

BIOLOGICAL PROFILE AND PATHOLOGICAL CAUSES OF MORTALITY OF TEETH USED FOR THE TEACHING OF ORAL BIOLOGY TO DENTAL STUDENTS IN TERTIARY INSTITUTIONS

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ABSTRACT

Background: Oral biology deals with development, structure, and functions of oral tissues, their interrelationship and relationship with other tissues/organs in health and disease. This study was on the collected human specimen for teaching of oral biology to dental students.

Methodology: 2,765 teeth were collected from the Department of Oral Surgery and Pathology, University of Benin and Department of Oral Pathology and Oral Biology, University of Port-Harcourt. These teeth were preserved in 10% formalin bottle. The teeth were collected over 10-year period and were sorted by tooth-type into deciduous and permanent teeth, using size, shape, colour and specific tooth indices as parameters. Deciduous teeth were sorted into deciduous anteriors and molars. The tooth-type was sorted into carious, periodontal disease, avulsion, and exfoliated teeth. Avulsion due to assault related and crime cases were excluded to avoid spuriousness.

Result: Study revealed that posterior teeth (67.5%) were lost, more than anterior teeth (32.5%). Sorting by tooth-type showed greater mortality of the molars; deciduous molars (4.52%) and permanent molar (48.98%). Dental caries was the main cause of tooth mortality (50.02%); followed by periodontal disease (41.52%), Avulsion contribution was (6.51%) and least was exfoliation (1.7%).

Conclusion: Dental specialist have an important positive role in improving dental education, oral health practices, stimulating dental research and defining quality expectations in their areas of expertise.

Key Words: Biological Profile, Pathology, Mortality, Teeth

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INTRODUCTION

Oral Biology is that area of scientific knowledge that deals with the development (embryology), structure (dental anatomy) and functions (physiology) of oral tissues; their inter-relationships and their relation to other organ systems in both health and disease.^{1,3} It is sequenced generally in dental curriculum after the basic medical sciences (anatomy, physiology and biochemistry) and before most of the clinical subjects. In the University of Benin, it is a BDS (Bachelor of Dental Surgery) Part 1B professional examination. BDS Part 1A (anatomy, physiology and biochemistry) is a prerequisite for writing Part 1B. In the University of Port-Harcourt, it is a BDS Part IV professional examination in the Department of Oral Pathology and Oral Biology as the knowledge of oral biology is a firm template for understanding clinical pathologies.

A detailed knowledge of the biology of a tissue is a prerequisite for clearer understanding of its pathologies and in addition deepens the knowledge of many oral and maxillofacial diseases which are wide spread in Nigeria. These diseases have led to increasing tooth mortality. Tooth extraction is a common practice in most dental centers. In the University of Benin Teaching Hospital Dental Centre, and University of Port-Harcourt Dental Centres; 2,765 deceased teeth were collected for the teaching of tooth morphology to Dental Students preparing for B.D.S. Part 1B and BDS Part IV professional examination in the respective universities.

These deceased teeth are products of periodontal disease, caries, trauma and malocclusion in Nigeria,^{4,7} in Brazil,⁸ Singapore,⁹ Afghanistan.¹⁰ Sofola et al¹¹ were specific that dental caries and periodontal diseases were the leading causes of tooth loss in Nigeria. This study therefore aims at analyzing the profile and

causes of mortality of 2,765 teeth used for the teaching of oral biology.

MATERIALS AND METHODS

This was a study of 2,765 extracted teeth (Figure 1) collected from the Department of Oral Surgery and Pathology, University of Benin and Department of Oral Pathology and Oral Biology, University of Port-Harcourt. These teeth were preserved in 10% formalin bottle (in line with Centre for Disease Control and Prevention guideline for infection control) used for research and teaching.^{12,13}

Tooth morphology is the core of oral biology and understanding of dental practice. The teeth were collected over a 10-year period and sorted by tooth-type into deciduous and permanent teeth using size, shape, colour and specific tooth indices as parameter. The deciduous teeth were sorted into deciduous anteriors and deciduous molars and the permanent teeth into anterior, premolars and molars. The cause of tooth loss was sorted into carious, periodontal disease, avulsion and exfoliation.

