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Distribution and Clinical Implications of Tooth Wear Lesions among Chronic Kidney Disease Patients Attending a Tertiary Hospital in South Western Nigeria

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Abstract

Background: Often times, the oral health care of chronic renal failure patients are often neglected, leaving such patients with serious complaints. Tooth wear lesion is one of such problems which are often complicated with dentinal and pulpal exposure. Little is known about its distribution and clinical implications in renal patients.

Methodology: This cross-sectional study was conducted among chronic kidney patients being managed with medication and hemodialysis attending at the renal Unit of the Obafemi Awolowo University, Ile- Ife. The participants were selected using simple random methods from among the pool of patients receiving treatment in the Renal clinic. Biodata of each patient was recorded. They were also interviewed for presence of oral complaints and other systemic problems. Oral examination was then conducted on each participant, each tooth was examined for tooth wear lesion and other oral problems. Blood sample was also taken for blood creatinine and urea. Data was analyzed using STATA 14.

Results: A total of 130 (99 male and 31 female) renal patients participated in the study out of which 120 (92.3%) had form of tooth wear lesions. Majority of those with oral lesion were above 60 years old. Tooth wear lesion see were dental tooth wear lesion see were dental erosion (95), attrition and abrasion. More than half (63, 52.5%) of the tooth wear lesions were seen in the lower posterior teeth, followed by lower anterior teeth and upper anterior teeth. Higher concentration of creatinine and urea was associated with presence of tooth wear lesion. Lesions seen with renal patients with oral lesion are dentine hypersensitivity, gingival recession. Others are tooth ache, halitosis and tooth mobility.

Conclusion: Prevalence of tooth wear lesion in renal patients was 92.3%. The most frequent tooth wear lesion seen was dental erosion. The teeth in the lower posterior segment of the mouth was the most frequently affected. The blood urea and creatinine concentration were significantly higher in patients with tooth wear lesion.

Introduction

Human teeth function together as a team and are important in feeding (mastication), speech, self-defense, aesthetics and forensic odontology [1]. Each types of teeth are known with their distinct shape, sizes, angulation and position which is important in their respective functions. However, the shapes and sizes tend to be altered as the teeth naturally perform its function due to physiological loss of tooth tissue, this is common during mastication [2]. The frequent intake of some tooth wearing (hard) foods and presence of substances (internal or external sources) that can predispose to tooth wear lesions such acidic. Such external (such as medications or foods, and appliance) and internal (such as regurgitation of gastric content into the oral cavity) substances often predispose to the tooth wear [2]. Since the formation of enamel (Amelogenesis) is completed by the death of all ameloblast before eruption, repairs following tooth eruption becomes impossible [3].

Common types of tooth wear are erosion, abrasion, attrition and abfraction. Dental attrition is caused by tooth to tooth contact in the mouth, it's usually results from malocclusion and oral habits. Tooth wear in dental abrasion is usually results from hard contact between teeth and foreign substances such as tooth brush. Dental erosion is caused by chemical substances such as acids that are introduced internally or eternally into the oral cavity. Abfraction which is due to flexure of the teeth from occlusal forces is not very common. Unlike dental caries which is also a form of tooth wear, the above types of tooth wear are physiological tooth wear lesions and are not due to any microorganism [4]. Clinically attrition is noted with the presence of wear facet at the point of opposing teeth and tends to be rough while abrasion is seen at the site of foreign substances introduced usually at the cervical margin. Dental erosion which is due to acidic substances in contact with the teeth is usually smooth and are often seen on the occlusal surfaces of the affected teeth or any other location where the acid is in contact with the mouth [4].

Tooth wear lesions, if left untreated may progress to dentinal exposure and eventual pulpal exposure. This (Dentinal and pulpal exposure) lead to insult on the exposed dentine and pulp resulting in dentinal hyper creativity and pulpitis respectively. Common symptoms are the presence of sharp excruciating pain which aggravated by air, touch and cold stimulus. This usually affect the quality of life of the affected patients [5]. Other possible secondary complications are periodontitis and periodontal abscess and space infection.

