



Orofacial Manifestations of Leprosy Patients in Cameroon

Tasing Kelmed Nfor¹, Ashu Michael Agbor^{1*}, Alfred Njamnshi Kongyuy² and Sudeshni Naidoo³

¹Faculty of Dentistry, Université des Montagnes, P.O.Box 208, Bangangte, Cameroon.

²Faculty of Health and Biomedical Sciences, University of Yaoundé Teaching Hospital, Cameroon.

³Department of Community Oral Health, Faculty of Dentistry, University of the Western Cape, Cape Town, South Africa.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Leprosy is a chronic infectious disease with interpersonal transmission caused by *Mycobacterium leprae*, a microorganism that has an affinity for the skin and peripheral nerves. In more advanced stages, it affects internal organs and the mucous membranes, with a high potential for causing physical disability.

The aim of the present study was to determine the frequency of orofacial manifestations in patients diagnosed with leprosy.

A cross-sectional, descriptive study was carried out over a 6 month period from January to June 2020. After explaining the study design to the patients, demographic information and a review on the evolution of leprosy were recorded in a structured questionnaire. An intraoral and extraoral examination was carried out to determine the orofacial leprosy lesions.

A total of 63 patients with leprosy, 39 (61.9%) males and 24 (38.1%) females with a mean age of 52.2±2.1 were examined. Two thirds 38 (60.3%) presented with the lepromatous variant, while 25 (39.7%) had the tuberculoid variant. Positive oral or facial lesions were seen in 41(65%) patients.

Facial lesions were present in 29 (46.1%) half 20 (52.6%) in the lepromatous type and 9 (36.6%) in tuberculoid type. The predominant manifestations were loss of eyelashes or scanty eyebrows 11 (15.9%), followed by hypopigmented patches over facial skin 8 (12.7%) and ocular involvement 6 (9.5%). Oral lesions were present in 12 (19.1%) patients, with which 9 (23.6%) were lepromatous and three (12%) tuberculoid. Fissured tongue 6 (9.5%) and circumferential papillary hypoplasia 3 (4.8%) were more predominant. The mean DMFT and plaque index were 16.5 and 2.7 ± 1.2 respectively.

Orofacial lesions are associated with leprosy infection with a low frequency. The present study found that dental caries and periodontal diseases were frequent and severe in this population. It is anticipated that the findings of the study will assist in initiating and creating periodic surveys and interventions in terms of awareness campaigns among the leprosy patients. The oral mucosa should be thoroughly examined in patients with leprosy, as the oral mucosa may be a secondary source of *Mycobacterium leprae* transmission and infection.

Keywords: Leprosy; orofacial lesions; *Mycobacterium leprae*; tuberculoid; lepromatous; Cameroon.

1. INTRODUCTION

Leprosy (also known as Hansen's disease) is a neglected infectious caused by slow-growing bacteria called *Mycobacterium leprae*. It affects the soft tissues of the body like nerves, skin, eyes, face, oral and nasal mucosa. Leprosy has been known since ancient times and is considered an antique disease [1]. It has been described as kushta roga in some parts of India [2] and infected people have been isolated from society because of their unsightly appearance and unacceptable deformities. It was considered as one of the major social stigmas, associated with much pain and emotional trauma due to prolonged isolation of infected people from the society and their families [3].

In 1991, the 44th World Health Assembly identified it as a public health problem and set a target for the elimination of leprosy from the world by 2000 [4]. Elimination was defined as a prevalence of less than 1 case per 10 000 population. Many people found this definition difficult to understand. The "elimination of leprosy" slogan galvanized activities worldwide, which has also dominated the priorities in leprosy prevention [5]. With the World Health Organization (WHO) preventive and treatment approaches, there has been a notable decline in the global prevalence of leprosy, which has been primarily attributed to the use of multidrug therapy (MDT). In 2011, 130 countries and territories (specifically from regions in Southeast Asia, North and South America, Africa and the Western Pacific) submitted reports of leprosy to the WHO. These reports revealed that a total of 228 474 new cases were detected in 2010, and the global registered prevalence for the first quarter of 2011 was 192 246 cases [6]. The

report also revealed that the disease was more frequent in less developed countries and most often affected populations with low socioeconomic status. With variable prevalence, India and Brazil were respectively the first and second with the highest number of leprosy cases [7]. This prompted the Pan American Health Organization (PAHO) to include leprosy in the group of neglected diseases and other poverty-related infections, and considered it a public health problem [8].

In 1985, Cameroon was classified among the 122 leprosy endemic countries. By the end of 2000, 107 countries including Cameroon had attained the leprosy elimination threshold of less than 1 case per 10000 population at the national level [9]. Though eliminated at the national level, Cameroon, like many other countries, continued to harbor leprosy hotspots at subnational levels. Hence, the declaration of elimination of leprosy led to a significant reduction in resource allocation for leprosy control activities in the country making the challenge for further reduction of the current leprosy burden a huge task [10]. All 10 regions of the country were said to have achieved leprosy elimination between 2000 and 2014. However, seven regions were found to be at 'medium-burden' for leprosy while two regions (Littoral and the Far North) were at 'low-burden' level at the end of 2014. Ten health districts were still to attain elimination by 2014, and some health regions and health districts (HD) have continued to report significant numbers of cases [11].