The tooth types were identified by their biological dominant key features and the diseased type from records during teeth collection and visible morphological records. Avulsion due to assault related and criminal cases were excluded to avoid spuriousness.

RESULTS

Study revealed that posterior teeth (67.5%) were lost, more than anterior teeth (32.5%) (Table 1, Figure 2). Sorting by tooth-type showed greater mortality of the molars; deciduous molars (4.52%) and permanent molar (48.98%) [Table 2]. Dental caries was the main cause of tooth mortality (50.02%); followed by periodontal disease (41.52%). Avulsion contribution was (6.51%) and least

was exfoliation (1.7%) [Table 3, Figure 3]. Permanent molar tooth mortality (n=1,054, 38.12%) was mainly caused by dental caries, while the mortality of permanent anterior teeth was mainly caused by periodontal disease (n=625, 22.60%) [Table 4, Figure 4].

Figure 1: The extracted teeth collected



Table 1: Distribution of the teeth by Tooth-Type

Tooth Type	Number	%
Anterior teeth	900	32.5
Posterior teeth	1,865	67.5
Total	2,765	100

Figure 2: Teeth by Tooth-Type

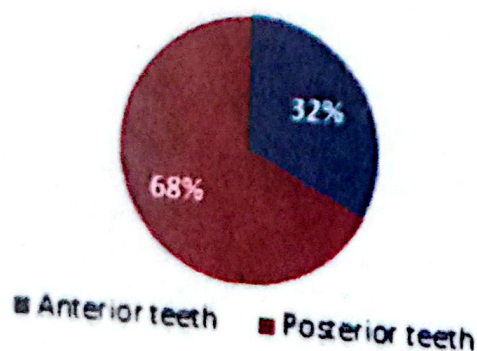


Table 2: Distribution of the tooth type in the deciduous and permanent dentition

Tooth Type	Number	%
Deciduous anterior teeth	81	2.93
Deciduous molars	125	4.52
Permanent anterior teeth	819	29.57
Premolars	388	14.02
Permanent Molars	1,352	48.98
Total	2,765	100

DISCUSSION

The availability of human teeth, like the human cadaver for teaching Medical and Dental students may be exciting, but the loss of a tooth causes aesthetic and masticatory embarrassment to the patients. This is where the pathological causes become important to stem the tide of tooth loss. The pathological causes of tooth loss range from caries, which is a localized, post-eruptive pathological process of external origin involving softening of the hard tooth tissue and proceeding to the formation of cavity. Periodontal diseases are those pathological processes of an inflammatory and degenerative type that involve the periodontium. They are generally characterized clinically by gingivitis, pocket formation, loss of alveolar bone, and eventually loss of teeth; avulsion, which is an injury in which a body structure is forcibly detached from its normal point of insertion by either trauma or surgical Dental avulsion is the complete displacement of a tooth from its socket in the alveolar bone owing to trauma.¹⁶

Figure 3: Pathology per Tooth-Type

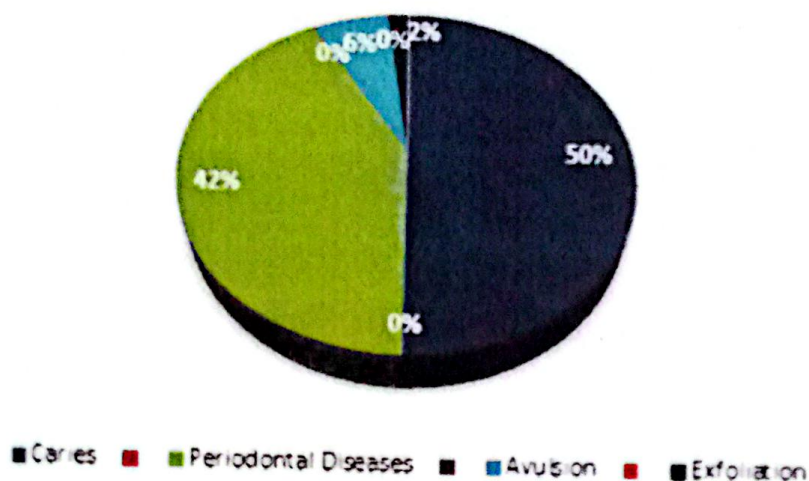


Figure 4: Analysis of Tooth-Type by Causes of Mortality (2,765)

