JIMMA UNIVERSITY
GRADUATE STUDIES PROGRAM
DEPARTMENT OF DENTISTRY
ORAL AND MAXILLOFACIAL SURGERY UNIT

Pattern and Trend of Odontogenic Tumors in Ethiopia

By: Biruktawit Kebede

A research paper submitted to the School of Graduate Studies, Jimma University Presented in Partial Fulfillment of the Requirements for the certificate of specialization program in Oral and Maxillofacial Surgery

JIMMA University
JIMMA, Ethiopia
September 2015

JIMMA UNIVERSITY

GRADUATE STUDIES PROGRAM

Pattern and Trend of Odontogenic Tumors in Ethiopia

By: Biruktawit kebede

A research paper submitted to the School of Graduate Studies, Jimma University Presented in Partial Fulfillment of the Requirements for the certificate of specialization program in Oral and Maxillofacial Surgery

Supervisors:

1. Dr. Fessahaye Alemseged (MD, MPH)
2. Dr. Dawit Tare (MD, General Surgeon)

Abstract

Back ground: Odontogenic tumor (OT) comprise a large heterogeneous group of lesions arising from the tooth producing tissues or its remnants. It ranges from hamartomatous or non-neoplastic proliferations to benign and malignant neoplasm with variable aggressiveness and metastatic potential. OTs cause facial disfiguring that necessitates subsequent reconstructive surgery. Studies on OTs are scare in Ethiopia. Thus, this study was aimed to assess the pattern and trend of OTs in Ethiopia.

Methods: An 8 years retrospective study was conducted at the Dental and Maxillofacial Department, St. Paul's hospital, Addis Ababa, Ethiopia. The data was collected by reviewing the medical cards of patients visited the department from 2008 to 2015 by using checklist. Data such as age, gender, duration of lesion, location of the tumors, size of the tumors, type of tumors, type of surgical treatment, and complaints during follow-up were reviewed. All the collected data were then coded, checked, edited and entered to SPSS windows 16. Finally, the data was analyzed by descriptive statistics, and logistic regression.

Results: A total of 448 patient's socio-demographic, and clinical data were reviewed from the registry book of patients who were diagnosed with OT. The complete data set was obtained for 163 patients, comprising 88(54 %) males and 75 (46 %) females. The mean age of patients was 34, with a range of (9–80 years. 132 (81.0 %) of the OTs were benign, and the remaining 31(19.0 %) were malignant OTS. Concerning the location of OTs, 37 (22.3 %) occurred in the maxilla, and the vast majority 126 (77.3 %) in the mandible. Ameloblastoma with predilection for the mandible was the most frequent OT (46 %), followed by odontogenic myxoma (8.6 %), keratocystic odontogenic tumours (KCOT) (6.1 %), and odontogenic fibroma (6.1 %). Interestingly, 128 (82.8 %) of the patients had primary surgical treatment. Nonetheless, malocclusion, facial disfigurement, and continuity defect were complications seen frequently.

Conclusion: OTs were found in both genders with similar proportion. Furthermore, benign OT was predominant over malignant OTs. Regular checkup and/or visit to dentists could help early case detection, and management of OT.

Acknowledgements

First of all I am very glad to thank my first supervisor Dr. Fessahaye Alemseged. Dr. Fessahaye, I am sincerely indebted to you for your great advices, insightful comments and remains throughout the development of this thesis. Thank you for your time, and friendly guidance.

Second, my sincere gratitude goes to my second supervisor Dr. Dawit Teare for his in-depth comments towards my thesis.

Third, I am thankful to St. Paul's Hospital for allowing me to have access to the medical records of patients. Also my gratitude to the Hospital's data records service for helping in sorting and compiling the medical cards.

Finally, I would like to acknowledge the Department of Dentistry, Jimma University for giving me the opportunity to study my specialization program, and explore this thesis.

Table of contents **Pages**

Abstract I

Acknowledgements II

List of tables V

List of figures VII

List of abbreviations VII

Definition of terms VIII

Background 1

Statement of the problem 3

Literature review 5

Significance of the study 7

Objectives 8

General objective 8

Specific objectives 8

Methods 9

Study area and period 9

Study design 9

Population 9

Source population 9

Study population 9

Inclusion and exclusion criteria 9

Sample size and sampling technique 10

Measurements 10

Variables 10

Data Collection procedure 10

Data analysis 11

Ethical consideration 11
Limitation of the study 11
Plan for dissemination 11
Results 12
Socio-demographic characteristics 12
Frequency of OT cases diagnosed in each Year 12
Classes of odontogenic tumors 14
Distribution of odontogenic tumors by sex 14
Distribution of different classes of OTs by age 15
Odontogenic tumors by location 16
Surgical Treatment and its complications 17
Factors associated with complication after surgery 18
Factor associated with time of presentation 19
Discussion 21
Conclusion and recommendations 25
Assurance of Principal Investigator 26
Annexes 27
Annex I - Conceptual framework 27
Annex II - References 28
Annex III - Checklist for data collection 31

List of tables pages

Table1:- Socio-demographic characteristics of patients with the diagnosis of OT, St. Paul's hospital, Addis Ababa, Ethiopia 2015 ----------12

Table 2:- Table 2:-Frequency distribution of odontogenic tumors according to the recent WHO classification, St. Paul's hospital, Addis Ababa, Ethiopia 2015 ----------14

Table 3:- Distribution of odontogenic tumors by sex in line with the recent WHO classification, St. Paul's hospital, Addis Ababa, Ethiopia 2015 ----------15

Table 4:- Distribution of odontogenic tumors by age, according to the recent WHO classification of Odontogenic Tumors, at St. Paul's hospital, Addis Ababa, Ethiopia 2015----------16

Table 5:- Distribution of odontogenic tumors by place of occurrence according to the recent WHO classification of OTs at St. Paul's hospital, Addis Ababa, Ethiopia 2015 ----------17

Table 6:- Frequency distribution of surgical treatment and its complications of odontogenic tumors at St. Paul's hospital, Addis Ababa, Ethiopia, 2015----------16

Table 7:- Bivariate analysis of year of presentation and complications after surgery of patients with OTs, St. Paul's hospital, Addis Ababa, Ethiopia, 2015 ----------19