Oro-facial morbidity of the disease had attracted a lot of attention of these patients since most lesions are located in this esthetic zone. The association of leprosy with the oral cavity and

facial region has been speculated over the past few decades [12]. Despite oral examination being part of the comprehensive examination of a patient with leprosy, there are few studies describing their oral health and dental care. Cutaneous manifestations of the disease are well documented in literature [13,14]. Descriptions of oral and facial findings are scarcely detailed, making comparisons difficult especially if the treatment of the disease was not effective [15-17]. Questions are often posed as to whether leprosy patients are at risk of oral lesions, and how often oral lesions are seen in leprosy patients. However, most dentists have little information when they see leprosy patients and are unaware of the oral and facial manifestations of leprosy [12]. It is important that dentists are aware of the presentation of leprosy in the orofacial complex. A number of studies have been conducted in southern India, Brazil, and Nigeria and in many other countries pertaining to this association [18].

In addition to the possibility of orofacial lesions being secondary to the disease, poor oral health status represents a potential risk factor for disease transmission, and the occurrence of leprosy reactive episodes. One of the most critically undervalued aspect within the comprehensive care plan for leprosy is oral health [19-21]. Oral health has a significant impact on the quality of life and clinical evolution of leprosy patients. The diagnosis and appropriate treatment of oral diseases, especially those associated with orofacial infections, might help reduce the incidence of leprosy reactions and facilitate their management upon occurrence [22-27]. Orofacial manifestations are very important in understanding the disease stage, its varied manifestations and complications. Thus, the aim of the present study was to determine the orofacial manifestations of leprosy in individuals affected by this disease in Cameroon.

2. METHODS

A multicenter cross-sectional, descriptive study was carried out over a period of 6 months from January to June 2020 at the following Centres: the Dibamba Leprosy Centre located in the Sanaga Maritime Division of the Littoral region, the Ayos Leprosy centre in the Centre region, the Kwamb Centre in Abong –mbang region and the Nden Centre in Sangmelima, East region.

Participants were recruited using convenience sampling of patients from leprosy centers and district hospitals. The study samples were categorized into four groups according to the duration of exposure to the disease process: 0-3, 3-10, 10-20, and more than 20 years. Inclusion criteria were all patients diagnosed of leprosy with either the lepromatous, or tuberculoid variants, treated or undergoing treatment who gave their consent and were willing to undergo clinical evaluation.

2.1 Procedure

After obtaining authorization to carry out the study, prospective patients were selected. The purpose of the study was explained to the study participants who fulfilled the inclusion criteria and provided written informed consent was obtained from them. After obtaining consent, the study was carried out in 3 steps: (i) the patient was interviewed using a guided, pretested and validated structured questionnaire, (ii) the patient's medical records were examined and (iii) a clinical examination was carried out under bright natural light [28,29].

A structured questionnaire was used to collect information that included the patient's sociodemographic information (sex, age, region of origin, marital status, educational level and profession), history of leprosy (type and duration of leprosy, treatment provided). Extra oral and intra oral clinical examinations were carried out under ample natural daylight and sometimes with artificial illumination, and facial and oral manifestations of leprosy were noted. The DMFT index was used to determine decayed, missing and filled teeth. Oral hygiene was rated using the Simplified Oral Hygiene Index (OHI-S) [30-37].

Greene and Vermillon Simplified Oral Hygiene Index 1964 (OHI-S): This index includes two distinct components: the debris index (ID) which measures the coronal extension of soft deposits to the first, second or last third of the buccal or lingual surfaces of the teeth and the tartar index (IT) which measures the corresponding coronal extension of the subgingival tartar in the form of isolated deposits or a continuous strip [38]. The oral hygiene index was categorized according to the Green and Vermilion classification as follows: Good: 0-1.2; Fair: 1.3-3.2; Poor: 3.3-6.

Table 1. Simplified Oral hygiene Score (Greene and Vermillon, 1964)

Debris index (ID)	Tartar index (IT)
0 = no debris.	0 = no tartar.
1 = 1/3 of the face is covered with debris.	1 = 1/3 of the face is covered with tartar.
2 = 2/3 of the face is covered with debris.	2 = 2/3 of the face is covered with tartar.
3 = The entire face is covered with debris.	3 = The whole face is covered with tartar.

A data template was created in Epi info 7.1.3 and data was directly introduced into the data base for analysis using Epi info 7.1.3. Test of association was done using Chi Square statistics and $p < 0.05$ was considered as statistical significant. The results are presented in the form of tables and figures from Microsoft Excel 2010 software. Both quantitative and qualitative variables were analysed.

3. RESULTS

3.1 Demographic Data

A total of 63 patients with leprosy were examined. The majority were from rural areas (73.1%) and half were from the Littoral and Centre regions. Nearly two thirds 39 (61.9%) were male and 24 (38.1%) females with an mean age of 52 years (± 2.2 sd). The most represented age group was 61-70 years 15 (23.8%), followed by the age groups 51-60 years 14 (22.2%) and 31-40 years 10 (15.8%) and a quarter (25.3%) were single and a fifth married (22.2%). Nearly half (46.0%) had only a primary school education, 23.8% a secondary education and 20.6% were uneducated. Almost half (49.2%) of

the participants were currently working, 21 (33.3%) were not actively working and 11 (17.7%) had never worked.

3.2 Leprosy Data

Patients were categorized using Hansen's criteria into four groups on the basis of their duration of exposure to the disease in years: 0-3 years (Group I), 3-10 years (Group II), 10–20 years (Group III), and more than 20 years (Group IV). Nearly half (44%) were found to be in Group IV (17 (26.9%) were male and 11 (17.5%) female) and 33% in Group III. All the groups were dominated by a higher number of males. The differences calculated between the groups was not statistically significant (Table 2).

