies in South Africa were done during the pre-democratic era and are over 30 years old (15-17). A study done in 1987 by Van Wyk and co-workers showed a higher prevalence of clefts in Caucasians compared to Black patients, and rates were reported to be 1.38 and 0.42 per 1000 live births respectively (18). In a recent study conducted in 2019 by Hlongwa and co-workers on the epidemiology of OFC in South Africa reported a prevalence rate of 0.3 per 1000 live births (2).

High income countries (HICs) have active surveillance systems and can thus produce many studies that provide prevalence rates as well as more accurate epidemiological trends (19). HICs may provide significant advances in treatment; however, problems in access to these treatments and evidence base for cleft care still exist. In the developing world, the lack of access to care and the lack of infrastructure to quantify the extent of the problem, results in the inability to address the problem (20).

There is a lack of reliable data on the prevalence of OFC in low-and-middle-income countries (LMICs) because most of the reported studies were hospital-based (16, 17, 21-25). A large number of births in LMICs are said to occur in remote, rural areas where health care facilities are inaccessible, thus rendering them undocumented (14). Poor patient record keeping can also be regarded as a contributing factor to the low prevalence rates reported in LMICs including Africa. There is a myriad of ideas regarding the aetiology of clefts in the different African traditions, creating a large stigma around cleft patients. This discourages cleft patients from seeking treatment from healthcare institutions in most Africa countries, thus rendering them undocumented (8).

It has been postulated that patients with OFC in LMICs often present to a healthcare facility at a later age due to unavailability of specialised medical facilities (26). Manyama *et al*., conducted a study in Tanzania and found that even though the amount of medical facilities in Tanzania were thought to be unable to meet the demands, most OFC patients presented to a medical facility before the age of 1 year (27). These results are similar to a Kenyan study that also found that patients with OFC present to medical institutions by the age of 1 year old (28).

Amongst different OFC types, parents of patients with CP or CLP are reported to present earlier than those with other types of clefts (29, 30). The reason for this is reported to be because patients with CP often have difficulty feeding and thus parents bring them in earlier to seek help. The results of a 2016 study reported that the mean age of presentation in upper MICs was 13 to 24 months, in lower MICs it was 17 to 35 months and in LICs it was 14 to 66 months. A delay in cleft repair has significant implications on a patients physical, mental and social well-being and this has been reported to increase the risk of infant and under-5 mortality in LMICs (31).

The frequency and variation of OFC amongst different populations differs greatly and is sometimes conflicting. A study done in Jordan in 2004 by Al Omari and Al Omari showed a higher incidence of CL compared to CP (32). CLP presented in 48% of patients, CL presented in 30% and CP in 22%. In Uganda, Dreise *et al.,* in 2011 also noted that CL was more common than CP (33). A study by Manyama *et al*., in 2011 did an assessment of clefts in Tanzania (27) and their order of frequency was: CL (49.2%), CLP (39.2%) and CP (11.7%). These results differ significantly to other LMICs such as Iran, Pakistan, Thailand and Brazil (34-37).

1.3 Aetiology of Orofacial Clefts

Growth of the face in humans is brought about by the fusion of five facial processes: the frontonasal process, two maxillary processes and two mandibular processes. As growth occurs, the five processes grow towards each other and fuse in the midline. Disruption in the fusion of these processes can result in a facial cleft (38). Non-fusion of the median nasal process and the maxillary process may result in a unilateral or a bilateral cleft of the palate. Non-fusion of the two medial nasal processes can result in a median cleft of the lip and can even extend to the nose. Non-fusion of the lateral nasal process and the maxillary process can result in a unilateral or bilateral oblique facial cleft. It is said that any decipherable groove between the adjoining processes results in a congenital facial cleft (39).

Clefts have a complex aetiology resulting from the disruption of the migration and fusion of the various facial processes by environmental, genetic or combined factors (40). Genetics has been reported to play a major role in the aetiology of OFC. Several genes have been identified that are directly related to the risk of formation of clefts (41). Chromosomal abberations or monogenic diseases can cause syndromic forms of clefts. An example of this is the IRF6 gene mutation that results in Van der Woude syndrome which accounts for about 2% of syndromic CLP (42). This is important for genetic counselling and can aid in determining the relative risk of cleft formation. Environmental risk factors that are linked to cleft formation include maternal age, smoking, alcohol, folic acid deficiency, corticosteroid use, diet and other influences (40). Martelli and Coletta reported that there is a direct link between maternal smoking and CLP (43). Hereditary, drug abuse and certain medical conditions such as diabetes mellitus have also been found to be risk factors in OFC development (44).

Four general groups of environmental “cleftogens” were categorized by Hunt and Hobar in 2002 (39):

1) Exposure to radiation increases the likelihood of cleft formation;
2) Vitamin imbalances i.e. excess vitamin A and related compounds and decreased levels of vitamin B increase the risk of cleft formation;
3) Infections such as rubella or toxoplasmosis increase the risk of clefts;
4) Maternal idiosyncrasies such as smoking and alcohol consumption, drug abuse as well as increased maternal age can all contribute to cleft formation.

1.4 Gender Differences of Orofacial Clefts

Studies regarding gender prevalence of OFC in different regions have reported that males are more likely to be born with clefts in general compared to females (27, 32, 45-48). Males are also reported to have a more severe form of cleft than females (45). A 1994 study found that male gender, white ethnicity and non-metropolitan background were all higher risk factors for being born with a cleft (49). Another study reported that males have a 3.5 fold greater chance of being born with a cleft compared to females (43).

CLP was reported to have a higher prevalence in males, whilst isolated CP was seen predominantly in females (18, 27, 45-47, 50, 51). In South Africa, Van Wyk *et al*., in 1987 reported that CP was more prevalent in females whereas CLP was more prevalent in males (18). The reason that CP prevalence in females is higher in comparison to males could be because palatine shelves are reported to close one week later in females compared to males (52).

A Canadian study reported the following distribution of cleft types: CL (17%), CP (41%) and CLP (42%). CP was predominantly found in females and CL and CLP were predominantly found in males. They also noted that birth weight and gestational age was significantly lower in new-borns with OFC compared to those born without clefts (53).

A study done in the Czech Republic combined gender and family history to observe if there was a link between the two variables. If the mother had a CL, either a CL or a CLP would present in 68% of boys and 32% of girls. If the mother had CLP, 64% of boys and 15% of girls would also have CLP. However, if the mother had CP, 37% of boys and 51% of girls would present with a CP. Similar results were found with fathers except that with CLP, 43% of boys would inherit it whilst with girls it was 40% (54). We can conclude from this study results that the risk calculation is dependent on multiple factors - the type of cleft of the mother, or the type of cleft of the father and the gender of the child. This information is important for pre-natal screening of malformations via ultrasonography in families with a genetic predisposition to clefts.