Table 8:- Binary logistic regression of variables and year of presentation, odontogenic tumor patients, St. Paul's hospital, Addis Ababa, Ethiopia, 2015 ----------20

List of Figures

Pages

Figure 1. Histological classification of OTs ----------2

Figure 2:- Distribution of OTs cases diagnosed from 2008 to 2015, St. Paul's hospital, Addis Ababa, Ethiopia, 2015 ----------13

Figure 3:- Frequency of OTS diagnosed by the year of presentations, St. Paul's hospital, Addis Ababa, Ethiopia, 2015----------13

Figure 4:- Conceptual framework ----------27

List of abbreviations

AOT: Adenomatoid Odontogenic Tumor

CEOD- Calcified Epithelial Odontogenic Tumor

COF- Central Odontogenic Fibroma

KCOT- Keratocystic Odontogenic Tumor

OT- Odontogenic Tumor

WHO- World Health Organization

Definition of terms

Anterior region: -the area from of one side canine to canine the other side.

Posterior region:-the area posterior to the canine, posterior area of the mandible included the Ascending ramus.

Upper jaw: - Alveolar process of the maxilla with the attached tooth.

Lower jaw: - Mandibular bone with the attached tooth.

Benign tumors: - Tumors that does not invade and destroy the tissue in which it originates or spread to distant sites in the body.

Malignant tumors: -Tumors that invades and destroys the tissue in which it originates and can spread to other sites in the body via the blood-stream and lymphatic system.

Duration of lesion: - The time between diagnosis of tumor and treatment in weeks.

Background

Oral health is fundamental to general health and essential for wellbeing. It implies that the absence of oral tumor, throat cancer, mouth and facial pain, oral infection and sores, periodontal disease, tooth decay, tooth loss, and other diseases and disorders that limit an individual's capacity in biting, chewing, smiling, speaking, and psychosocial wellbeing (1). Among others, oral tumors (neoplastic conditions) impose substantial impact on the lifestyle of human beings.

The jawbones are one of the most suitable sites of neoplastic conditions. These neoplasms can be either benign or malignant. In addition, they can also be odontogenic or non-odontogenic. Odontogenic tumors (OTs) are rare and specifically formed in the jaw bones. OTs constitutes a heterogeneous group of lesions due to the different degrees of intertissue interaction and various growth patterns. Furthermore, they show variable clinical and histopathological features. Among other, the ability of OTs to transit from one form to another complicates the formal classification of OTs. As a result, the World Health Organization (WHO) is obligated to revise the classification of OTs for the second time to have a consensus all over the world (2, 3). Nevertheless, this does not resolve the controversial issues of classifying OTs consistently throughout the world. In 2005, the WHO published the latest updated edition 3 of odontogenic tumors histological typing that brought some substantial changes (4-7). (Figure- 1)

OTs include entities of a hamartomatous nature, such as odontoma, benign neoplasms, some of which are aggressive as in the case of ameloblastoma and myxoma, and malign neoplasms capable of metastasis (8).

Ameloblastoma is the most quoted odontogenic tumor in several case series in the literature, equating to approximately 10% to 30%. It is the most common among individuals of the second and fifth decades of life. However, there is some disagreement amongst authors as to the gender most affected. With respect to the choice of jaws, a greater preference for the lower jaw has been reported (9).

In addition to the aforementioned once, other tumors of odontogenic origin are worthy to mention, such as the keratocystic odontogenic tumor, odontoma, odontogenic myxoma, ameloblastic fibroma, odontogenic fibroma. The keratocystic odontogenic tumor (KCOT) occurs

predominantly as an asymptomatic lesion between the second and fourth decades of life in the posterior mandibular region. KCOT cause extensive areas of bone reabsorption prior to being diagnosed and around 10 % occur in edentulous patient. KCOTs have a high recurrence rate, reportedly between 25 % and 60 % (10, 11).

MALIGNANT TUMOURS	
Odontogenic carcinomas	
Metastasizing (malignant) ameloblastoma[1]	9310/3
Ameloblastic carcinoma – primary type	9270/3
Ameloblastic carcinoma – secondary type (dedifferentiated), intraosseous	9270/3
Ameloblastic carcinoma – secondary type (dedifferentiated), peripheral	9270/3
Primary intraosseous squamous cell carcinoma – solid type	9270/3
Primary intraosseous squamous cell carcinoma derived from keratocystic odontogenic tumour	9270/3
Primary intraosseous squamous cell carcinoma derived from odontogenic cysts	9270/3
Clear cell odontogenic carcinoma	9341/3
Ghost cell odontogenic carcinoma	9302/3
Odontogenic sarcomas	
Ameloblastic fibrosarcoma	9330/3
Ameloblastic fibrodentino–and fibro-odontosarcoma	9290/3
BENIGN TUMOURS	
Odontogenic epithelium with mature, fibrous stroma without odontogenic ectomesenchyme	
Ameloblastoma, solid / multicystic type	9310/0
Ameloblastoma, extraosseous / peripheral type	9310/0
Ameloblastoma, desmoplastic type	9310/0
Ameloblastoma, unicystic type	9310/0
Squamous odontogenic tumour	9312/0
Calcifying epithelial odontogenic tumour	9340/0
Adenomatoid odontogenic tumour	9300/0
Keratocystic odontogenic tumour	9270/0
Odontogenic epithelium with odontogenic ectomesenchyme, with or without hard tissue formation	
Ameloblastic fibroma	9330/0
Ameloblastic fibrodentinoma	9271/0
Ameloblastic fibro-odontoma	9290/0
Odontoma	9280/0
Odontoma, complex type	9282/0
Odontoma, compound type	9281/0
Odontoameloblastoma	9311/0
Calcifying cystic odontogenic tumour	9301/0
Dentinogenic ghost cell tumour	9302/0
Mesenchyme and/or odontogenic ectomesenchyme with or without odontogenic epithelium	
Odontogenic fibroma	9321/0
Odontogenic myxoma / myxofibroma	9320/0
Cementoblastoma	9273/0
Bone-related lesions	
Ossifying fibroma	9262/0
Fibrous dysplasia	
Osseous dysplasias	
Central giant cell lesion (granuloma)	
Cherubism	
Aneurysmal bone cyst	
Simple bone cyst	
OTHER TUMOURS	
Melanotic neuroectodermal tumour of infancy	9363/0
see Chapter 1, pp. 70-73	

Figure-1.Histological classification of OTs. Taken from WHO Histological Typing of OTs (6)

Odontogenic myxoma is an intraosseous neoplasm consisting of myxomatous fibrous extracellular matrix originating from mesenchymal remnants. Adenomatoid odontogenic tumors arise from the dental lamina in the gubernacular cord of developing permanent teeth. Ameloblastic fibromas are similar in origin to ameloblastomas, being derived from the enamel organ or dental lamina, except there is a lack of dental hard tissue in them specimen (12).