Two types of leprosy - the lepromatous and the tuberculoid variant were found in the present study. In a total 63 leprosy patients, 25 (39.7%) had the tuberculoid variant while 38 (60.3%) had the lepromatous variant. All four groups of duration of exposure were analyzed on the basis of whether they were of the tuberculoid or lepromatous type (Table 3).

Table 2. Duration of exposure with respect to gender

Duration of exposure (years)	Male [n (%)]	Female [n (%)]	Total [n (%)]	P value
0-3 years (I)	3 (4.7)	0 (0%)	3 (4.7%)	0.67
3-10 years (II)	6 (9.5%)	5 (7.9%)	11 (17.4)	0.58
10-20 years (III)	13 (20.6%)	8 (12.6%)	21 (33.3%)	1.00
>20 years (IV)	17 (26.9%)	11 (17.5%)	28 (44.4%)	0.86
Total	39 (61.9%)	24 (38.1%)	63 (100%)	

Table 3. Type of Hansen's disease with reference to the duration of disease

Duration of exposure (years)	Hansen's patients n(%)	Tuberculoid n (%)	Lepromatous n (%)	pvalue
0-3 years (I)	3 (4.7%)	2 (3.2%)	1 (1.5%)	0.33
3-10 years (II)	11 (17.4)	7 (11.1%)	4 (6.3%)	0.07
10-20 years (III)	21 (33.3%)	9 (14.3%)	12 (19.0%)	0.72
>20 years (IV)	28 (44.4%)	7 (11.1%)	21 (33.3%)	0.03
Total	63 (100%)	25 (39.7%)	38 (60.3%)	

Hansen`s patients were more present in group (IV) with which 21 (33.3%) were lepromatous and 7 (1 1.1%) were tuberculoid with a p value 0.03 whereas patients in group (II) had the tuberculoid type 7 (11.1%) more than the lepromatous 4 (6.3%).

3.3 Oral and Facial Manifestations

The total number of participants presenting with oral and facial manifestations was 41 (65.5%), 24 (58.5%) were male and 17 (41.5 %) female.

3.4 Facial Manifestations

More than a third 29 (46.1%) presented with facial manifestations with 29 (46.1%) in the lepromatous variant 20(52.6%) and 9 (36%) in the tuberculoid variant. The predominant facial manifestations were loss of eyelashes /scanty eyebrows 10 (15.9%), hypo-pigmented patches over facial skin 8 (12.7%) and ocular involvement 6 (9.5%). Atrophy of the nasal spine, saddle nose and leonine facies were not represented in the present study. The different between the various facial manifestations were not statistically significant (Table 4).

3.5 Oral Manifestations

Twelve participants (19.1%) presented with oral manifestations with a greater number in the

lepromatous variant 9 (23.6%) than in the tuberculoid variant 3 (12.0%). The most common oral manifestations were fissured tongue 6 (9.5%) and inflammatory papillary hyperplasia 3(4.8%). The difference between the various facial manifestations were not statistically significant (Table 5).

3.6 Oral Health Status and Treatment Needs

3.6.1 Oral health practices and social habits

Most patients 47(74.6%) reported following proper hygiene measures regarding tooth brushing with minimum frequency of twice a day; however, mouth rinse and dental floss was not used by any individual. A third, 25 patients (39.6%) reported not having received specific dental guidance after leprosy diagnosis. Intake of alcohol and smoking were reported by 12 (19.0%) participants.

3.6.2 DMFT index

Decayed teeth were present in 41(64%) of the patients, missing teeth in 52 (82%) and filled teeth in 8 (12%). The overall mean DMFT was 12.0. The DMFT index for the age range 61-70 years had the greatest mean DMFT index of 16.5 followed by the age range 51-60 years with a mean DMFT index of 14.4 (Table 6).

Table 4. Facial manifestations

Facial manifestations	Tuberculoid n (%)	Lepromatous n (%)	Total n(%)	p-value
Hypopigmentation or erythematous facial patches	3(12.0%)	5(13.2%)	8(12.7%)	0.65
Collapse of the nasal bridge	0	2 (5.3%)	2(3.2%)	0.33
Loss of eyebrows or eyelashes	3(12.0%)	7(18.4%)	10(15.9%)	0.63
Nodular eruptions	1(4.0%)	2(5.3%)	3(4.8%)	0.93
Ocular involvement	2(8.0%)	4(10.6%)	6(9.5%)	0.89
Total	9(36.0%)	20(52.6%)	29(46.1%)	

Table 5. Oral manifestations

Oral manifestations	Tuberculoid n (%)	Lepromatous n (%)	Total n(%)	p value
Erythematous lesions on oral mucosa	0	1(2.6%)	1(1.6%)	0.56
Fissured tongue	2(8.0%)	4(10.5%)	6(9.5%)	0.52
Lingual varices	0	1(2.6%)	1(1.6%)	0.56
Candidiasis	0	1(2.6%)	1(1.6%)	0.56
Inflammatory papillary hyperplasia	1(4.0%)	2(5.3%)	3(4.8%)	0.72
Total	3(12.0%)	9(23.6%)	12(19.1%)	

Table 6. DMFT Index with respect to Age

Age range (Years)	Numbers of patients n (%)	OHI-S Index
20-30	9(14.3%)	1.3
31- 40	10(15.8%)	1.4
41-50	8(12.7%)	2.2
51- 60	14(22.2%)	3.7
61-70	15(23.8%)	4.2
71-80	3(4.8%)	2.7
81-90	4(6.3%)	3.1

3.7 Greene and Vermillon Simplified Oral Hygiene Index 1964 (OHI-S)

The mean Debris Index-Simplified score and the mean Calculus Index-Simplified score was summed up to give the mean Oral Hygiene Index-Simplified score. The categorization of oral hygiene index according to the Green and Vermillon classification is as follows: Good: 0-1.2; fair: 1.3-3.2; Poor: 3.3-6.