1.5 Classification of Orofacial Clefts

Because clefts are so phenotypically diverse, a comprehensive classification system is difficult to formulate. Hence there have been many OFC classification systems that have been developed over the years.

Davis and Ritchie's classification of 1922 (55) was one of the first classifications to be reported in the literature. It consisted of 3 groups that were all centered around

the alveolus. Group 1: Pre-alveolar clefts which depicted median, unilateral or bilateral clefts of the lips. Group 2: Post alveolar clefts which comprised of palatal clefts extending up to the alveolar ridge. Group 3: Complete alveolar clefts; that is complete median, unilateral or bilateral clefts of the lip, alveolar and palate (55).

Brophy in 1923 (56) developed a classification of 16 groups based on very specific morphological characteristics.

Veau created a classification in 1931 (57). This classification has four groups: Veau (I) cleft of the soft palate, Veau (II) cleft of the hard and soft palate extending to the incisive foramen, Veau (III) complete unilateral cleft of the soft and hard palate, lip and alveolus, Veau (IX) complete bilateral clefts of the soft and hard palate and lip and alveolus.

Fogh-Andersen in 1943 proposed a classification comprising of 3 groups. Group 1 was clefts of the lip which could be median, unilateral or bilateral. Group 2 was clefts of the lip and palate which could also be median, unilateral or bilateral. Group 3 was clefts of the palate (58).

Harkins in 1962 developed a classification comprising of 6 groups. These groups were further subdivided to describe the extent and the side of the cleft (59). Spina in 1973 modified Harkins' classification into 4 groups and using the incisive foramen as the reference point. Group 1 was for pre-incisive foramen clefts, group 2 was for trans-incisive foramen clefts. Group 3 was for post incisive foramen clefts and group 4 was for rare facial clefts. Each group could then be subdivided into unilateral, bilateral or median (60).

The Lahshal classification was presented by Kriens in 1989 (61). It made use of the acronym LAHSHAL to describe the anatomic areas of the cleft; L: lip(Right), A: alveolus(Right), H: hard palate(Right), S: soft palate(Median), H: hard palate(Left), A: alveolus(Left) and L: lip(Left). For example, a complete cleft of the lip, alveolus, hard and soft palate on the right would be written as: - "LAHS".

One of the most commonly used classifications for OFC was developed by Kernahan and Stark in 1958 (62). It was modified in 1971 into a Y-symbolic classification (63). It uses nine boxes that represent different areas with the incisive foramen as the central point as illustrated in Figure 2. The incisive foramen is used to divide anterior and posterior deformities. Number 1 and 4 describe the lip, 2 and 5 are alveolus, 3 and 6 are palate anterior to incisive foramen. Number 7 is for the anterior hard palate behind the incisive foramen, 8 is for the posterior hard palate and 9 is for the soft palate, uvula or for a submucus cleft.

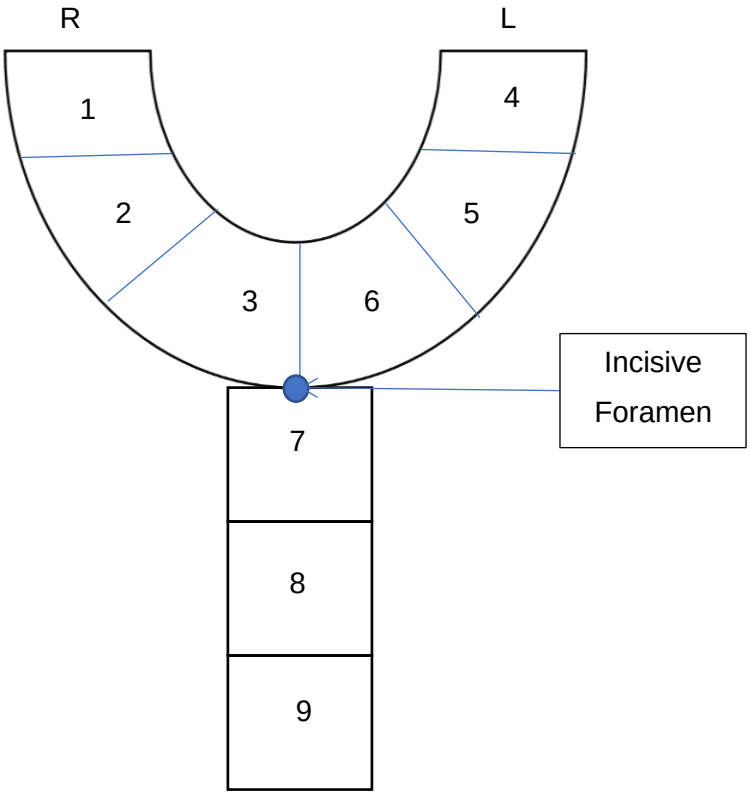


Figure 2: Kernahan and Starks Y Classification

Source: (63)

1- Right lip, 2- Right alveolus, 3- Right palate anterior to incisive foramen, 4- Left lip, 5- Left alveolus, 6- Left palate anterior to incisive foramen, 7- Anterior hard palate, 8- Posterior hard palate, 9- Soft palate.

1.6 Facial Clefts

Facial clefts, as shown in Figure 1 D, are atypical craniofacial clefts because they affect any other part of the face that is different from the typical pattern (64). They are rare congenital malformations and are reported to arise between 1.4-4.9 in 100 000 births (65). Mishra and Purwar reported in 2009 that the prevalence of facial clefts is less than 0.25% of all clefts (66). The literature regarding rare craniofacial clefts is sparse (67), leaving this subject poorly understood. The exact aetiology of these rare developmental anomalies is said to be largely unknown. Atypical facial clefts can be broadly divided into median and transversal or oblique clefts. The most commonly occurring are the median clefts which were first described by Bechard in 1823, with the prevalence of 1 in 100 000 births (68). Simpler facial clefts can be treated with simple techniques and satisfactory outcomes, however the more complex ones require multi-staged surgical approaches (64).

In 1976, Tessier created an internationally recognised classification system for atypical facial clefts. The principle of this classification was based on the fissures of soft tissue that correspond to a cleft of a bony structure (69).

The orbit is used as the primary reference point wherefrom 15 locations of clefts can be differentiated. Number 8 forms the equator that divides the clefts into two hemispheres: the top hemisphere and the bottom hemisphere. The bottom hemisphere represents facial clefts and are allocated numbers 0 to 7. The top hemisphere represents cranial clefts and are allocated numbers 9 to 14. The number 30 represents a facial cleft that is through the tongue, lower lip and mandible.

This numerical classification has eliminated old terminology and nomenclature inconsistencies used by practitioners. It facilitates the ease of recording of malformations and takes into consideration the three-dimensional aspect of these clefts. A comprehensive classification allows for better understanding of the specific clefts which leads to more specific investigations and subsequently more adequate planning and management of these patients. This will bring about less complications in corrective surgery and thus achieve better results (69). The interpretation of the numbers of the Tessier Classification are indicated in Table1.