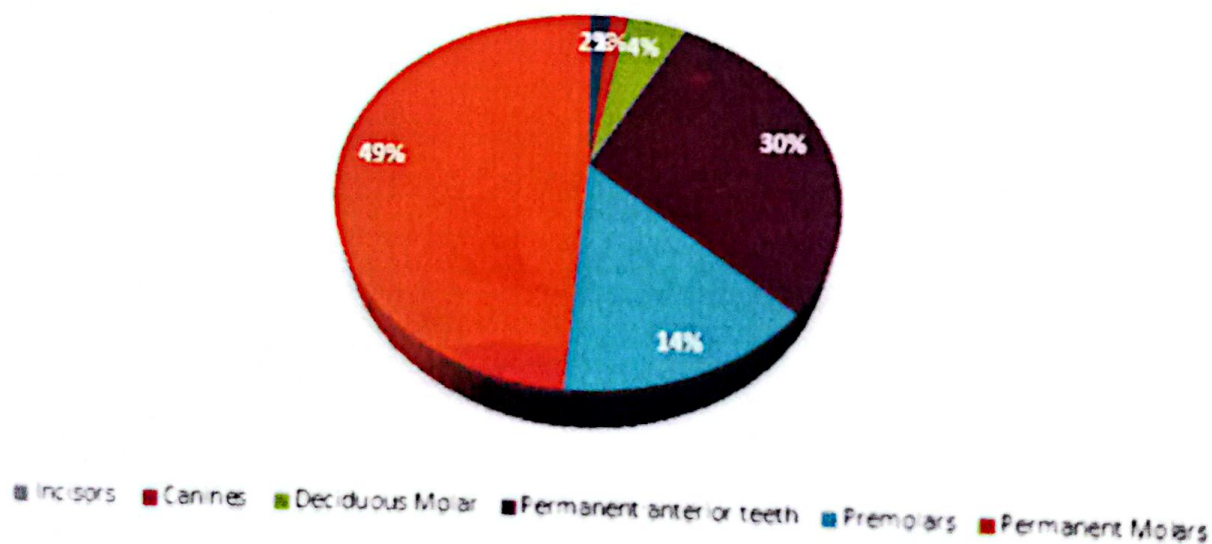


Table 3: Analysis of Tooth-Type by Causes of Mortality (n=2765)

Tooth-Type	Pathology	Number	%
Deciduous anterior teeth 11 (2.93%)	(i) Caries	8	0.29
	(ii) Avulsion	44	1.59
	(iii) Exfoliation	5	0.181
(a) Incisors 42 (1.52%)	(i) Caries	6	0.22
	(ii) Avulsion	16	0.58
	(iii) Exfoliation	2	0.072
(b) Canines 39 (1.41%)	(i) Caries	6	0.22
	(ii) Avulsion	16	0.58
	(iii) Exfoliation	2	0.072
Total 81 (2.933%)		81	2.933%

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Deciduous Molar 125 (4.52%)	(i) Caries	28	1.013
	(ii) Avulsion	5	0.181
(a) Upper Molars 48 (1.74%)	(iii) Exfoliation	20	0.723
(b) Lower molars 77 (2.78%)	(i) Caries	40	1.45
	(ii) Avulsion	5	0.181
	(iii) Exfoliation	20	0.723
Total 125 (4.52%)		125	4.52%
Permanent anterior teeth 819 (29.62%)	(i) Caries	60	0.20
(a) Incisors 689 (24.92%)	(ii) Periodontal	566	20.47
	(iii) Avulsion	63	2.29
(b) Canines 130 (4.70%)	(i) Caries	10	0.36
	(ii) Periodontal	86	3.11
	(iii) Avulsion	34	1.23
Total 819 (29.62%)		819	29.62%
Premolars 388 (14.03%)	(i) Caries	94 (3.4%)	3.40
(a) Upper Premolars 197 (7.12%)		-Proximal caries 54(1.95%)	
		-Occlusal caries 40 (1.45%)	
	(ii) Periodontal	96	3.47
	(iii) Avulsion	7	0.253
(b) Lower premolars 191 (6.91%)	(i) Caries	83 (3.00%)	3.00
		- Proximal caries 30(1.08%)	
		- Occlusal caries 53 (1.92%)	
	(ii) Periodontal	102	3.69
	(iii) Avulsion	6	0.22
Total 388 (14.03 %)		388	14.03
Permanent Molars: 1,352 (48.90%)	(i) Caries	347 (12.55%)	12.55
(a) Upper Permanent Molars: 388 (13.85%)	Proximal caries	262 (9.48%)	
	Occlusal caries	85 (3.07%)	
	(ii) Periodontal disease	36	1.30
(a) Upper Permanent Molars: 969 (35.05%)	(i) Caries	707 (25.57%)	25.57
	Proximal caries	364 (13.16%)	
	Occlusal caries	343 (12.41%)	
	(ii) Periodontal Disease	262	9.48
Total 1,352 (48.90%)		1,352	48.90