The mean Debris Index- Simplified score was 1.2 ± 0.6, the mean Calculus Index-Simplified score 1.5 ± 0.4 and the mean Oral Hygiene Index-

Simplified score was 2.7 ± 1.2 (Table 7). The oral hygiene of leprosy patients was considered to be fair according to the Green and Vermillon classification (Table 7).

The majority 52 (82.5%) needed dental treatments. The highest treatment needs was the need for teeth restoration (root canal treatment RCT and coronal reconstruction). Restorative treatment needs were seen in 15 (23.8%), 13 (20.6%) required dental scaling and polishing, and 10 (15.8%) prostheses to replace the loss of one or more teeth. Dental extraction was required by 7(11.1%) (Fig. 1).

Table 7. Simplified oral hygiene index (OHI-S) with respect to age

Age range (Years)	Numbers of patients n (%)	OHI-S Index
20-30	9(14.3%)	1.3
31- 40	10(15.8%)	1.4
41-50	8(12.7%)	2.2
51- 60	14(22.2%)	3.7
61-70	15(23.8%)	4.2
71-80	3(4.8%)	2.7
81-90	4(6.3%)	3.1

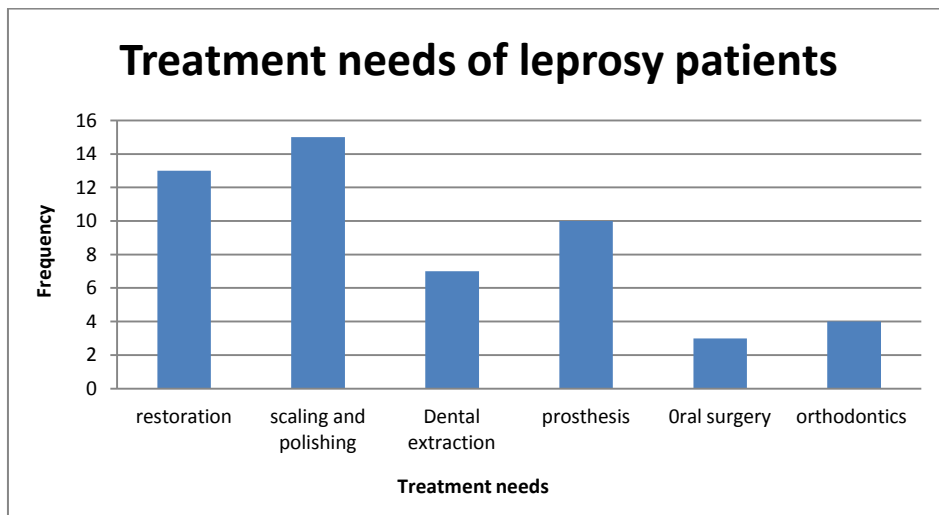


Fig. 1. Unmet dental treatment need

4. DISCUSSION

Leprosy is an infectious disease of great significance in dentistry because of its infectivity; precautions have to be taken when handling patients in the clinic. Although leprosy involves the oral cavity in up to 60% of the patients, examination of the oral cavity in leprosy clinics or oral health science clinics is often neglected [39].

4.1 Sociodemographic Data

The patients included in our study were a heterogeneous group of 63 known leprosy patients of which 61.9 % were male. Similar results of higher male than female patients were reported by Taheri et al. [40], Pooja et al. [41], Boggild et al. [42], but Souza et al. [18], reported an almost equal percentage of males to females. There appears to be no specific reason for this predisposition apart from the fact that, men are probably more exposed to infection in the external environment and generally women are swift to seek medical advice earlier in cases of an abnormal cutaneous presentation, perhaps for aesthetic reasons.

The mean age of our study population was 52.2 ± 2.1 , with an age range from 23 to 85 years. The mean age was close to previous studies by Babu et al. [3] and Taheri et al. [40] who had the average of 51.86 ± 6.1 and with an age group ranging from 7 to 87 years.

In the current study, participants from the Littoral and Centre regions had a higher representation in the present study, in contrast to the study conducted by Tabah et al. [11], who found higher prevalences in the Adamawa, East, North, and South-west regions. This might be because the leprosy centers in these regions are more populated with good health rehabilitation services that in the northern regions of the country. The recent study also revealed that more than two thirds of the patients resided in rural areas. This is similar to a review by Nsagha et al. [10] on leprosy epidemiological surveillance that highlighted that endemic foci is mostly in rural localities. This could be explained by the fact that under previous policies, people diagnosed with leprosy were moved to rural areas for isolation.

The current study revealed that a third of the participants were either single or divorced. This could be due to social stigma and risk of infection associated with the disease making the patients preferring to stay single or later divorcing after

being diagnosed with leprosy [43-44,42,45,46]. In addition it was found in the current study that leprosy may influence the marital and sexual relationship of married women. Similar observations were found in the Eastern Terai region of Nepal by Noordende et al. (2006) who concluded that significant problems during treatment, (which is often a full year), such as having no intimate relations due to fear of contamination, experiencing more distancing from each other, and husband and wife sleeping in separate beds contributed to divorce and singlehood [47]. The fear of contamination also affected the education as nearly half of the participants only had a primary school education. They had to be isolated and were prevented from being in contact with other students in school because of the risk of infection [48-50] This isolation resulted in dropping out of school. Some patients reported of that the trembling of their hands hindered them from writing. Similar reports were made by Frare [44].