Table 1: Description of Tessier Classification

Classification	Description
0	Midline upper lip and nose affected – Craniofacial dysgraphia
1	Cleft lip – Paramedian craniofacial dysgraphia
2	Paranasal
3	Oro-nasal-ocular involvement
4	Oro-ocular cleft that passes medial to infraorbital foramen
5	Oro-ocular cleft that passes lateral to infraorbital foramen
6	Cleft entering at lateral third of orbit separating zygoma from maxilla
7	Cleft passing between zygoma and temporal bone
8	Cleft passing from lateral canthus of eye to temporal region (Equator)
9	Lateral supraorbital cleft
10	Middle third supraorbital cleft
11	Medial supraorbital cleft
12	Cleft passing through frontal process of maxilla
13	Cleft passing medial to eyebrow
14	Midline cranial defect
30	Midline lower lip and mandible cleft

Source: (69)

1.7 Management of Orofacial Clefts

Services and treatment for patients with OFC vary depending on the type of cleft, the presence of any associated syndromes, birth defects as well as the child's age and needs (72). The optimum treatment for patients with OFC is a multi-disciplinary approach. A team consisting of, inter alia, audiologists, ear-nose-throat specialists, geneticists, maxillo-facial surgeons, orthodontists, plastic surgeons, psychologists and speech and language therapists is required to fully treat this condition and its lifelong effects (73). The combined expertise assists in ensuring that the correct interventions are carried out at the correct time to obtain the best functional and aesthetic results.

The quality of life of patients with OFC may be reduce throughout their lifetime (70). Problems such as difficulty feeding and ear infections may begin very early in the life of children born with OFC. Speech problems, and the need for surgery, dental, aesthetic and psychological problems may follow, and can be a long and arduous journey not only for the patient, but for the family as well (71). OFC also places a great economic burden upon the families of the patients as well as the society and thus the health care system as a whole (12). They require complex multidisciplinary treatment and are associated with elevated infant mortality and significant lifelong morbidity (72).

1.8 Conclusions of Literature Review

There is an increasing body of knowledge regarding the prevalence of OFC in different countries and regions. There are vast variations reported on prevalence of different oral and facial clefts, however, very few studies have been done within Africa.

Reported studies have shown that boys are generally more affected with CLP compared to girls, who have a higher predominance of CP. OFC distribution has variation regarding the frequency of the different types of clefts especially within

different races, demographics and countries. LMICs have a lack of reliable studies and thus our study will provide valuable baseline information.

1.9 Rationale for the Study

The WOHC Cleft Clinic is among a few cleft centres in South Africa, receiving many referrals from surrounding provinces as well as neighbouring countries. OFC have been treated at WOHC for over many decades and this study would be the first to describe the profile of OFC at WOHC. The results of this study will assist to develop an electronic database of patients with OFC who have presented at the WOHC Cleft Clinic. Furthermore, the findings will assist in better understanding of the profile of these patients to plan for services.

1.10 Aim of the Study

The aim of this study was to determine the profile of all patients and patterns of OFC presenting at the Wits Oral Health Centre (WOHC) Cleft Clinic from 1 January 2013 to 31 December 2019.

1.11 Objectives of the Study

1. To determine the distribution of type and site of OFC in patients presenting at WOHC Cleft Clinic according to the type and site of clinical presentation.

2. To determine the gender distribution of patients with OFC that presented at the WOHC Cleft Clinic.

3. To determine the racial distribution of patients with OFC that presented at the WOHC Cleft Clinic.

CHAPTER 2
Materials and Methods

2.1 Study Design and Setting

This study was a record review, cross-sectional retrospective study of OFC patients presented from 1 January 2013 to 31 December 2019. The study setting was the WOHC Cleft Clinic. Individuals with OFC make numerous visits to the centre over a prolonged period. Care was taken to record each individual only once, in order to avoid duplications.

2.2 Study Sample

Clinical records of individuals with OFC who were treated at WOHC Cleft Clinic were used for this study. All clinical records for the selected study period, 1 January 2013 to 31 December 2019 were reviewed.

2.3 Data Collection

A data collection form (Appendix A) was used to obtain demographic and clinical information on each individual with OFC. The chronological age of patients at their first consultation was documented. Ethnicity of individuals with clefts were recorded from a list of categories: African, Coloured, Indian or Asian, White and other. Our study did not intend to perpetuate the apartheid roots of these group classifications, it is unfortunate that legislated racism still continue to shape socio-economic circumstances and access to care in South Africa (75). Gender, nationality and patients' hospital classification for patient tariffs was also recorded. The clinical information of the clefts was recorded in four categories: (1) type of cleft, (2) description of cleft, (3) laterality of cleft and (4) position of cleft in relation to the face and palate.

2.4 Data Management and Analysis

Responses from the record review form were captured, cleaned in Excel, and stored on a secure computer. These responses were password protected and only the researcher had access to this password.

The data was imported into STATA version15 for descriptive and inferential statistical analyses. Data was summarized by means of frequency counts and percentage calculations.

Chi square test was used to compare any significant differences between the following proportions: 1) cleft description and gender and 2) cleft description and race. All statistical tests were conducted at 5% significance level.

The Cronbach's alpha was used to assess the reliability test. The overall test scale alpha value was 0.6468 which indicates an acceptable level of reliability.

2.5 Ethical Considerations

Ethical approval was obtained from the Human Research Ethics Committee (Medical) of the University of the Witwatersrand, Johannesburg to conduct the study under reference number M1911172 (Appendix B). Permission for data collection was obtained from the Chief Executive Officer/Head of School of Oral Health Sciences as well as the Head of the Orthodontic Department. Informed consent was not sought from patients as this was a retrospective study reviewing previous records. Confidentiality and anonymity were maintained throughout the study, and information which could identify patients was not used.

The principal investigator (PI), Fatima Carrim (FC) is registered with the Health Professions Council of South Africa as a dentist in the category Independent Practice General Practitioner and is familiar with all the principles of patient

confidentiality in medical records. Only the PI had access to the relevant records for the study period. The patients' records were assessed in a private area and were not left unattended. The PI allocated each patient record a unique identifier and no patient name or any other form of identification was recorded on the data collection form. The data containing unique numbers was kept on a password-protected computer.

CHAPTER 3

Results

3.1 Study sample

The total sample size was 230 patients' records and of those, 97 records were incomplete; lacking demographic data, or lacking one or more of the variables for example cleft type, description, laterality or position. The 97 records which were excluded from the analysis of the data set comprised of 51 males and 46 females. The reviewed sample size was 133 records of which 68 were males and 65 were females.