Table 4: Percentage Pathology per Tooth-Type

Pathologies	Deciduous anterior teeth	Deciduous Molar	Permanent Anterior teeth	Premolar	Molars	Total %
Caries	14	68	70	177	1,054	1,383 (50.02%)
Periodontal Diseases	(0.0) (0.0)	(0.0) (0.0)	652	198	298	1,148 (41.52%)
Avulsion	60	10	97	13	(0.00)	180 (6.51%)
Exfoliation	7	40	(0.0) (0.0)	(0.0) (0.0)	(0.0) (0.0)	47 (1.7%)
Total	81	118	819	388	1352	100%

Facial trauma that results in fractured, displaced, or lost teeth can have significant negative functional, aesthetic and psychological effects on patients especially children.¹⁷ Other related injuries are crown fracture (an enamel and dentin fracture with or without pulp exposure), root fracture (a dentin and cementum fracture involving the pulp), concussion (injury to the tooth – supporting structures without abnormal loosening or displacement of the tooth), subluxation (injury to tooth-supporting structures with abnormal loosening but without tooth displacement), lateral luxation (displacement of the tooth in a direction other than axially). The periodontal ligament is torn and contusion or fracture of the supporting alveolar bone occurs; intrusion (apical displacement of tooth into the alveolar bone) extrusion (partial displacement of the tooth axially from the socket); partial avulsion;¹⁸ exfoliation which is loss of deciduous teeth following physiological loss of root structures. Of forensic interest are some hard tissue anomalies unique to an individual which

will be traceable to him radiographically in the event of any forensic enquiries. These hard tissue anomalies are supernumerary teeth (Figure 5), which are usually extracted for aesthetic reasons; germination (Figure 6), den evaginatus (extra cusp protruding from the occlusal surface) [Figure 7]; and



Figure 5: A 20-year female patient with lingually placed left supernumerary premolar

dilaceration (Figure 8), which are easily seen on radiographic views.

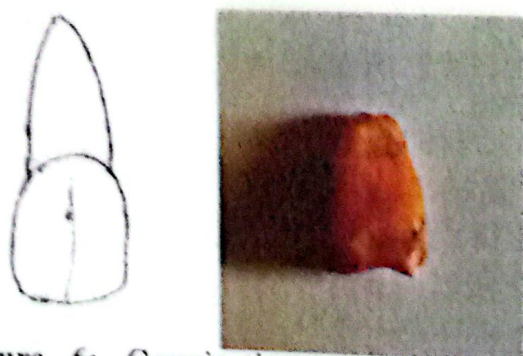


Figure 6: Germination, graphic (a) and morphologic (b) presentation

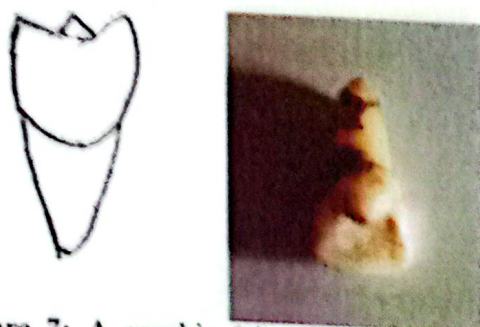


Figure 7: A graphic (a) and morphologic (b) presentation of dens evaginatus

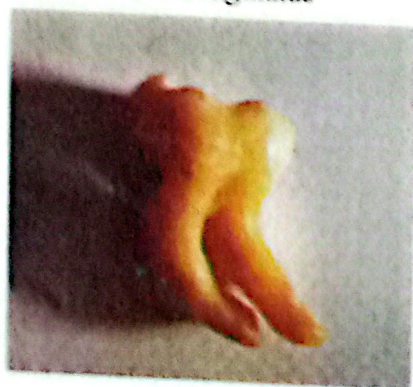


Figure 8: A morphologic presentation of dilacerations.