Central Odontogenic Fibroma (COF) originates from ectomesenchymal odontogenic tissues such as dental follicle and the periodontal ligament. COF constitute approximately 1.5% of odontogenic tumor. The tumor is more common in females than males. Furthermore, COFs are dictated during the two decade of life. Generally, COF resembles as a painless swelling with a slow growth (13).

Statement of the problem

OTs are derived from epithelial, ectomesenchymal and/or mesenchymal elements of the odontogenic tissues. The skull, jaws and facial bones are not only the site of a number of usual lesions but also pose unique histological problems often associated with intra-oral variation in oral structure ranging from potentially malignant to pseudo-malignant features (14, 15). Even though tumors of Oral and Maxillofacial are rare, they cause facial disfiguring which necessitating subsequent reconstructive surgery. OTs are heterogeneous group of tumors that pose a significant diagnostic and therapeutic challenge (5, 14-17).

Of the total tumors reported, about 5% are tumors and tumor like lesions of the orofacial lesion. Many retrospective studies have been conducted in different continents of the world such as: in Africa, Asia, Europe, and North and South America to assess the distribution of OTs. The prevalence rates of OTs ranging from 1 % to 28 % have been reported from different parts of the world. The overall and relative frequency of individual OTs differs from region to region. It is speculated that the difference in the frequencies observed are attributed to variations in geographic or cultural effects (18).

Nonetheless, unanswered question still remain about the relative frequency and the incidences of certain odontogenic tumors. However, the overall incidence of OTs is reported to be higher among Africans, and hence a distinct racial predilection is suggested in the incidence rates of these orofacial lesions. The majority of OTs seems to arise *de novo*, without an apparent causative factor. Thus, the cause(s) of OTs remains unclear (16, 19, 20).

Depending on the type of OT, there are different intervention methods for the treatment of OTs. Again within the same group of OTs, interventions also differ according to the extent of lesion, and stage of the tumor. Generally, the intervention of OT could involve either radical or conservative excision. In the radical surgical excision, the bone is resected with a 1 to 2 centimeters safety margin of macroscopically healthy bone. Thus, radical surgery includes marginal and segmental resections. On the other hand, conservative excision involves the removal of tumor without safety margin though enucleation. In addition to enucleation, conservative surgery involves curettage, in which it is sometimes followed by cryotherapy with

liquid nitrogen. As such, the overall intervention for OTs requires reconstructive surgery (21, 22).

Nevertheless, the intervention methods are not effective all the time. Thus, leading to further complications such as facial deformity, malocclusion and impaired mastication were predominant seen after surgical treatment of OT (23).

Knowledge of prevalence of various types of OTs and their clinical characteristics could be extremely valuable both for pathologists and dentists when mounting a differential diagnosis, and may indicate the causes of these lesions (16). Despite this fact, there is no any information available on the prevalence of OTs in Ethiopian. Thus, the aim of this study is to assess the pattern and trend of various types of OTs at the Department of Dental and Maxillofacial surgery, St. Paul's hospital, Addis Ababa, Ethiopia over the past 10 years.

Literature review

The mouth and the maxillofacial complex are made of structures that are the target of a wide variety of odontogenic lesions varying in location, etiology and histogenesis, attacking soft tissue and bone, as well as presenting variable clinical manifestations. Amongst the neoplasms of the oral cavity, odontogenic tumors constitute a heterogeneous group of lesions with histopathological characteristics and diverse clinical manifestations (8).

Patterns of odontogenic tumors

The patterns of odontogenic tumor in different parts of the word are different. For instance, according to the study conducted in Pakistan, 1.7 % of the cases of OTs were diagnosed malignant, and all the rest, 98.3 %, were benign (24). In addition, a retrospective study that was conducted in Diyarbakyr, Turkey of the study groups, 23.3% were odontogenic tumors (8). In another retrospective study conducted in Argentina, among 153 cases 7 % of the study groups were diagnosed with odontogenic tumor (9). In a similar study, a total of 4,319 lesions were obtained at the Biopsy Service of the Department of Pathology and Forensic Medicine at the Federal University of Ceará, Brazil. Of these, 131 were diagnosed as OTs (10). Similarly, a study conducted at federal University of Rio Grande do Norte, Brazil, among 5,289 oral biopsies registered during the 30-year period, 127 cases of benign odontogenic tumors were identified (20).

Preferred location of odontogenic tumors

Based on the study conducted in Diyarbakýr, Turkey (8), Buenos Aires, Argentina (9), Kenya (17), Ceará, Brazil (19), Rio Grande do Norte, Brazil (20), Pakistan (24), Mumbai, India (25), Nigeria (23,26), and Tanzania (27), posterior region of the mandible is the common sit for these tumors (8, 9, 17, 19, 20, 23, 24, 25, 26, 27).

Types of odontogenic tumor

According to the study conducted in Pakistan, Ameloblastoma was the most common OT type followed by KCOT, Adenomatoid odontogenic tumors (AOT), Odontoma, Odontogenic myxoma, Odontogenic Fibroma and ameloblastic fibroodontoma respectively (24). In another

study conducted in Turkey Odontoma was the most common type of OT followed by fibroma which was ameloblastic, Cementifying and odontogenic, and ameloblastoma was the list one (8). Similarly, study was conducted among 127 cases in Argentina (9). The most frequent OTs were odontoma; followed by ameloblastoma, myxoma. AOT, calcified epithelial odontogenic tumor (CEOT). In addition, a study conducted in Brazil among 5,289 oral biopsies registered during the 30-year period, the most frequent lesions were odontoma, followed by ameloblastoma, adenomatoid odontogenic tumor, and odontogenic myxoma (20).