3.2 Descriptive Statistics of the Sample

There were 133 records. The patients' ages ranged between 0 and 40 years. The median age for the first consultation was 6 years with an interquartile range of 3-11 years as shown in Figure 3. The majority of patients were below the age of 10 years at first consultation.

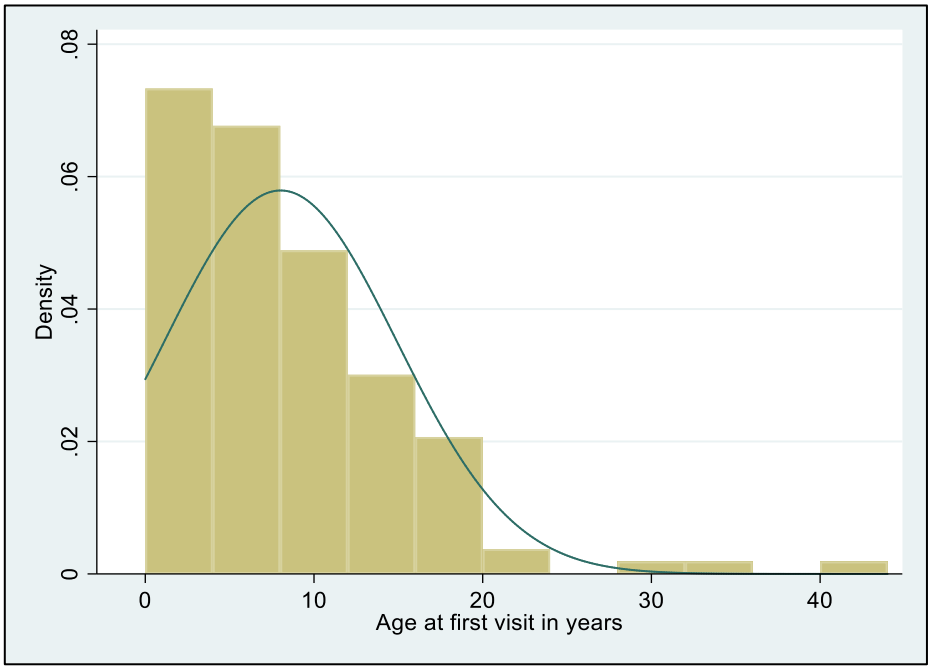


Figure 3: Age at first consultation

Gender distribution showed that the majority of the study sample were males (n=68, 51.13%), whilst 48.87% (n=65) were females. Nationality distribution revealed that the majority of the participants were from South Africa 91.73% (n=122,), whilst 8.23% (n=11) were non-South Africans who had not specified their nationality. The racial distribution of this study were as follows: African 67.67% (n=90,) Asian 14.29% (n=19,), White 9.77% (n=13,) and Coloured 8.27% (n=11).

Table 2 summarises the descriptive characteristics of the sample.

Table 2: Descriptive characteristics of the sample

Variable	**Sample Size** n=133
Gender	
Male	68 (51.13%)
Female	65 (48.87%)
Nationality	
RSA	122 (91.73%)
Other	11 (8.27%)
Race	
African	90 (67.67%)
Asian	19 (14.29%)
Coloured	11 (8.27%)
White	13 (9.77%)
Hospital class	
HO/HG	73 (54.89%)
H1	35 (26.32%)
H2	10 (7.52%)
H3	2 (1.50%)
PF	4 (3.00%)
PH	9 (6.77%)

Table 3 shows the patient tariffs of the sample based on the hospital classification . The most predominant group was HO/HG at 54.89% (n=73) who do not pay for services. Those with H1 were 26.32% (n=35) of the sample and pay R75 for every hospital visit. The H2 classification was 7.52% (n=10) and PH was 6.77% (n=9). Hospital classification PF and H3 had the least numbers with 3.00% (n=4) and 1.50% (n=2) respectively.

Table 3: Patient tariffs as at May 2019

Hospital Classification	Patient Group	Patient Tariffs
HO/HG	Pensioners and recipients of grants	Exempted
H1	Income between R0 – R70000	R75 per visit
H2	Income between R70001 - R250000	R95 Consultation fee
H3	Income greater than R250000	R138 Consultation fee
PF	Private patients	R460 Consultation fee
PH	MVA/SAPS/DOJ/IOD/DOD/MED	R460 Consultation fee

3.3 Distribution of the Orofacial Clefts

Figure 4 illustrates the distribution of cleft types. Majority of the sample presented with CLP 55.64% (n=74,), followed by CP 24.81% (n=33), CL 17.29% (n=23) and 2.26% (n=3) presented with a facial cleft.

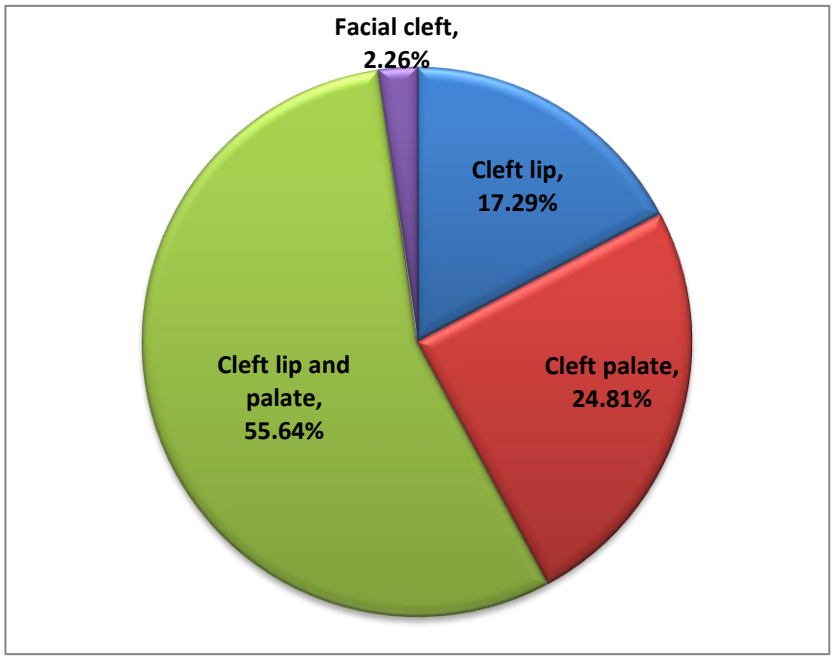


Figure 4: Distribution of cleft types

CL included the clefts of the lip only and/or the cleft of the lip and alveolar, where the palate was not involved. Of the 23 CL that were documented, 7 (30.43%) were cleft lip and 16 (69.57%) were cleft of the lip and alveolar as shown in Figure 5.