A third of the study participants were not currently working due to sequelae of the disease such as finger disfigurement or leg amputation, ocular involvement, visual impairment as well as facial deformities. Leprosy is a notifiable disease known for its disfiguring capability [51].

4.2 Leprosy Data

With regard to the duration of exposure of leprosy with respect to the gender, it was found that gender representations were less pronounced in Group I followed by Group II. The majority of Hansen's patients were in group IV (>20years) and with a greater preponderance in males. However the differences between the groups were not statistically significant. This observation is similar to that of Babu et al. [3] and Taheri et al. [40] and could be due to the fact that males are more exposed to infection and are not always prompt to show up for early consultation.

The number of participants with both the lepromatous and the tuberculoid type of leprosy increased with increased in duration of exposure. The majority presented with the lepromatous type of leprosy than the tuberculoid type in Groups II, III and IV. However Group I had a majority of the tuberculoid form. Group IV showed diversity in the distribution of the two polar forms of this disease – two thirds were affected with lepromatous leprosy. The differences in Groups II and IV were statistically

significant. These findings corroborates that of Babu et al. [3] and Souza et al. [18]. However, the results were in contrast to the study conducted by Boggild et al. [42], where the rate of lepromatous leprosy was lower than other type of leprosy. The lepromatous type of leprosy is known to have a greater risk of contagion and it usually presents with widespread lesions [52].

4.3 Orofacial Manifestations

Oral and facial changes recorded in the present study were less prevalent than previously reported studies. The gradual reduction of oral and facial changes reported in recent studies may be attributed to the efficacy of multidrug therapy (MDT) together with earlier diagnosis of the disease [53,54]. Orofacial changes were analysed with respect to the type of Hansen's disease and the difference between the various facial and oral manifestations were not statistically significant. They were found to occur more frequently in the lepromatous form of leprosy than the tuberculoid form as with the study of Babu et al. [3]. Oral and facial manifestations were also found more commonly in Group IV participants suggesting that orofacial manifestations increased with increased duration of the disease [55,56]. These manifestations were rarely found in patients with less duration of exposure suggesting that early diagnosis and prompt treatment would control the disease progression to severe unaesthetic oral and facial changes that are seen later as the disease progresses [18,57]. Cell-mediated immunity is considered to be a crucial defense against the disease and the magnitude of this immunity defines the extent of the disease [12,58].

In the current study, participants with more than 20 years of disease exposure manifested various facial features such as the loss of eyelashes, scanty eyebrows, hypopigmented patches over the facial skin and ocular involvement. Atrophy of the nasal spine, saddle nose and leonine facies typical of most leprosy patients were not seen in the present study. Babu et al. [3] reported the occurrence of similar facial manifestations albeit with higher frequency. Taheri et al. [40] found atrophy of the anterior maxillary ridge, facial deformity and atrophy of nasal spine, however these severe facial changes were not seen in the present study. Similarly earlier literature reports on high prevalences of these lesions together with leonine facies, lepromas and inflamed ear lobules. This could be explained by the fact that

the nowadays the disease does not progress to such severe stages and it is being controlled earlier with the use of multidrug therapy [3].

Our study revealed a fifth of participants presented with oral manifestations presented more with the lepromatous variant than in the tuberculoid variant. Bommanavar et al. [59] reported that the involvement of the oral cavity in leprosy is variable and may be seen in 19%–60% of patients and that the oral lesions are more common in the lepromatous (LL) form [53]. Similarly, Prabhu et al. [58], in a review of 700 leprosy patients found a 11.5% prevalence of oral involvement and the lesions tended to occur more in lepromatous leprosy variant. In the current study, the predominant oral lesions found included fissured tongue and inflammatory papillary hyperplasia. The high prevalence of fissured tongue corroborates with the study in India by Rawalani et al. (2011), [60] who reported tongue abnormalities as the most common finding with fissured tongue being the commonest feature. In contrast to reports by Pooja et al. the incidence of crenated tongue was the lowest [58]. Reasons attributed for the predominance of fissured tongue was non-specific and may not be directly related to the disease progression. Motta et al. [61] found that the dorsal aspect of the tongue, soft palate and uvula were the common areas of involvement [62]. The progression of these lesions are slow and are usually asymptomatic. The presence of oral lesions is directly proportional to the duration of the disease which is usually considered a late clinical manifestation [53,63]. Frare [44] indicated that in the advanced stages of the disease process, there may be deformities and functional alterations, such as fibrosis of the soft palate or perforation of the hard palate, with serious disturbances in the production or utterance of speech sounds [63].

4.4 Oral Hygiene Data

In the current study, most participants reported following oral hygiene measures regarding tooth brushing, brushing with a minimum frequency of two times a day; however, mouth rinse and dental floss was seldom used. Alcohol intake and smoking were reported by less than twenty per cent of the respondents. The unsatisfactory oral hygiene practices reported by participants was probably related to difficulties with performing routine oral hygiene activities due to hand deformities, aging, low educational levels and poor oral-health habits. However, a recent

study by Robert et al. [2019] concluded that approximately one-third of older people who presented with hand deformities have a dependence on others for brushing and rinsing which is a challenging task for them to perform [63]. Furthermore, the majority of patients resided in rural areas with poor accessibility of dental services being a barrier to dental care.