These form landmarks in patients that have them. The use of all human specimens has been integral to medical research and teaching for many years. It is the living that are principally affected by what is done to cadavers, teeth and body parts, used for teaching purpose.^{19,20} By learning gross anatomy through cadaver, medical and dental students get a firsthand impression about the structure of human body which is the basis for understanding pathologic and

clinical problems. Although, cadaver from the past, through dissection and lectures were the sole pedagogy worldwide, it does not remove the pains of death by the living.²¹ Extracted human teeth are routinely used in dental institutions to train and acquaint dental students about various procedures before they do it on patients.^{22,23} Our study revealed that posterior teeth (67.5%) were lost more than anterior teeth (32.5%). Sorting by tooth-type showed greater mortality of the molars; consisting of deciduous molars (4.52%) and permanent molar (48.98%). These findings are in tandem with Sanya et al.²⁴ Dental Caries was the main cause of tooth mortality (50.02%), especially permanent molars. Caries is dominantly the breakdown of teeth due to the activities of bacteria; therefore forming a number of cavities ranging from yellow to black colours.²⁵ If untreated may progress to evoke symptoms of pain and difficulty with eating.^{26,25} Complications may include inflammation of the tissue around the tooth, tooth loss and infection or abscess formation.²⁵ Periodontal disease was the second cause of tooth mortality (41.52%), especially permanent anterior teeth. This is in consonance with Jaafar et al findings.²⁷ Periodontal disease affects one or more of the periodontal tissues, alveolar bone, periodontal ligament, cementum and gingiva. While there are many different periodontal diseases that can affect these tooth-supporting structures, the most common ones are plaque-induced inflammatory conditions,²⁸ such as gingivitis and periodontitis.²⁹ Avulsion contribution to tooth loss was (6.51%). This is usually due to trauma to the face and mouth from sports, sudden contact falls or accidents that can cause teeth to fracture, or knocked completely out of its socket.¹⁷ Traumatic injuries represents one of the most common

reasons for emergency appointments, and ensuring the survival of traumatized teeth is one of the main responsibilities of the dental practitioners. Our findings reveal 6.51% avulsion, this is in line with Karayilmaz et al³⁰ studies that revealed 5.87% avulsion within 9-year studies. Exfoliation of tooth was 1.7%. Exfoliation follows tooth reabsorption which is a process by which all or part of a tooth structure is lost due to activation of the body's innate capacity to remove mineralized tissue, as mediated by cells such as osteoclasts.³¹ Root reabsorption is a physiologic event for primary teeth. It is still unclear whether odontoclasts, the cells which reabsorb the dental hard tissue, are different from the osteoclasts, the cells that reabsorb bone. Root reabsorption seems to be initiated and regulated by the stellate reticulum and the dental follicle of the underlying permanent tooth through the secretion of stimulatory molecules (cytokines and transcription factors).³² This study therefore revealed caries (50.02%) and periodontal disease (41.52%) as the leading causes of tooth mortality. These results aligned with Odusanya's³³ report of dental caries (43.9%) and periodontal disease (46.4%), and Esan et al³⁴ report of dental caries (52.4%) and periodontal disease (30.9%) as causes of tooth mortality. These studies show that dental caries and periodontal disease are the leading causes of tooth mortality.

Conclusion

We conclude that stemming this tide of tooth mortality caused by caries and periodontal disease entails primary prevention of dental caries and periodontal disease, by improving oral hygiene practices through explicit caries and periodontal risk assessment. This can be done by assessing clinical evidence of previous caries and periodontal disease; dietary habit improvement, use of fluoride and plague control measures. Therefore, dental

specialists have important positive role in improving dental education, oral health practices, stimulating dental research and defining quality expectations in their areas of expertise.

Recommendation: Intensive preventive oral health campaign is recommended.

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