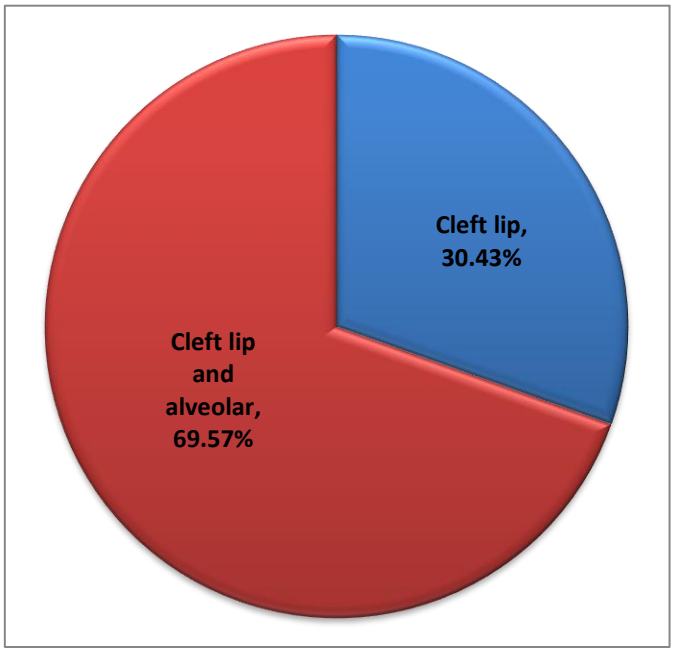


Figure 5: Cleft lip versus cleft lip and alveolar

Majority of the clefts were described as unilateral (n=50, 37.59%) and 30.83% (n=41) of the clefts were described as bilateral. Cleft of the palate accounted for 24.81% (n=33) while 4.51% (n=6) were midline clefts. Facial clefts accounted for 2.26% (n=3). (Figure 6).

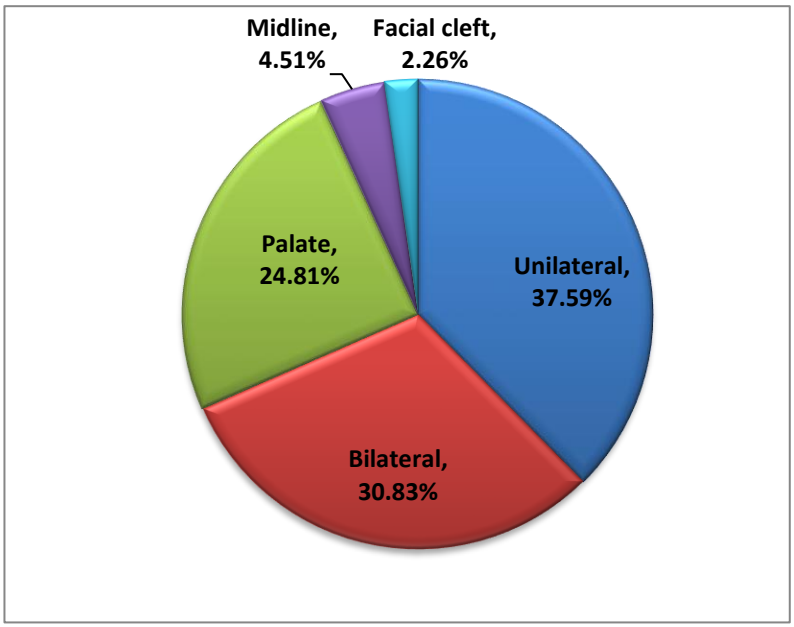


Figure 6: Cleft description

Figure 7 displays cleft laterality. Of all unilateral clefts (n=50), those that presented on the left side account for 68% (n=34) whilst those that presented on the right side accounted for 32% (n=16).

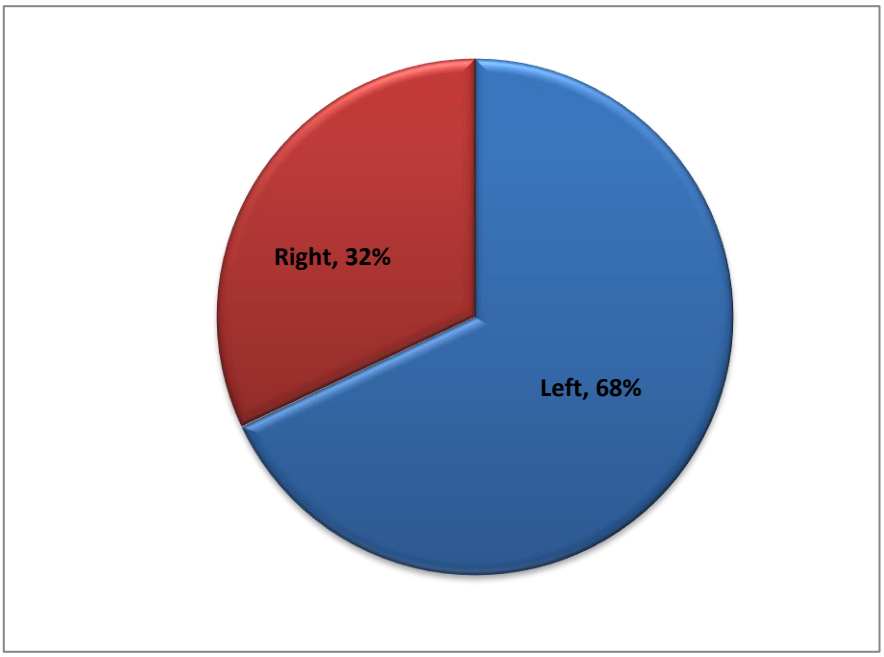


Figure 7: Cleft laterality

3.4 Gender Distribution of Orofacial Clefts

Gender differences in Cleft Type

CL presented in 17.65% of males (n=12) and 16.92% of females (n=11). CP presented more in females 27.69% (n=18) compared to males 22.06% (n=15). CLP presented predominantly in 60.29% of males (n=41) compared to 50.77% of females (n=33). All facial clefts were present in females at 4.62% (n=3) of the sample. There was no statistically significant difference in the cleft type proportions by gender in this study, $p < 0.249$.

Gender differences in Cleft Position

CL alone were present in 5.88% of males (n=4) and 4.62% of females (n=3). CLA had equal distribution between males (n=8) and females (n=8). There was no statistically significant difference in the cleft positions' proportions by gender in this study, $p < 0.378$.

Gender differences in Cleft Description

Unilateral clefts presented in 35.29% of males (n=24) compared to 40% (n=26) in females. Bilateral clefts were predominant in males at 33.82% (n=23) compared to females who presented with 27.69% (n=18). All midline clefts presented in males at 8.82% (n=6) of the sample. There was statistical significance in gender distribution of cleft description with $p < 0.042$.

Gender differences in Cleft Laterality

The clefts on the left side presented equally in males and females (n=17). Right sided clefts presented in 10.29% (n=7) of males and 13.85% (n=9) of females. There was no statistically significant difference of the cleft laterality between genders in this study, $p <0.073$.