A total of 60 cases with OTs were seen and diagnosed at the Department of Oral Pathology and Microbiology of Government Dental College and Hospital, Mumbai, India from January 2001 to March 2010. Interesting, all these tumors were benign. Ameloblastoma was the most common benign tumor followed by odontome, adenomato 1id odontogenic tumor respectively (25). According to studies conducted in Kenya (17), Nigeria (24, 26) and Tanzania (27), odontogenic tumors were the most common types of tumors that occurred in the jaw. Of these, ameloblastoma was the most common one followed by Keratocystic Odontogenic tumor, Adenomatoid odontogenic tumor, odontogenic myxioma and odontoma respectively.

Socio-demographic characteristics and odontogenic tumor

According to different studies conducted in Pakistan (24), Diyarbakýr Turkey (8), Argentina (9), Ceará Brazil (19), Rio Grande do Norte Brazil (20), the peak age of incidence was the second and third decades of life. On the other hand studies reported from India (25), Tanzania (27), Kenya (17) and Nigeria (23,26) OTs were most frequent from the second to fifth decades of life.

Studies conducted in Ceará, Brazil (19), Rio Grande do Norte, Brazil (20), Mumbai, India (25) reported that odontogenic tumors are more common among females than their counter males partners. In contrary, males were more affected than females according to studies conducted in Pakistan (24) and Nigeria (16, 26). Intriguingly, researchers reported in Diyarbakýr, Turkey (8), Buenos Aires, Argentina (9), Tanzania (27), Kenya (17) and Nigeria (23), there was no significant difference in the gender distribution.

Significance of the study

The oro-facial regions including the oral cavity, the maxilla and mandible and related tissues are the most common sites of a multitude of neoplastic conditions. These tumors have a predilection for the entire facial region. However, OTs tend to affect more often the mandible than the maxilla. The treatment of choice for OT is surgical operation; extirpation and curettage for benign and segmental resection for malignant once. If left untreated, it could result in death within 4 to 6 months of diagnosis. Despite these consequences, little is known about the magnitude of OT in Ethiopia. This highlights the urgent need for assessing the frequency of these tumors in Ethiopia which will in turn improve patient survival and quality of life ([28). Therefore, this study determined the pattern and trend of OT in Ethiopia which will in turn alarm the ministry of health to act on interventional strategies, and endow information for proper management of the patients. In addition this study will increase awareness in the community, and promote effective planning and policy in relation to OTs. Furthermore, it will provide baseline data for further studies.

Objectives

General objective

- To assess the pattern and trend of odontogenic tumors in Ethiopian over a period of 8 years.

Specific objectives

- ✓ To describe the pattern of odontogenic tumors
- ✓ To assess the trend of odontogenic tumors
- ✓ To determine the preferred location of odontogenic tumors
- ✓ To assess associations between socio-demographic characteristics and type of tumor
- ✓ To assess factors associated with time of OT presentation

Methods

Study area and period

The study was conducted at St. Paul's hospital, Addis Ababa, Ethiopia. St. Paul hospital has more than 13 Departments. Of these, the Department of Dentistry and Maxillofacial-surgery is one of the largest and pioneer centers for maxillofacial surgery in Ethiopia. The Department comprises different professionals such as one maxillofacial surgeon, five dental surgeons, one dental therapist, and five nurses. Currently, the Department has 12 beds, with an annual average of 10,000 patients. [Personal communication with the head of the Department] In this study, medical records of patients who visited the Department of Dentistry and Maxillofacial-surgery from 2008 to 2015 were reviewed.

Study design

A retrospective cross-sectional study design was conducted to determine the pattern and trend of OTs.

Population

Source population

Medical cards of patients with the diagnosis of odontogenic tumor at St. Paul's hospital from 2008 to 2015.

Study population

Medical cards of patients with diagnosis of odontogenic tumor with complete medical record at St. Paul's hospital from 2008 to 2015.

Inclusion and exclusion criteria

Medical cards showing both genders, and all ages with jaw swellings that were histopathologically diagnosed as odontogenic tumors were included in the study. On the other

hand, patient's cards with incomplete medical record, different histopathology result of biopsy and fine needle aspiration cytology were excluded from the study.

Sample size and sampling technique

From the time of maxillofacial surgery service launch at St. Paul hospital to the end of 2008, the Department did not provide consistent services throughout the years due to constraint of maxillofacial surgeons at the Department. Furthermore, the medical cards of patient's treated before 2008 were not filled properly, and could not be traced. Therefore, in this study, medical records from 2008 onwards were reviewed. As such, 448 medical cards were reviewed. However, 163 cards fulfilled the inclusion criteria of the study. To this end, the medical card and histopathology result of all patients in the study period were revised.

Measurements

Variables

Age, sex, Present address , Duration of the lesion, Location of the lesion, Size of the lesion, Histopathology result, Type of operation and Compliant after surgery were considered as independent variables, whilst type of OT as dependent variable. (see conceptual framework)

Data Collection procedure

Extractions of patient's identification (card) number with the diagnosis of odontogenic tumor were made from the registration book at the Department. Consequently, the patient's identification number was used to collect the entire patient cards with all medical records from the hospital card room. Once the cards are at hand, all the necessary data was collected (based on the check list).

A checklist was used to extract the data from patients' cards (see annex III). This checklist was developed based on reviewing the existing medical records of our patients, and literature review on the topic. Data was collected by a well oriented nurses working at the Department. I, the candidate, supervised them during the data collection. All completed data collection forms were examined for clarity and consistency.

Data analysis

Descriptive statistics such as median, standard deviations (SDs) and tables were used to investigate the characteristics of the study subjects. Descriptive statistics and logistic regression analysis were analyzed using Statistical Package for Social Sciences (SPSS) version 16. 95 % confidence intervals were used as measures of association between the independent and outcome variable. A p-value of less or equal to 0.05 was considered statistically significant.