Patients with chronic kidney disease are known to have raised concentration of blood urea and in many cases are often complicated with uremic syndrome, a clinical condition characterized by the

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retention of a host of compounds (such as urea) which in healthy subjects are secreted into the urine by the healthy kidneys [6]. The retained unwanted substances cause gross disturbances in almost all organs/systems in the body such as gastroenteritis (uremic gastritis), nervous system (uremic encephalopathy), hematology (anemia, bleeding tendencies). Ureamic patients, therefore, due to gastric irritation tends to vomit acidic gastric content of the stomach into the mouth thus lowering the pH of the mouth predisposing the affected teeth to tooth wear. The contact of the acidic gastric content with such teeth will result in dental erosion, a common form of tooth wear and also predisposes the teeth to other forms of tooth wear [7]. Moreso, raised blood urea tends to bring about raised salivary urea because primary saliva is essentially an ultra filtrate of plasma this further lowers the mouth pH [8]. Ureamia also affects tooth development and may predisposed to tooth hypoplasia, anther condition that may further predispose a tooth to attrition abrasive tooth loss.

Scientific studies had reported higher prevalence of tooth wear lesion in renal patients Klassen et al. in a study among patients on dialysis reported a prevalence of 67% [9,10]. Because of the associated complications of toothwear such as dentine sensitivity, pulpitis and difficulty of eating, most patients suffer in silence as they cannot feed nor use their medication effectively Unfortunately, studies evaluating the relationship between the Chronic Kidney Disease (CKD) and tooth wear lesions are scanty and emphasis on the distribution of the tooth wear is grossly deficient in the literature especially in African population where the prevalence of CKD is on the increase. Information on relative distribution of toothwear lesion is important in planning and preventive measure especially in resource limited environment. This justifies the presence study which is aimed at determine the distribution and clinical implications of tooth wear lesions among CKD patients with a view to providing appropriate recommendations on the prevention and appropriate treatment strategies towards avoiding associated complications of this distressing condition among renal patients.

Materials and Methods

Study Design: This study was designed as a cross-sectional study to determine the pattern of distribution of tooth wear lesions among chronic renal patients

Subjects Selection: Participants for this study were randomly selected from the pool of patients on hemodialysis being managed at attending renal Unit of Obafemi Awolowo University Teaching Hospitals complex. Simple random sampling method was used to select the participants. Each consenting patient were asked to blindly pick from a box containing papers marked YES or NO, only those whom picked YES were recruited. The details of the study were duly explained to the patients.

Selection criteria: Dentate patients with established case of chronic kidney failure on hemodialysis and medications. Patients with anorexia nervosa or bulimia nervosa or any debilitating disease were excluded from the study.

Ethical consideration: Ethical approval was obtained from the Ethics and Research Committee of Obafemi Awolowo University Ile Ife.

Data Collection

Data collection was recorded with use of questionnaire which was organized into sections. Section A recorded the biodata of the patients such as age, sex, and marital status. The section B records information on oral and systemic symptoms associated with their kidney disease. Specific oral symptoms/lesions that were evaluated include dentinal hypersensitivity, tooth ache, tooth mobility, gingival recession, and bleeding gum. Any other oral lesions were also recorded.

Section C records the finding from oral examinations. Examination was done with patient comfortably sitting on a chair of a well illuminated room in the clinic. Extra oral examination done include checking for asymmetry, temporomandibular joint tenderness and the integrity of sub mandibular lymph nodes. The mouth is then thoroughly examined determine the oral hygiene status using Green and Vermiliion criteria. Mouth opening was assessed by measuring interincisal distance with the aid of Venieer caliper findings, interincisal distance of between 3-6 cm was taken as normal. Halitosis was also assessed with organoleptic method following validation of the examiner using Miyazali method. Patients with or above the point of perceivable order (score 2 and above) was taken as having halitosis. Each tooth was examined also for gingival recession, the migration of apical gingival below mucogingival junction was taken as gingival recession. Oral mucosa was also examined for presence of macular and papillary and white lesion and the findings were recorded accordingly.