Table 4 summarises the results of the profile of clefts according to gender.

Table 4: Gender distribution of orofacial clefts

Parameter	Gender		Chi 2 p-value
Type	**Male n=68(%)**	**Female n=65(%)**	
Cleft lip	12(17.65)	11(16.92)	
Cleft palate	15(22.06)	18(27.69)	0.249
Cleft lip & palate	41(60.29)	33(50.77)	
Facial cleft	0	3(4.62)	
Position			
Lip	4(5.88)	3(4.62)	
Palate	15(22.06)	18(27.69)	0.378
CLP	41(60.29)	33(50.77)	
Lip & alveolar	8(11.76)	8(12.31)	
Facial cleft	0	3(4.62)	
Description			
Unilateral	24(35.29)	26(40.00)	
Bilateral	23(33.82)	18(27.69)	0.042*
Palate	15(22.06)	18(27.69)	
Midline	6(8.82)	0	
Facial cleft	0	3(4.62)	
Laterality			
Left	17(25.0)	17(26.15)	
Right	7(10.29)	9(13.85)	0.073
Left and right	23(33.82)	18(27.69)	
Palate	15(22.06)	18(27.69)	
Midline	6(8.82)	0	
Facial cleft	0	3(4.62)	

*Statistically significant

3.5 Racial Distribution of Orofacial Clefts

Racial differences in Cleft Type

CL and CLP were all found to be predominantly in the African race. The White, Coloured and Asian races had high frequencies of CP compared to the African race. All the facial clefts 4.62% (n=3) were found were in the African race females. There was no statistically significant difference on the cleft description between race in this study, $p < 0.246$.

Racial differences in Cleft Position

The Africans had the predominance for CLP and CLA. CL alone was not found in the Whites, and CLA was not found in the Coloureds. There was no statistically significant difference in the cleft description between race in this study, $p < 0.213$.

Racial differences in Cleft Description

The Asians had the highest frequency of unilateral clefts followed by the Africans. Bilateral clefts were found predominantly in the Africans. 83% of midline clefts were noted in the Africans. There was a statistically significant difference regarding racial differences in cleft distribution with $p < 0.042$.

Racial differences in Cleft Laterality

The left side clefts were found predominantly in the Asians, whereas right side clefts showed predominance in Whites. Bilateral clefts were predominant in Africans. There was no statistically significant difference in the cleft laterality between races in this study, $p < 0.448$.

Table 5 summarises the results of the profile of clefts according to race.

Table 5: Racial distribution of orofacial clefts

Parameter	Race				Chi 2 p-value
Type	African: 90	Asian: 19	Coloured: 11	White: 13	
CL	17(18.89)	3(15.79)	1(9.09)	2(15.38)	
CP	15(16.67)	7(36.84)	5(45.45)	6(46.15)	0.246
CLP	55(61.11)	9(47.37)	5(45.45)	5(38.46)	
Facial cleft	3(3.33)	0	0	0	
Position					
Lip	4(4.44)	2(10.53)	1(9.09)	0	
Palate	15(16.67)	7(36.84)	5(45.45)	6(46.15)	0.213
CLP	55(61.11)	9(47.37)	5(45.45)	5(38.46)	
Lip&alveolar	13(14.44)	1(5.26)	0	2(15.38)	
Facial cleft	3(3.33)	0	0	0	
Description					
Unilateral	36(40.0)	8(42.11)	2(27.27)	4(30.77)	
Bilateral	31(34.44)	4(21.05)	3(27.27)	3(23.08)	0.042*
Palate	15(16.67)	7(36.84)	5(45.45)	6(46.15)	
Midline	5(5.56)	0	1(9.09)	0	
Facial cleft	3(3.33)	0	0	0	
Laterality					
Left	25(27.78)	6(31.58)	1(9.09)	2(15.38)	
Right	11(12.22)	2(10.53)	1(9.09)	2(15.38)	0.448
Left & right	31(34.44)	4(21.05)	3(27.27)	3(23.38)	
Palate	15(16.67)	7(36.84)	5(45.45)	6(46.15)	
Midline	5(5.56)	0	1(9.09)	0	
Facial cleft	3(3.33)	0	0	0	

*Statistically significant

CHAPTER 4

Discussion and Conclusion

4.1 Age Distribution of the Sample

The comprehensive management of patients with OFC should begin at birth or during early infancy and continue into adulthood. The ages of patients with OFC in our study ranged from 0 to 40 years with 50% of the sample being below 13 years. It is evident that many of patients with OFC continue to present to WOHC for continued management even into adulthood.

Most of the patients in this study were below the age of 6 years when they presented for their first assessment after birth. This age is old in comparison to other studies where majority of the patients presented before they were one year old (27, 28). The late first presentation for consultation could be due to late referral of patients from other provinces or relocation from other regions.

4.2 Cleft Distribution

OFC have been generally grouped into three categories i.e. clefts affecting the lip (CL), clefts affecting the palate (CP) and clefts affecting the lip and palate (CLP). These categories also indicate severity as well as difficulty of management: CL is the least severe with more predictable outcomes; CLP is the most severe and most difficult to manage. Our study findings showed that more than half of the sample presented with CLP (55.64%). CP followed with 24.81% and lastly CL with 17.29%. These results are concurrent with other studies showing that CLP has a higher prevalence than CL alone (76). In 2010, Jagomagi *et al*., published a study wherein of the 583 clefts assessed, 42% had CLP and 19% had CL.

This study results have found similar order of frequency compared to other studies (18, 48, 77), with CLP being the most common followed by CP and lastly CL being the least common. A study in Mexico by Gonzales *et al*., also reported the following frequency: CLP 70%, CP 21%, CL 8% (48). A South African study conducted in 1987 also showed a similar pattern; 50.4% with CLP, 26.9% with CP and 22.7% with CL (18). Ademiluyi *et al.,* found 35% of their patients with CLP, 28% with CP and 19% with CL (77).

The findings of this study have shown that the most common cleft was unilateral clefts (37.59%) followed by bilateral clefts (30.83%) and lastly palatal clefts (24.81%) with regard to cleft distribution. Shapira *et al*., in 1999 that reported similar order of frequency to our study findings (46). Our results were also similar to a study conducted in Tanzania by Manyama *et al*., who reported unilateral clefts were much more common than bilateral clefts (27). Another study done in France by Doray *et al*., reported that the majority of unilateral clefts presented particularly on the left side (78). The results of this study coincide with this – of the 50 unilateral clefts, 34 (68%) were left sided clefts and 16 (32%) were right sided clefts.

Table 6 shows a comparison of our study to other different African studies documenting cleft types.