Ethical consideration

The study protocol was submitted to Jimma University, College of Public Health and Medical Sciences Ethical and Review office for budget and ethical approval. After ethical clearance was obtained, formal letter to St. Paul's hospital was written from research and publication office to get permission for data collection. Patient confidentiality was strictly maintained by not mentioning patient name and any potential identifier on the check list.

Limitation of the study

- Incompleteness of the medical cards of patients lowered the sample size in turn reduced the power of our test.

Plan for dissemination

The findings of this study will primarily be submitted to Jimma University Postgraduate office, college of public health and medical sciences, Department of Dentistry, Jimma University, and Department of Maxillofacial and Surgery, St. Paul hospital. Furthermore, the finding of this thesis will be submitted to pear reviewed international journals for publication. Importantly, it will be presented to dental association annual meetings to create awareness among dentists.

Results

Socio-demographic characteristics

According to the review of the medical cards, a total of 448 OT cases were treated at St. Paul's hospital, Addis Ababa, Ethiopia from September 2008 to May 2015. Out of these, 163 medical cards fulfilled the inclusion criteria of the study. From the total 163 reviewed medical cards, 88 (54 %) were males, while the remaining 75 (46 %) were their counter partner females. The majority, 82 (50.3 %) of patient's age ranged between 20 and 39 years. 96 (58.9 %) of the participant were living in rural areas of the country (Table 1).

Table 1:- Socio-demographic characteristics of patients with the diagnosis of OT, St. Paul's hospital, Addis Ababa, Ethiopia, 2015

Socio-demographic characteristics	**Frequency (%)**
Gender	
Male	88 (54)
Female	75 (46)
Age	
0-19	34 (20.8)
20-39	82 (50.3)
>= 40	47 (28.8)
Address	
Urban	67 (41.1)
Rural	96 (58.9)

Frequency of OT cases diagnosed in each Year

Concerning the number of OT cases diagnosed, the majority 44 (27%) of the patients were diagnosed in the year of 2010. In contrast, the least numbers of cases 3 (1.8 %) were diagnosed in the year of 2008 (Fig 2).

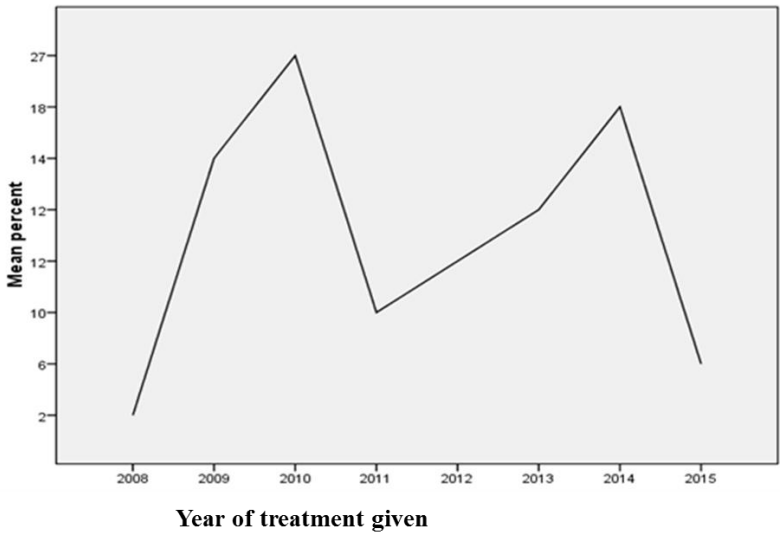

Figure 2:- Distribution of OTs cases diagnosed from 2008 to 2015, St. Paul's hospital, Addis Ababa, Ethiopia, 2015

Frequency of OTs by the year of presentation

In this study, the majority 112 (68.7 %) of OT cases were presented to St. Paul hospital after 1 year of onset of symptoms. On the other hand, 51 (31.3 %) of the cases were presented before 1 year of onset of symptoms (Fig 2).

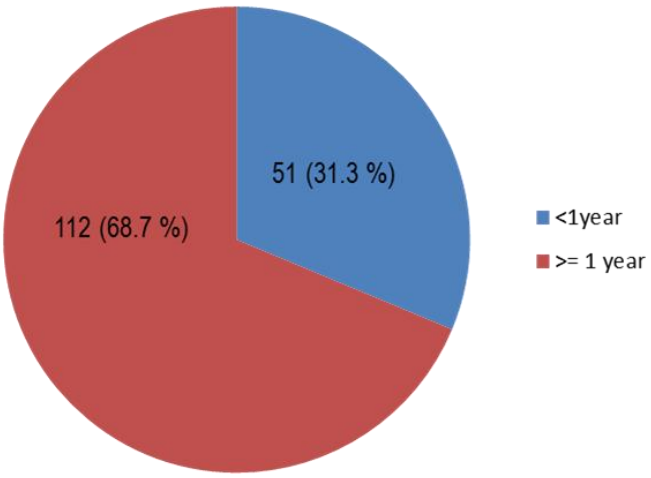

Figure 3:- Frequency of OTS diagnosed by the year after onset of symptoms, St. Paul's hospital, Addis Ababa, Ethiopia, 2015

Classes of odontogenic tumors

Of the 163 cases, 80.4 % were benign, and the remaining 19.6 % were malignant tumors. The most frequent type of benign odontogenic tumor was ameloblastoma (46 %) followed by odontogenic myxioma (8.6 %). On the other hand, intraosseous squamous cell carcinoma was the most common type of malignant odontogenic tumor (Table 2).