Hard tissue examination was also done by checking for their integrity of the teeth. Tooth mobility was checked for by using bimanual palpation. Attrition was diagnosed with the presence of wear facet on the tooth at the point of tooth to tooth contact as well as the presence of sharp borders. Abrasion was diagnosed when worn area is devoid of tooth to tooth contact but evidence/history of introduction of foreign substances into the mouth usually as tooth cleaning aid (hard toothbrush), oral application e.t.c. In addition, surfaces of abrasive tooth wear are rough and tend to follow the motion or forms of application of the implicated foreign appliances. Dental erosion on the other side was diagnosed when the tooth wear lesion is smooth and rounded with no tooth to tooth contact, introduction of foreign substances or infectious decay of the teeth.

Blood samples of the subjects were also taken and are transported to the laboratory for assessment of blood urea and creatinine

Data analysis

Data were analyzed using STATA 10 statistical software. Continuous variables such age, blood urea and blood creatinine were analyzed using mean, media and mode. For qualitative variables such as the presence or absence of tooth wear lesion as well as other oral symptoms, they were analyzed with frequency and percentages, comparison of proportion were made using Fischer's exalt. For continuous variables were subjected to parametric test and comparison of mean was done using appropriate test such as Students t-test or Rank sum test as the case may be, p set at $p< 0.05$.

Results

Out of the 130 (99 male and 31 female) Chronic Kidney Disease

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Table 1: Sociodemographic of the Participants.

Variable	Tooth wear present	Tooth wear absent	Total (%)	P value
Sex Male Female	 95 (95.9) 25 ((80.6)	 4 (4.1) 6 (19.4)	 99 (100) 31 (100)	0.012*
Religion Christian Islam	 77 (87.5) 30 (93.7)	 11 ((12.5) 2 (6.25)	 88 (100) 32	0.559
Marital status Married Single Divorced	 72 (88.9) 45 ((97.8) 3 (100)	 9 (0.11) 1 (2.2) 0 (0)	 81 (100) 46 (100) 3 (100)	0.711
Mean age (SD)	50.7 (18.4)	20.4(3.02)	48.4 (19.4)	0.001*
Age category <20 21-30 31-40 41-50 51-60 >60	 7 (46.7) 15 (88.2) 13 ((100) 24 (100) 16 (100) 45(100)	 8 (53.3) 2 (11.8) 0 (0) 0 (0) 0 (0) 0 (0)	 15(100) 17 (100) 13 (100) 24 (100) 16 (100) 45 (100)	0.0001*

Fischer's exalt, *statistically significant

patients that participated in the study, 120 (92.3%) had tooth wear lesion. More than three quarter of those with tooth wear lesions were male and of Christian religion. The mean age of those who developed tooth wear lesion is significantly higher than those without the lesion. Tooth wear lesion was most frequent among those older than 60 years (Table 1).

The section of the mouth affected

More than half (63,52.5%) of the tooth wear lesions were seen in the lower posterior teeth, followed by lower anterior teeth and upper anterior teeth. The upper posterior teeth were the least frequently involved (Table 2 and Figure 1).

The section of the mouth affected

More than half (63,52.5%) of the tooth wear lesions were seen in the lower posterior teeth, followed by lower anterior teeth and upper anterior teeth. The upper posterior teeth were the least frequently involved (Table 2 and Figure 2).

Relationship between blood Creatinine, blood Urea and Types of tooth wear Lesion

The mean blood creatinine was higher among those with all tooth wear lesions but the difference was not statistically significant (p=0.51) However, when each type of toothwear lesion is considered individually: participants with attrition and erosion has a significant increased blood creatinine (p=0.04 and 0.029 respectively. Likewise, blood urea of those with dental tooth wear were higher than those without tooth wear but the differences were not statistically significant, p=0.128 (Table 3-5).