In the present study the overall mean DMFT was 12.0. While the 61-70 year olds had the highest mean DMFT, there was no statistically significant differences between the age groups. The cumulative DMFT values increased with increasing age. In a study of leprosy patients from Serra, Brazil, Souza et al. (2009), reported a mean DMFT of 14.0 and similarly observed an increase of cumulative DMFT with respect to age [18]. As age increased, dental caries became more severe and DMFT scores were found to be related to the educational level of participants, suggesting that increased education enhances an awareness of oral health care and reduce the prevalence of dental disease. In the present study, the majority were non-schooled and had little education, and this affected both their quality of life and oral health, and contributed to high dental caries. There were high levels of decayed and missing teeth, similar to the findings of Souza et al. [18].

Oral hygiene status was and is considered of the participants of the current study was fair according to the Green and Vermillion categorisation. Kungsi et al. [64] in South India found a higher OHI-S score of while Rawalani et al (2011) in Central India reported an OHI-S score of 3.50, both in the poor category [60]. Generally the poor oral hygiene index of leprosy patients is due to the poor manual dexterity as a results of deformities and scars from leprosy. Poor oral health education can also be a contributing factor. This is supported by the fact that lack of oral health education and care reported by a third of the participants was the reason given for the accumulation of dental plaque and calculus. The lack of oral health education, organized oral health care or even basic emergency dental treatment are often more pronounced in isolated groups, such as leprosy centers or known leprosy villages. This poses a barrier to the acquisition of adequate oral health education on oral health practices by persons afflicted with leprosy. The lack of improvised measures and oral hygiene aids for assisting patients with hand deformities to utilize various

implements (e.g. pens and toothbrushes) makes it difficult for them to perform their routine oral hygiene activities [18]. Robert et al. 2019 [63] reported that by providing leprosy patients with assistive devices, it increased their independence in oral hygiene activities. Most the patients who accepted and adopted a personalized assistive device showed improved performance in brushing or utilizing mouthwashes.

4.5 Unmet Treatment Needs

The high DMFT and the Oral hygiene index levels found in the present study were reflective of the extensive treatment needs required. There was a high need for restorative treatment and this could be due to the fact that teeth restoration is expensive, require special equipment and skills . Furthermore, to avoid contamination, oral health personnel are fearful of the consequently there is a high burden of dental treatment needs among patients with leprosy. Simple dental interventions like the atraumatic restorative treatment could go a long way to assist these patients.

5. CONCLUSION

The majorities of the patients, were males, lived in the rural settlement and of age range was 23-85 years.

The lepromatous variant of leprosy were more than the tuberculoid variant.

Facial lesions findings were present in more than half of the patients. Loss of eyelashes or scanty eyebrows, hypopigmented patches over facial skin and ocular involvement were the predominant facial manifestations. Oral lesions included fissured tongue and circumferential papillary hypoplasia. The mean DMFT and plaque indices were high.

The oral health unmet treatment needs were mostly restorations and periodontal treatment.

As compared to earlier studies, the advent of modern protocols in the treatment of leprosy, the severity of the disease and the number of patients with oral and facial manifestations seen in this study was relatively low. Advanced orofacial lesions were only found in participants who were afflicted by the disease for more than 10 years.

6. RECOMMENDATIONS

The Ministry of Public Health should constitute Multidisciplinary teams with oral health professionals with that will be involved in the diagnosis, treatment and management of people with leprosy.

Oral health workers should educate assigned to leprosy centers should equip leprosy patients and presenting with manual disabilities with assistive technology that can reduce dependence on others for oral hygiene.

Encourage people with leprosy to seek treatment and expand multidrug therapy (MDT) services to all health facilities.

Faculties of Dentistry should include the diagnoses and management of leprosy in the curriculum.

7. LIMITATIONS OF STUDY

The use of an interpreter in rural areas to translate the interviews from the local dialects to English or French may have introduced some misinterpretations, since not all words could be translated literally.

Leprosy is a disease in which most infected persons lived in isolated areas and are faced with social stigma, so convincing them to take part in the study was challenging.

The time constraint due to the unprecedented long period of Covid19 confinement was a limitation to the size of the study population.

ETHICAL APPROVAL AND CONSENT

Ethical clearance was obtained from the Institutional Ethics Committee of Université des Montagnes (21/CD/UdM/2020). In addition, research authorization was obtained from the management of the National Yaws, Leishmaniasis, Leprosy and Buruli Ulcer Control Programme, Ministry of Public Health Cameroon (007/20/Minsante /SG/DLMEP/SDMPMTN/CNLP2LUB). The consultation, interview and examinations took place only after written informed consent was freely obtained from the participants, formal consent was obtained from the parent/guardian for children or minors who participated in the study . They were informed that they could withdraw from the study at any