Table 2:-Frequency distribution of odontogenic tumors according to the recent WHO classification, St. Paul's hospital, Addis Ababa, Ethiopia, 2015

Types of odontogenic tumor		**Frequency (%)**	**Frequency (%)**
Being tumors	Ameloblastoma	75 (46.0)	131 (80.4%)
	Odontogenic myxioma	14 (8.6)	
	Keratocystic OT	10 (6.1)	
	Odontogenic fibroma	10 (6.1)	
	Ameloblatic fibroma	9 (4.3)	
	Odontoma	6 (3.7)	
	Others	9 (5.4)	
Malignant tumors	Primary intra osseous scc	26 (16.8)	32 (19.6 %)
	Others	6 (3.6)	

Distribution of odontogenic tumors by sex

OTs were presented in both genders with similar distribution, i.e about 53.3 % in males, and 46.7 % in females. The male to female ratio was 1.4: 1. However, in males, almeloblastom and intaosseous scc were found to be the most frequent types of OTs with male to female sex ratio of 1.27 and 1.6 respectively. Odontogenic myxioma and ameloblatic fibroma frequently seen in males with male to female sex ratio of 2.5 and 2 respectively. On the other hand, Keratocystic odontogenic tumor, Odontogenic fibroma, Calcifying cystic OT, Cementoblatoma and others were the predominant classes of OT seen among females. Interestingly, odontoma was found with equal distribution among both genders (Table 3).

Table 3:-Distribution of odontogenic tumors by sex in line with the recent WHO classification, St. Paul's hospital, Addis Ababa, Ethiopia, 2015

Types of OTs	Gender		Total	Male to female ratio
	Male	Female		
Ameloblastoma	42	33	75	1.27
Primary intra osseous scc	16	10	26	1.6
Odontogenic myxioma	10	4	14	2.5
Keratocystic OT	2	8	10	0.25
Odontogenic fibroma	4	6	10	0.67
Ameloblatic fibroma	6	3	9	2
Odontoma	3	3	6	1
Others	6	9	15	0.67
Total OTs cases	89	74	163	1.2

Distribution of different classes of OTs by age

The age of patients diagnosed with OT ranged from 8-80 years with a mean age of 34 years. 40 (24.5 %) of patients with the diagnosis of ameloblastoma (benign tumor) were within the age group of 20-39 year. The second common OT was intra osseous SCC which is malignant tumor. It is most frequently seen in the age group greater than or equals to 40 years. Odontogenic myxioma, odontogenic fibroma and odontoma (benign tumor) were commonly seen within the age group of 20-39 year which accounts 7(50%), 6(75%) and 4 (66.7%) respectively. 5(50%) of KCOT were diagnosed with the age range of 0-19 years old. Amelobastic fibromas were distributed equal within the age group of 0-19 and 20-39 which account 4(44.4 %). 11 (73.3%) of other type of OTs were seen in the age group of 20.39 years old (Table 4).

Table 4:- Distribution of odontogenic tumors by age, according to the recent WHO classification of Odontogenic Tumors, at St. Paul's hospital, Addis Ababa, Ethiopia, 2015

Odontogenic tumors	Age (years)		
	0-19	20-39	>=40
Ameloblastoma	17	40	18
Intra osseous scc	0	7	19
Odontogenic myxioma	5	7	2
Keratocystic OT	5	3	2
Odontogenic fibroma	1	6	1
Ameloblatic fibroma	4	4	1
Odontoma	1	4	1
Others	1	11	3
Total OTs cases	34	82	47

Odontogenic tumors by location

In this study, tumors were sited at every place. However, the mandible was the most frequently affected site corresponding to 126 of the cases, while the maxilla was affected in 37 (22.7 %) of the cases. Based on this serious, the mandible was the most commonly affected site. Of the different classes of OTs affecting the mandible, ameloblastoma, intra osseous scc, Odontogenic myxioma, odontogenic fibroma were the frequently found tumor types among the patients. Similarly, ameloblastoma, intra osseous scc and keratocystic odontogenic tumor were the commonly diagnosed OT types affecting the maxilla (Table 5).

Table 5:- Distribution of odontogenic tumors by place of occurrence according to the recent WHO classification of OTs at St. Paul's hospital, Addis Ababa, Ethiopia, 2015

Odontogenic tumors	**Maxilla**	**Mandible**	**Maxilla: Mandible**
Ameloblastoma	8	67	0.18
Intra osseous scc	8	18	0.44
Odontogenic myxioma	3	11	0.27
Keratocystic OT	6	4	1.5
Odontogenic fibroma	3	7	0.43
Ameloblatic fibroma	4	5	0.8
Odontoma	0	6	-
Others	5	10	0.5
Total OTs cases	37	126	0.3

Surgical Treatment and its complications

Out of the total 163 patients, 128 (82.8 %) received primary treatment while 28 (17.2 %) were referred to other oncology centers. From the 128 patients that were treated at St. Paul's hospital, 80 (49.1 %) of patients had segmental resection whilst 20 (12.3 %) had marginal resection. In addition enucleation and curettage were performed in 35 (21.5 %) of the treated patients. Concerning the complications after surgical treatment, facial disfiguration, malocclusion, numbness, recurrence, and continuity defects were seen in 66 (40.5 %), 56 (36.2 %), 13 (8.0 %), 20 (12.3%) and 80 (49.1 %) of the patents that had surgical treatment, respectively. However, out of the total 128 patients who had surgery, 47 (28.8 %) of them had no any complication after surgery (Table 6).

Table 6:- Frequency distribution of surgical treatment and its complications of odontogenic tumors at St. Paul's hospital, Addis Ababa, Ethiopia, 2015

Variables			Frequency (%)
Surgical treatment	Jaw Resection	Segmental	80 (49.1)
		Marginal	20 (12.3)
	Enucleation and curettage		35 (21.5)
	Referral to oncology center		28 (17.2)
Surgical Complication	Yes		116 (71.2)
	No		47 (28.8)
Type of surgical Complications	Facial disfigurement		66 (40.5)
	Malocclusion		56 (36.2)
	Numbness		13 (8.0)
	Recurrence		20 (12.3)
	Continuity defect		80 (49.1)
	Other		4 (2.5)

Factors associated with complication after surgery

To assess the relationship between complication after surgery and different factors such as: gender, age, place of residence, size and time of OT presentation; bivariate logistic regression analysis was conducted. Interestingly, complication after surgery had statistically significant relation with place of residence and tumor size. Living in the rural areas had more likely chance of having complication after surgery than living in the urban areas [Adjusted OR = 2.13, (95% CI: 0.98, 4.6)], and as size of tumor increases the chance of having complication after surgery also increases [Adjusted OR = 4.24, (95% CI: 1.76, 10.21)]. However, gender, age, time of OT presentation were not statistically significant ($P > 0.05$) (Table 7).