Discussion

Tooth wear lesion is one of the common oral manifestations of renal patients [9]. It is associated with wide range of clinical presentation depending on the severity of toothwear and type of teeth affected. Following tooth wear, the associated dentinal and pulpal exposure results in complications such as dentine hypersentivity, pulpitis, crack tooth syndrome and periodontitis. These are clinical conditions that are associated with pain, discomfort and tends to impair the quality life of affected patients [11].In this study, we found the prevalence of toothwear lesions to be 92.3% and this is significantly higher than the prevalent of tooth wear lesion in a group of study participants in Benin city, Nigeria which was reported by Ojehanon to be 17% [12]. The present study was conducted among patients with oral complication from their systemic (renal) problems, this, in addition to the relative older age group may be responsible for the higher value in this study. The commonest form of tooth wear lesion seen in this study was dental erosion and was found to be present in70 (54%) patents. This may be due to acidic nature of the oral environment of renal patients which predisposes to dental

Table 2: The section of the mouth affected.

Part of the mouth	Frequency	Percentage
Lower posterior teeth	63	52.5
Lower anterior teeth	34	28.3
Upper anterior teeth	27	0.25
Upper posterior teeth	2	1.6
Total	120	100

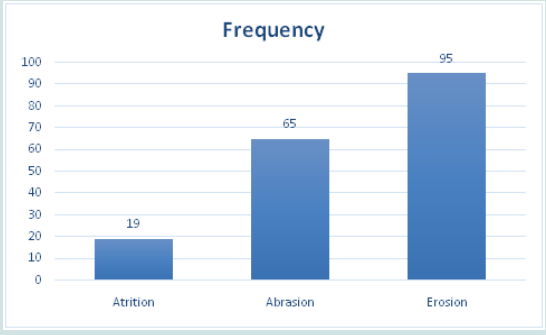

Figure 1: Types of Tooth wear lesion present. Tooth wear lesion seen in the study were dental erosion, abrasion and atrition in decending order, (Fig 1) Some of the subjects had omore than one form of tooth wear lesion.

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Figure 2: Distribution of toothwear lesions in the mouth.

Table 3: Relationship between blood Creatinine and Types of tooth wear.

Types of Tooth wear	Present (SD)	Absent (SD)	P value
Erosion	140.9 (52.1)	124.8 (41.7)	0.029*,
Abrasion	137.3 (4.8)	129 (40.1)	0.183
Attrition	136.5 (50.5)	115.7 (24.5)	0.040*
All forms of tooth wear	135.4 (49.5)	109.2 (21.5)	0.051, df=128

erosion. This results is also higher than the reports of Imirzalioglu et al. which conducted among chronic renal failure patients which showed a prevalence of 65% of erosion like lesion among chronic renal failure patients [9]. Unlike Ojehanon et al. who found the commonest toothwear lesion to be attrition, we found, in this study, dental erosion as the commonest tooth wear lesion, seen in 70 (54%) followed by abrasion and attrition. Tooth wear in chronic renal failure is multifactorial. Constant regurgitation and gastro-esophageal reflux in uremic patients lead to introduction of gastric acids in the oral cavity. Tooth wear (erosion) results when acidic substance come in contact with vulnerable tooth [7]. More so, chronic periodontitis and gingival recession are prominent oral features in chronic renal patients. Following gingival recession from the periodontal pathology [13], exposure of the coronal pat of the root is inevitable and the overlying cementum (of the root surface) is more vulnerable to wear during tooth brushing compared to the enamel of the crown. Due to poor oral hygiene and uremic smell, patients tend to observe more aggressive tooth brushing with a view to alleviating the odour but this will rather further compromise the integrity of the tooth structure, leading to tooth wear. Enamel hypoplasia which is also known to be prevalent in renal patients also further rendering the tooth to tooth wear by attrition and abrasion.

Although any tooth can be affected by tooth wear in as much as it is in contact with acidic substanbces, our study showed that the lower posterior teeth the most frequent tooth affected by tooth wear, this findings is in agreement with the findings of Braimoh et al. [14]. The acidic content of regurgitated gastric juice and saliva tends to settle in the floor of the mouth and occlusal surfaces of teeth and since lower most proximal to the pharynx they are mostly to be the first to be affected having also aided by gravity [7]. A study by Wang et al. however reported upper central incisor as the most frequently teeth affected, the study was however, conducted among children without chronic kidney disease [15].