Table 6: Comparison of studies done in Africa regarding cleft types

Author and year	Study time frame	Country	Sample size (n)	CL (%)	CP (%)	CLP (%)	Other (%)
Van Wyk *et al*., (1987) (18)	1987	South Africa	260	22.7	26.9	50.4	-
Ademiluyi *et al*., (1989) (77)	1981-1985	Nigeria	106	19	28	35	18
Spritz *et al*., (2007) (79)	2007	Kenya	368	52.7	5.7	41.6	-
Manyama *et al*., (2010) (27)	2004-2009	Tanzania	240	49.2	11.6	39.2	-
Dreise *et al.,* (2011) (33)	2008-2009	Uganda	19	31.5	5.3	63.2	-
Moodley *et al.*, (2016) (80)	2003-2014	South Africa	326	24.2	30	45.8	-
Hlongwa *et al*., (2019) (2)	2013-2014	South Africa	699	19	35.4	43.6	2
Carrim & Hlongwa (2021)	2013-2019	South Africa	133	17.3	24.8	55.6	2.3

4.3 Gender Distribution

Our study findings showed that of the 133 study sample, the majority were males (51.13%) and 48.87% were female. The gender distribution of our sample is similar to other studies that have shown males being more commonly affected with clefts in general compared to females (27, 32, 45, 47, 48).

Oka *et al.,* in 1999 found that females are more commonly affected by isolated CP than males, which is concurrent with the findings of this study and many other studies around the world (45-47, 81). CP was found in 27.69% of females compared to 22% of males. Van Wyk *et al*., in 1987 also found CP more common in females (18).

CLP was the most common cleft identified amongst both gender groups, but with male predominance. This is in concurrence with a study done in 2016 by Moodley *et al.,* (80). In terms of cleft description, females presented more with unilateral clefts as well as palatal clefts in comparison to males. All of the facial clefts were found in females and none in males. Males presented more with bilateral clefts compared to females. All of the midline clefts were found in males and none in females. These results were statistically significant ($p<0.05$).

4.4 Facial Clefts

Three patients out of 133 patients (2.26%) presented with facial clefts in our study. These results are similar to a study conducted by Moodley and co-workers in 2016 that reported a facial cleft frequency of 2.4% (80). In 2010, Butow and Botha found the frequency of facial clefts to be 0.69% (82). Worldwide prevalence has been reported to range from 0.3 – 1.1% (83). The incidence is estimated to be between 1.4 and 4.9 per 100 000 live births (65). Our study also found that all facial clefts identified were in female patients. In 2017, a study by Kalantar-Hormozi *et al*., found that out of 80 rare facial clefts, 48.7% were males and 51.3% were females (65).

4.5 Racial Distribution

The literature is replete with varying distributions of clefts amongst various races. Moodley *et al*., reported that the vast international variation may be due to deficiencies in birth defect recording and birth defect surveillance systems specifically in many parts of the developing world (80).

In Uganda, Dreise *et al*., found the highest frequency of clefts in African patients (33). Of the sample of 133 patients in our study, the African race had the highest frequency (67.7%), followed by the Asian race (14.3%) then the White race (9.8%) and lastly the Coloured race (8.2%). In 1987, Van Wyk *et al*., reported prevalence rates of 1.38 per 1000 for Whites and 0.42 per 1000 for Blacks (18). In 1985, Morrison *et al*., conducted their research in the Western Cape and reported that 83% of clefts were found in Coloureds (84).

These marked racial differences appear to be regional. The main race that populates the specific geographical location in which the research was done will appear to dominate the cleft frequency counts. Our study was done in South Africa, where the majority of the population in the immediate as well as the surrounding areas are African, thus we had a higher cleft frequency in the Africans compared to other races.

Cleft distribution amongst races showed the highest percentages were as follows: unilateral clefts were found in 42.11% of Asians, bilateral clefts were found in 34.4% of Africans, palatal clefts were found in 46.15% of Whites. All of the facial clefts and most of the midline clefts were found in the African race. These results were found to be statistically significant ($p<0.05$).

4.6 Limitations of the study

Our study sample was based on the hospital records which were not intended for research, therefore, challenges with incomplete records were encountered. The total number of records that were retrieved for our study was 230. Of these, 40% had

incomplete records, thus 97 records had to be excluded. Complete and accurate clinical records are vital for delivering quality patient care. Furthermore, the study findings will be applicable to WOHC and cannot be generalized. We were not able to use any recognized clefts classification system because the records that were collected did not use any classification to describe the cleft types.

4.7 Study Conclusions

- Wits Oral Health Centre, Cleft Clinic is providing services to a growing number of patients with OFC.
- Our study findings have shown that CLP is the most common cleft type to present, followed by CP and then CL.
- In terms of cleft distribution, unilateral clefts are the most common, followed by bilateral clefts then palatal clefts.
- Clefts that occur on the left side were more predominant than those on the right side.
- Facial clefts were rare, found in 2.26% of the study sample.
- Gender distribution showed more males presented with OFC compared to females.
- CLP is the most common cleft to present in both males and females. Females present more with CP than males.
- All facial clefts were found in females, and all midline clefts were found in males.
- The racial distribution shows that Africans have a higher cleft frequency and this could be due to the location in which the research was conducted as this aspect seems to be geographically dependant.

4.8 Recommendations

The data collected in this study could be used as a baseline for an electronic cleft data base for WOHC Cleft Clinic. This would aid in the planning and management of the resources that are required for patients with OFC.

The WOHC makes use of paper examination forms that insert into plastic slip clovers. Many of the files in this study were misplaced and subsequently duplicated thus losing all clinical notes and tests that had been completed. A number of these records were illegible but due to incompleteness, they were excluded from our study. It will be beneficial to the WOHC facility to consider electronic forms. This will minimize loss of records and clinicians will be able to easily keep track of information and treatment progress. Records should be password protected to maintain confidentiality. Patient information can be made electronically available to different departments for treatment that requires a multi-disciplinary team, or if information needs to be sent to a different institution in the case of a referral or a relocation of a patient. Electronic data collection offers direct data entry at the initial point of contact. It is less time consuming and information is stored immediately electronically. The availability of information and communication technologies for direct data transfer has great potential in improving the conduct of public health research in resource-poor settings (85).

Further research is recommended to analysis and explore the data regarding patient and parent perceptions of OFC, treatment and surgical waiting times, treatment costs and outcomes.

Taking into consideration the increasing world population as well as annual birth rates, OFC places an enormous burden on healthcare systems worldwide. It will be beneficial to establish an active birth surveillance system for congenital anomalies in South Africa. This will improve public health service planning, it will contribute to developing appropriate health policies as well as enabling comprehensive management of individuals with OFC.