Table 7:- Bivariate analysis of complication after surgery for OT treatment and different factors, St. Paul's hospital, Addis Ababa, Ethiopia, 2015

Variables		Complication after surgery		Crud OR	Adjusted OR	P - value
		Yes	No			
Gender	Female	55 (33.7 %)	20 (12.3 %)			
	Male	61 (37.4 %)	27 (16.6 %)	0.82 (0.42,0.82)	1.02 (0.48,2.14)	0.97
Age	0-19	27 (16.6 %)	7 (4.3 %)			
	20-39	60 (36.8 %)	22 (13.5 %)	0.71 (0.27,1.85)	2.18 (0.74,6.42)	0.16
	>=40	29 (17.8 %)	18 (11.0 %)	0.42 (0.15,1.16)	1.42 (0.61,3.28)	0.41
Place of residence	Urban	53 (32.5 %)	14 (8.6 %)			
	Rural	63 (38.7 %)	33 (20.2 %)	1.98 (0.96,4.09)	2.13 (0.98,4.6)	0.05*
Tumor size	0-3 cm	23 (14.1 %)	20 (12.3 %)			
	4-6 cm	28 (17.2 %)	14 (8.6 %)	1.74 (0.72,4.18)	1.86 (0.74,4.66)	0.186
	>= 7 cm	65 (39.9 %)	13 (8.0 %)	4.35 (1.87,10.12)	4.24 (1.76,10.21)	0.001*
Time of OT presentation	< 1 year	32 (19.6 %)	19 (11.7 %)			
	>=1 year	84 (51.5 %)	28 (17.2 %)	1.78 (0.88,3.63)	1.71 (0.8,3.67)	0.17

Factor associated with time of presentation

Binary logistic regression analysis was done between socio-demographic characters and size of tumor against year of OT presentation to investigate their association. Nonetheless, no statistically significant association was observed (Table 8).

Table 8:- Binary logistic regression of different variables and year of presentation, odontogenic tumor patients, St. Paul's hospital, Addis Ababa, Ethiopia, 2015

Variables		Year of presentation		Crude OR	Adjusted OR	P-value
		< 1 year	>= 1 year			
Gender	Female	23 (30.7 %)	52 (69.3%)			0.97
	Male	28 ((31.8%)	60 (68.2%)	0.95 (0.49,1.84)	1.02 (0.51, 2.02)	
Age	0-19	9 (26.5%)	25 (73.5%)			0.48 0.46
	20-39	26 (31.7%)	56 (68.3%)	0.78 (0.32,1.89)	0.72 (0.29, 1.90)	
	>=40	16 (34.0%)	31 (66.0%)	0.69 (0.26,1.84)	0.69 (0.26, 1.86)	
Place of residency	Urban	22 (32.8%)	45 (67.2%)			0.60
	Rural	29 (30.2%)	67 (69.8%)	1.13 (0.58,2.21)	1.17 (0.59,2.31)	
Size of tumor	0-3 cm	14 (32.6%)	29 (67.4%)			0.31 0.44
	4-6 cm	17 (40.5%)	25(59.5%)	0.71 (0.29,1.72)	0.69 (0.28,1.70)	
	>= 7 cm	20 (25.6%)	58 (74.4%)	1.4 (0.62,3.17)	1.40 (0.61,3.22)	

Discussion

Studies of OT among population are crucial for identification of the population groups at risk, possible factors associated to their development, and to develop more precisely differential diagnoses (31). Despite this fact, studies of OTs are very scare in Ethiopia. Therefore, we aimed at investigating the distribution of OTs in Ethiopian over a period of 8 years.

In the present study, a total of 163 cases, 89 (54.6 %) males and 74 (46.4 %) females were included. The majority, 82 (50.3 %) of them were within the age range of 20-39 years old. On the other hand, 96 (58.9 %) of the participant live in the rural areas, while the remaining 67 (41.1 %) in urban areas. Concerning the year of diagnosis, the majority, 44 (27 %) of the patients were diagnosed in the year of 2010. On the other hand, the least numbers of cases 3 (1.8 %) were diagnosed in the year of 2008. Furthermore, 112 (68.7 %) of OT cases were presented to St. Paul hospital after 1 year of OT presentation, whereas 51 (31.3 %) of the cases were presented before 1 year of OT presentation.

Classes of OTs can either be benign or malignant. However, when considered globally, there is considerable racial predilection for the specific tumor types. In this study, about 80.4 % of the cases were benign OTs. This finding is slightly lower than studies reported from Nigeria (22), India (23), Turkey (28), and Brazil (31). Since some of benign odontogenic tumor do not exhibit clinical symptom and are detected during routine dental examination. This might be reason for low incidence benign tumors in this study because most the patient in this area do not seek medical checkup unless they have suggestive symptoms for evident pathology. On the other hand, about 19.6 % of our cases were found to be malignant. This finding is higher compared to reports from Nigeria (22, 24), India (23), Turkey (28) and Brazil (31). These differences in the distribution of malignant OTs might be due to the geographical and cultural variation among the different study population. For example, some of the participants were using traditional medicine like, leaves, stem and root of some plants before coming to the hospital. This might increase the risk transformation of tumors in to malignant type. Besides, most of these patients in this area seek medical treatment in late stage. This may lead malignant transformation some benign tumors (34). This finding implies that benign OTs are more common than malignant OTs among Ethiopian patients diagnosed from 2008 to 2015.

Concerning the pattern of OT types, in the present study, ameloblastoma was the most frequent tpe of all OTs accounting for about 46 % of all OTs. This finding is similar to studies conducted in Pakistan (23), India (24), Kenya (17), Nigeria (23, 25) and Tanzania (26). Additionally, primary intra-osseous SCC was found to be the second most common (16 %) OTs in this study. This finding is lower compared to a study conducted in Pakistan (3) and china (5), and higher compared to a study conducted in China (4). This observed variation could probably be because of small sample size in this study. Likewise, myxoma was found to be the third most common type of OT seen in this study which accounted for about 8.6 % of all OTs. This finding is consistent to a study conducted in Nigeria (29). Furthermore, the remaining OTs types such as keratocystic OT, odontogenic fibroma, ameloblastic fibroma, odontoma, calcifying cystic OT, cementoblastoma, malignant ameloblastoma, clear cell odontogenic tumor and gouts cell odontogenic tumor accounted for about 29.4 % of the total OTs.