time without any penalties or it affecting their further management. No compensation of any kind was offered to the patients. The present study was conducted in strict compliance with medical and ethical norms; the photographs were taken in strict compliance with anonymity and after written consent was obtained. The sterilization and hygiene conditions were strictly observe.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Whitcher JP, Srinivasan M. Leprosy--a new look at an old disease. *Br J Ophthalmol.* 2000;84(8):809-810. DOI: 10.1136/bjo.84.8.809
2. Manchester K. Tuberculosis and leprosy in antiquity: an interpretation. *Med Hist.* 1984; 28:162–173.
3. Babu AB, Ravikiran A, Samatha Y, Abhishek S, Mohammed A, Krishnaveni B. Oral manifestations of patients with leprosy: A disease, actually infectious but not always, still a stigma in society. *Egypt J Dermatol Venereol.* 2015;35:37–44.
4. WHO. World Health Assembly, Elimination of leprosy: resolution of the 44th World Health Assembly. Geneva: World Health Organization; Resolution No. WHA. 1991;44.
5. Lockwood DNJ, Suneetha S. Leprosy: Too complex a disease for a simple elimination paradigm. *Bull World Health Organ.* 2005; 83(3):230-5.
6. World Health Organization. Global Leprosy Programme. *Epidemiology: epidemiological situation, burden and distribution of leprosy.* Available:http://www.searo.who.int/entity/global_leprosy_programme/epidemiology/en/. [Accessed 9/9/2020.]
7. Alencar CH, Ramos AN Jr, dos Santos ES, Richter J, Heukelbach J. Clusters of leprosy transmission and of late diagnosis in a highly endemic area in Brazil: focus on different spatial analysis approaches. *Trop Med Int Health.* 2012;17:518-25.
8. Ministry of Health Brazil. *Epidemiological Bulletin. Epidemiological situation of leprosy in Brazil – analysis of the selected*

- last decade indicators and challenges for disposal. 2013;44.
9. World Health Organization. Leprosy: Global situation. WER. 2002;77(1):1-8.
 10. Nsagha DS, Bamgboye EA, Assob JCN, Njunda AL, Kamnga HLF, Bissek ACZB, Elimination of leprosy as public health problem by 2000 AD: an epidemiological perspective. Pan African Medical Journal. 2011;9:4.
 11. Tabah EN, Nsagha DS, Bissek A-CZ-K, Bratschi MW, Njamnshi TN, Plushke G, et al. The Burden of Leprosy in Cameroon: Fifteen Years into the Post-elimination Era. PLoS Negl Trop Dis. e0005012. 2016;14.
 12. Ghosh S, Gadda RB, Vengal M, Pai KM, Balachandran C, Rao R et al. Oro-facial aspects of leprosy: report of two cases with literature review. Med Oral Patol Oral Cir Bucal. 2010;15:459-62.
 13. Costa A, et al. Oral lesions in leprosy. Indian Journal of Dermatology Venereol Leprol; 2003.
 14. Mhapuskar AM, Nadpurohit MR. Facial lesions of Hansen's disease mimicking odontogenic infection – a case report. J Int Dent Med Res 2010;3:137–141.
 15. Trautman JR. A brief history of Hansen's disease. Bulletin of the New York Academie of Medicine. 1984;60(7):689-695.
 16. Monot M, Honore N, Garnier T, Zidane N, Sherafi D, Paniz-Mondolfi A, et al. Comparative genomic and phylogeographic analysis of Mycobacterium leprae. Nature Genetics. 2009;41(12):1282-9.
 17. Martins MD, et al. Orofacial lesions in treated southeast Brazilian leprosy patients: a cross-sectional study. Oral Diseases. 2007;13:270-227.
 18. Souza VA, Emmerich A, Coutinho EM, Freitas M, Silva EH, Merçon FG et al. Dental and oral condition in leprosy patients from Serra, Brazil. Lepr Rev. 2009;80:156-163.
 19. World Health Organisation, Regional Office for Africa. Progress towards the reduction of the burden of leprosy 2000-2011. WHO Afro. Brazaville, Congo; 2013. Available:http://apps.who.int/iris/bitstream/10665/164715/1/Lep_prog.pdf?ua=1
 20. ILEP. Interpretation of epidemiological indicators in leprosy. ILEP Technical Bulletin. London; 2001.
 21. Irgens LM. The discovery of the leprosy baby. Tidsskr Nor Legeforen. 2002;122: 708-709.
 22. Job CK, Jayakumar J, Kearney M, Gillis TP. Transmission of leprosy: A study of skin and nasal secretions of household contacts of leprosy patients using PCR. Am. J. Trop. Med. Hyg. 2008;78(3):518-521.
 23. Truman R, Fine PEM. Enviromental sources of Mycobacterium leprae: issues and evidence. Lepr Rev. 2010;81:89-95.
 24. Truman R. Leprosy in wild armadillos. Lepr Rev. 2005;76:198-208.
 25. Meridith A, Del-Pozo J, Smith S, Milne E, Stevenson K, McLuckie J, Leprosy in red squirrels in Scotland. Vet Rec. 2014;175: 285-6.
 26. Dave B and Bedi R. Leprosy and its dental management guidelines. International Dental Journal. 2013;63:65-71.
 27. Ridley DS, Jopling WH. A classification of leprosy for research purposes. Lepr Rev 1962;33:119-28.
 28. Naik VB, Naik UB, More S, Rao VP. Evaluation of significance of skin smears in leprosy for diagnosis, follow-up, assessment of treatment outcome and relapse. Asiatic J Biotech Res. 2011;2: 547–552.
 29. Siminovitch KA. Advances in the molecular dissection of inflammatory bowel disease Seminars in Immunology. 2006;18:244-53.
 30. Lastoria JC, Morgado de Abreu MAM. Leprosy: review of epidemiological, clinical, and etiopathogenic aspects-part 1. An Bras Dermatol. 2014;89(2):205-18.
 31. Rodrigues GA, et al. The oral cavity in leprosy: what clinicians need to know. Oral Disease. 2017;23:749-756.
 32. Pallagatti S, et al. Oral cavity and leprosy. Indian Dermatology Online Journal. 2012; 3:101-104.
 33. Groenen G, Saunderson P, Ji B. How to do a skin smear examination for leprosy. s.l. : ILEP. 2003;lg3.
 34. Siminovitch Katherine Anne. Advances in the molecular dissection of inflammatory bowel disease seminars in immunology. 2006;18:244-53.
 35. Neville, Bouquet Damm Allea. Oral and maxillofacial pathology (2nd ed). Elsevier Publishers and Distributors. 2002;176-78.