Blood creatinine is a good indicator of renal disease as chronic kidney patients usually have significantly increased creatinine concentration which is usually persistent as long as patient's kidney could not perform its physiological function of getting the body rid of nitrogenous waste products. In this study, patients with tooth wear lesion had a significantly higher concentration of blood creatinine than those without tooth wear. This is in agreement with earlier studies which showed that erosion and other tooth care lesion are complications of chronic kidney disease which is associated with elevated blood creatinine [9,16]. Likewise, blood urea was also found to be higher among chronic kidney disease patients with dental wear in this study consistent with Imirzalioglu et al. [9]. Patients with chronic kidney disease tends to have raised salivary urea, studies had shown that the presence of excess salivary urea tends to increase plaque, a condition which is necessary for both physiological tooth wear lesion and dental caries [17]. Acids are known for their ability to dissolve the hydroxy appetite in dental hard tissue unlike floroapetite which is resistant [18].

Patients with dental tooth wear tends to present with some oral complaints which can be quite disturbing, affecting the quality of life of affected individuals. In this study, the frequency of occurrence of dentine sensitivity among renal patients with tooth wear lesion was significantly higher. Similar relationship was observed with gingival recession [19]. Tooth wear lesion may be complicated with exposure of the dentinal tubules and the presence of stimulus such as air or cold stimulus, the shock like pain signal is transmitted via the exposed dental tubules to the pulp which will be perceived as dentine hypersensitivity [20], Factors which predisposes to gingival recession such as wrong brushing habit using third tooth brush might as well responsible for tooth wear lesion. Halitosis, bleeding gum and tooth ache were also more frequency seen in renal patients with tooth wear lesion. The presence of tooth wear may create rough surface which precludes effective tooth brushing and tends to encourage plaque accumulation and hence accumulation of bacteria that may cause inflammation of tooth supporting tissue, bleeding gum and periodontal infection [21].

Table 4: Relationship between blood Urea and Types of tooth wear.

Types of Tooth wear	Present (SD)	Absent (SD)	P value
Erosion	14.9 (6.2)	14.7 (7.1)	0.412
Abrasion	14.5 (6.2)	15.2(7.17)	0.6959
Attrition	14.9 (6.2)	14.4 (6.8)	0.369
All forms of tooth wear	15.07 (6.8)	12.56 (4.3)	0.128

Fishers exalt, df=128. t= 1.1388

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Table 5: Relationship between Dental Complaints and Tooth wear.

Variable	Tooth wear present	Tooth wear absent	Total (%)	P value
Halitosis Present (%) Absent (%)	 95 (93.1) 25 (89.2)	 7 (6.9) 3 (10.8)	 102 (100) 28 (100)	0.448
Bleeding gum Present Absent	 68 (89.4) 52 (96.2)	 8 (10.6) 2 (3.8)	 76 (100) 54 (100)	0.134
Dentine sensitivity Present Absent	 65 (86.7) 0 (0)	 10 (13.3) 55 (100)	 75 (100) 55 (100)	0.001*
Gingival recession Present Absent	 75 (88.2) 0 (0)	 10 (11.8) 45 (100)	 85 (100) 45 (100)	0.001*
Toothache Present Absent	 52 (43.3) 2 (20)	 68 (56.7) 8 (80)	 120 (100) 10 (100)	0.738
Oral Hygiene Good Fair Poor	 20 (90.1) 48 ((88.9) 52 ((96.3)	 2 (9.9) 6 (11.1) 2 (3.7)	 22 (100) 54 (100) 54 (100)	0.227

Fischer's exalt, * statistically significant.

Conclusion

Prevalence of toothwear lesion is significantly higher among renal patients. The commonest tooth wear lesion was dental erosion closely followed by attrition. Lower posterior teeth were the most frequent teeth affected. Common oral complaints among renal patients tooth wear lesion is dentine hypersensitivity, gum bleeding and toothache. Since majority of renal patients with tooth wear lesion has oral lesions it is recommended that prophylactic dental treatment to prevent dental tooth wear such as fluoride therapy, avoidance of refined sugar consumption and maintenance of good oral hygiene and correct tooth brushing method. Patients with chronic renal failure are thus advised to pay much attention to their oral health.

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