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Appendices

Appendix A – Data Record Sheet

Section 1: Background Information

For official use only		Unique Identity Number _____
☐	Age of Patient	Years ____ Months_____
☐	Age of patient at first Consultation(0 if at birth)	Years____ Months _____
☐	Nationality	☐ RSA…1 ☐ Other…2
☐	Gender	☐ Male…1 ☐ Female…2
☐	Ethnicity	☐ African…1 ☐ Asian…2 ☐ Coloured…3 ☐ White…4 ☐ Other…5
☐	Hospital Classification	☐ H0/HG…1 ☐ H1…2 ☐ H2…3 ☐ H3…4 ☐ PF…5 ☐ PH…6

SECTION 2: Clinical Information

For official use only		
☐	Type of defect	☐ Cleft lip…1 ☐ Cleft palate…2 ☐ Cleft lip & palate…3 ☐ Other…9
☐	Description of cleft	☐ Unilateral…1 ☐ Bilateral…2 ☐ Palate…3 ☐ Midline…4 ☐ Other…9
☐	Cleft laterality	☐ Left…1 ☐ Right…2 ☐ Left & Right…3 ☐ Palate…4 ☐ Midline…5 ☐ Other…9
☐	Position of the cleft	☐ Lip…1 ☐ Alveolar…2 ☐ Palate…3 ☐ CLP …4 ☐ Lip & alveolar…5 ☐ Other…9

End of form

Appendix B – HREC Ethics Clearance Certificate

UNIVERSITY OF THE WITWATERSRAND JOHANNESBURG

R14/49 Dr F Carrim

HUMAN RESEARCH ETHICS COMMITTEE (MEDICAL)
CLEARANCE CERTIFICATE NO. M1911172

NAME: (Principal Investigator)	Dr F Carrim
DEPARTMENT:	School of Oral Health Sciences Department of Orthodontics Dental School University
PROJECT TITLE:	Profile of cleft lip and palate patients at Wits Oral Health Centre Cleft Clinic
DATE CONSIDERED:	2019/11/29
DECISION:	Approved unconditionally
CONDITIONS:	
SUPERVISOR:	Professor P Hlongwa
APPROVED BY:	Dr CB Penny, Chairperson, HREC (Medical)
DATE OF APPROVAL:	2020/03/11

This clearance certificate is valid for 5 years from date of approval. Extension may be applied for.

DECLARATION OF INVESTIGATORS

To be completed in duplicate and **ONE COPY** returned to the Research Office Secretary on the 3rd Floor, Phillip Tobias Building, Parktown, University of the Witwatersrand, Johannesburg.

I/we fully understand the conditions under which I am/we are authorized to carry out the above-mentioned research and I/we undertake to ensure compliance with these conditions. Should any departure be contemplated, from the research protocol as approved, I/we undertake to submit details to the Committee. I **agree to submit a yearly progress report**. When a funder requires annual re-certification, the application date will be one year after the date when the study was initially reviewed. In this case, the study was initially reviewed in **November** and will therefore reports and re-certification will be due early in the month of **November** each year. Unreported changes to the application may invalidate the clearance given by the HREC (Medical).

Principal Investigator Signature

13 MARCH 2020
Date

PLEASE QUOTE THE CLEARANCE CERTIFICATE NUMBER IN ALL ENQUIRIES

Appendix C – Turnit-in Report

PROFILE OF CLEFT LIP AND PALATE PATIENTS AT WOHC CLEFT CLINIC

ORIGINALITY REPORT

12%	8%	10%	2%
SIMILARITY INDEX	INTERNET SOURCES	PUBLICATIONS	STUDENT PAPERS

PRIMARY SOURCES

1	journals.plos.org Internet Source	3%
2	Cleft Lip and Palate, 2013. Publication	1%
3	Mary O'Brien. "Plastic & Hand Surgery in Clinical Practice", Springer Science and Business Media LLC, 2009 Publication	1%
4	discovery.ucl.ac.uk Internet Source	1%
5	P.A. Mossey, B. Modell. "Epidemiology of Oral Clefts 2012: An International Perspective", S. Karger AG, 2012 Publication	<1%
6	open.uct.ac.za Internet Source	<1%
7	link.springer.com Internet Source	<1%

8	propertibazar.com Internet Source	<1%
9	worldwidescience.org Internet Source	<1%
10	hdl.handle.net Internet Source	<1%
11	wiredspace.wits.ac.za Internet Source	<1%
12	Submitted to Loma Linda University Student Paper	<1%
13	"Craniomaxillofacial Reconstructive and Corrective Bone Surgery", Springer Science and Business Media LLC, 2019 Publication	<1%
14	Sabrina Pavri, Christopher R. Forrest. "Demographics of Orofacial Clefts in Canada from 2002 to 2008", The Cleft Palate-Craniofacial Journal, 2013 Publication	<1%
15	Phumzile Hlongwa, Jonathan Levin, Laetitia C. Rispel. "Epidemiology and clinical profile of individuals with cleft lip and palate utilising specialised academic treatment centres in South Africa", PLOS ONE, 2019 Publication	<1%

16	Thangamadhan Bosemani, Andrea Poretti. "Cerebellar disruptions and neurodevelopmental disabilities", Seminars in Fetal and Neonatal Medicine, 2016 Publication	<1%
17	curationis.org.za Internet Source	<1%
18	www.guident.net Internet Source	<1%
19	Mary OBrien. "Craniofacial, Cleft Lip, and Palate", Plastic & Hand Surgery in Clinical Practice, 2009 Publication	<1%
20	"Gregory's Pediatric Anesthesia", Wiley, 2012 Publication	<1%
21	onlinelibrary.wiley.com Internet Source	<1%
22	www.mdpi.com Internet Source	<1%
23	"Prevalence at Birth of Cleft Lip with or without Cleft Palate: Data from the International Perinatal Database of Typical Oral Clefts (IPDTOC)", The Cleft Palate-Craniofacial Journal, 2011 Publication	<1%

24	Submitted to University of Birmingham Student Paper	<1%
25	Agneta Karsten, Margareta Larson, Ola Larson, (for the Stockholm Cleft Palate Tea. "Length of the cleft in relation to the incidence of hypodontia of the second premolar and to inheritance of cleft lip and palate in children with isolated cleft palate", Scandinavian Journal of Plastic and Reconstructive Surgery and Hand Surgery, 2009 Publication	<1%
26	Seidu A. Bello, Allwell Brown Ibikari, Ifeoluwa Oketade, Saliu A. Balogun. "Atypical Facial Clefts From Northcentral Nigeria, Review of 36 Cases", The Cleft Palate-Craniofacial Journal, 2018 Publication	<1%
27	Yusuke Katayama, Kenta Tanaka, Tetsuhisa Kitamura, Taro Takeuchi et al. "Incidence and mortality of patients transported by ambulance during the first surge of the COVID-19 pandemic in Osaka Prefecture, Japan", Research Square, 2021 Publication	<1%
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32	Emily R. Gallagher, Brent R. Collett, Sheila Barron, Paul Romitti, Timothy Ansley, George L. Wehby. "Laterality of Oral Clefts and Academic Achievement", Pediatrics, 2017 Publication	<1%
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