36. Jopling WH, Mc Dougall AC. Handbook of leprosy (5th ed), CBS Publishers and Distributors, New Delhi; 1996.
37. Lima LNGC, Frota CC, Mota RMS, Almeida RLF, de Andrade Pontes MA, et al. Widespread nasal carriage of Mycobacterium leprae among health population in a hyperendemic region of northeastern Brazil. Mem Inst Oswaldo Cruz, Rio de Janeiro. 2015;110(7):898-905.
38. Greene JC, Vermillion JR. The Simplified Oral Hygiene Index. JADA. 1964;68: 7-13.
39. Pallagatti S, Sheikh S, Kaur A, Aggarwal A, Singh R. Oral cavity and leprosy. Indian Dermatol Online J. 2012;3(2):101-104.
40. Taheri JB, Mortazavi H, Moshfeghi M, Bakhshi M, Bakhtiari S, Azari-Marhabi S, Alirezaei S. Oro-facial manifestations of 100 leprosy patients. Med Oral Patol Oral Cir Bucal. 2012;17(5):e728-e732.
41. Pooja VK, et al. Evaluation of the orofacial lesions in treated leprosy patients. Journal of Oral and Maxillofacial Pathology. 2014; 18:386-389.
42. Boggild AK, Correia JD, Keystone JS, Kain KC. Leprosy in Toronto: an analysis of 184 imported cases. CMAJ. 2004;170: 55-9.
43. WHO Oral Health Country/Area Profile Programme Caries Prevalence: DMFT and DMFS. Available:<http://www.whocollab.od.mah.se/exp/orhdmft.html> Accessed in April 16th, 2008.
44. Frare RW, Frare MM. A Brief Summary of Orofacial Lesions Associated with Leprosy. Acta Scientific Dental Sciences. 2019;3(3): 74-77.
45. Reibel F, Cambau E, Aubry A. Update on the epidemiology, diagnosis, and treatment of leprosy. Medecine et maladies infectieuses. 2015;45:383-393.
46. ILEP. How to diagnose and treat leprosy. London; 2001. ISBN: 094754321 X.
47. Rawlani SM, Rawlani S, Degwekar S, Bhowte RR, Motwani M. Oral health status and alveolar bone loss in treated leprosy patients of central India. Indian J Lepr. 2011;83:215-24.
48. Siddiqui R, et al. Oral Manifestation of Leprosy: A narrative review. Acta Scientific Dental Sciences. 2019;3(2):131-134.
49. Scheepers A. Correlation of oral surface temperatures and the lesion of leprosy. Int J Lepr Other Mycobact Dis. 1998;66: 214-17.
50. Greenberg CS. Burkitt oral medicine (11th ed). Bc Decker Inc Hamilton. 2008;488-89.
51. Suzuki K, et al. Current status of leprosy: epidemiology, basic science and clinical perspectives. J Dermatology. 2012;39: 121-129.
52. Manjunath Shenoy M, Suchitra U, Girisha BS, Pinto Jerome. Oro-facial lesions in leprosy: A review. JIAOMR. 2007;19(04): 54-59.
53. Walker SL and Lockwood DNJ. The clinical and immunological features of leprosy. British Medical Bulletin. 2006;77:103-121.
54. Fucci Da Costa AP, Augusto Da Costa Nevy J, Wan-del-Rey de Olveyra ML, Ramos e Silva M. Oral lesions in leprosy. Indian J Dermatol Venerol Leprol. 2003;69: 381-85.
55. Milanez MA, Abreu MD, Alchorne MM, Michalany NS. The oral mucosa paucibacillary leprosy: a clinical and histopathological study. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2007;103: e48-e52.
56. Van't Noordende A, Van Brakel W, Banstola N. The Impact of Leprosy on Marital Relationships and Sexual Health among Married Women in Eastern Nepal. J Trop Med. 2016;10:1-9.
57. Britton Wardick J, Diana NJ. Lockwood Leprosy. The Lancet. 2004;363(10):1209-19.
58. Prabhu SR, Daftary DK. Clinical evaluation of oro-facial lesions of leprosy. Odontostomatol Trop. 1981;4:83-95.
59. Bommanavar S, et al. Leprosy of the hard palate: A rare case report. Journal of Oral and Maxillofacial Pathology. 2018;22: S121-125.
60. Chemotherapy of leprosy for control programmes. WHO Technical report series 675, WHO, Geneva; 1982.
61. Motta AC, Komesu MC, Silva CH, Arruda D, Simão JC, Zenha EM, et al. Leprosy-specific oral lesions: a report of three cases. Med Oral Patol Oral Cir Bucal. 2008;13:E479-82.
62. Browne SG. The history of leprosy. In: Hastings RC. (Ed). Leprosy, pp1-14. Edinburgh (Scotland) and Churchill Livingstone, New York; 1985.

63. Lubbers WJ, Schipper A, Hogeweg M, de Soldenhoff R. Paralysis of facial muscles in leprosy patients with lagophthalmos. *Int J Lepr Other Mycobact Dis.* 1994;62:220-24.
64. Kungsi SR, Acharya AK, Shrikanth M, et al. Oral Hygiene status of Leprosy Patients from Raichur district, South India. *Indian J Lepr.* 2018;90:261-267.

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