In the present study, OT occurred in males more frequently than in females. This finding is in accordance with other studies reported from Pakistan (23) and Nigeria (16, 25). In contrary, studies conducted in Ceará, Brazil (18), Rio Grande do Norte, Brazil (19) and Mumbai, India (24) reported that OTs are more common among females than their counter male partners. Regarding the distribution of specific OT types, ameloblastoma was slightly higher (56 %) among males than the females. This finding is similar to studies done in Nigeria (16, 24,2 9), India (23), and Argentina (8). In addition, primary intra osseous scc were found to be the most frequent types of OTs in male 16 (61.5%). This finding is consistent with studies conducted in china (4, 5). This might be due to a custom of chewing and smoking habit among Ethiopian males than females (35). So as to myxoma, it affected more males than females with sex ratio of 2.5. This finding is similar to studies conducted in Nigeria (16, 29).

Regarding the distribution of OT by age, OTs were most frequent in the second and third decades of life among our study patients. This finding is similar to previous reports from Pakistan (24), Diyarbakýr, Turkey (8), Argentina (9), Ceará, Brazil (18) and Rio Grande do Norte, Brazil (19). In relation to distribution of different OT types by age, 40 (53.3 %) Amelobastom cases were within the age group of 20-39. This finding is comparable to studies conducted in Pakistan (26), Brazil (31), Nigeria (22, 24) and India (23). Moreover, 19 (73.1 %) of primary intra osseous scc were seen among patients with age of 40 years and older. This fnd is

in line with studies conducted in chain (4, 5). This is probably due to increase the risk of poor oral hygiene and local irritation. Likewise, 7(50%) of myxoma cases were commonly seen from 2^{nd} to 4^{th} decades of life, a result similar to studies conducted in Nigeria (16, 29).

Regarding location of OT, 77.3 % of all OTs were observed in the mandible, whereas the remaining 22.7 % were located in the maxilla among our study patients. This finding is similar to reports from Diyarbakýr, Turkey (8), Buenos Aires, Argentina (9), Kenya (17), Ceará, Brazil (18), Rio Grande do Norte, Brazil (19), Pakistan (23), Mumbai, India (24), Nigeria (22,25), and Tanzania (26). Concerning to individual cases, mandible was found the most common site in about 89.3 % of ameloblastoma cases. This finding is comparable to studies conducted in Nigeria (16, 24, 29), India (23), and Argentina (8). In addition, predilection of mandible was observed among the primary intra-osseous SCC, a finding consistent with studies reported from Pakistan (3) and China (4, 5). Similarly, mandible was the most commonly affected site in myxoma cases, a finding similar to reports from Argentina (8) and Nigeria (29).

Treatments of OTs are generally classified as conservative or aggressive. Conservative treatment usually includes simple enucleation, with or without curettage, or marsupialization. Aggressive treatment principally includes peripheral ostectomy, chemical curettage with Carnoy's solution, cryotherapy, or electrocautery and resection. Resection of the tumor with adequate margin of normal bone was satisfactory for locally invasive tumors like ameloblastoma, odontogenic fibromyxoma, KCOT and myxoma. On the other hand, the use of enucleation and curettage leads to recurrence of these lesions.

In this study, about 12.3% of the cases had history of recurrence, a finding which is higher compare to a study conducted in Nigeria (22). This might be due to inappropriate diagnosis of the cases leading to wrong surgical treatment. In this study hospital, obtaining biopsy results are extremely time consuming. As a result, surgical treatments are given for patients without definitive diagnosis supported by biopsy.

The present study showed statistically significant association between two variables: place of residence and tumor size, with the dependent variable complication after surgery, particularly in the case of rural people and large sized OTs, respectively. Living in the rural areas had more likely chance of having complication after surgery than living in the urban areas. In addition, an

increase in the size of tumor increased the chance of having complication after surgery. To my knowledge this is a first finding showing these associations. However, the association could be explained by the fact that dental services in general and maxillofacial services in particular are extremely scare in Ethiopia, moreover in the rural parts. Thus, patients from the rural area would have a late presentation to dental and/or maxillofacial clinics. This late presentation of cases in turn could result in large sizes of OTs. As a consequence, necessitates a wide surgical procedures to be carried out for the treatment. Hence, patients will have a higher chance of having complications after surgery.

Conclusion

The present study showed different patterns of OTs in different age groups and two genders. Most of the OTs cases were diagnosed in the year of 2010 and from rural area. Furthermore, participants came to the hospital after greater than one year duration of presentation. In addition, benign OTs were predominant compared to malignant. Moreover, ameloblastoma and primary intraosseous squamous cell carcinoma were the most common diagnosed benign and malignant tumors respectively. OT cases were more frequently seen among males with age group of 20-39 years old. Intriguingly, posterior mandible was the commonest site involved. Furthermore, complication after surgery has significant association with tumor size and place of residency.

Recommendations

To my best knowledge, this is the first report on the distribution of OTs in Ethiopian. I believe that this report will create awareness among health care workers in general, and dentists in particular about OTs. Preventive mechanisms and early case detection could have a substantial role in minimizing the consequences of OTs. Therefore, the ministry of health should put an effort in increasing the services of dentistry in alliance with other medical services at different health institutions in all parts of the country. Moreover, dentists should create awareness among health workers about preventive and early diagnosis of OT cases. Furthermore, health care workers should create awareness among the community about the consequences of OTs. Finally, the community needs to bring behavioral change in having a habit of regular visit to dentists.

Assurance of Principal Investigator

The undersigned agrees to accept responsibility for the scientific, ethical and technical conduct of the research project and for provision of required progress reports as per terms and conditions of the College of Public Health and Medical Science in effect at the time of grant is forwarded as the result of this application.

Name of the student: _____

Date._____ Signature _____

Approval of the first advisor

Name of the first advisor: _____

Date._____ Signature _____

Annexes

Annex I - Conceptual framework

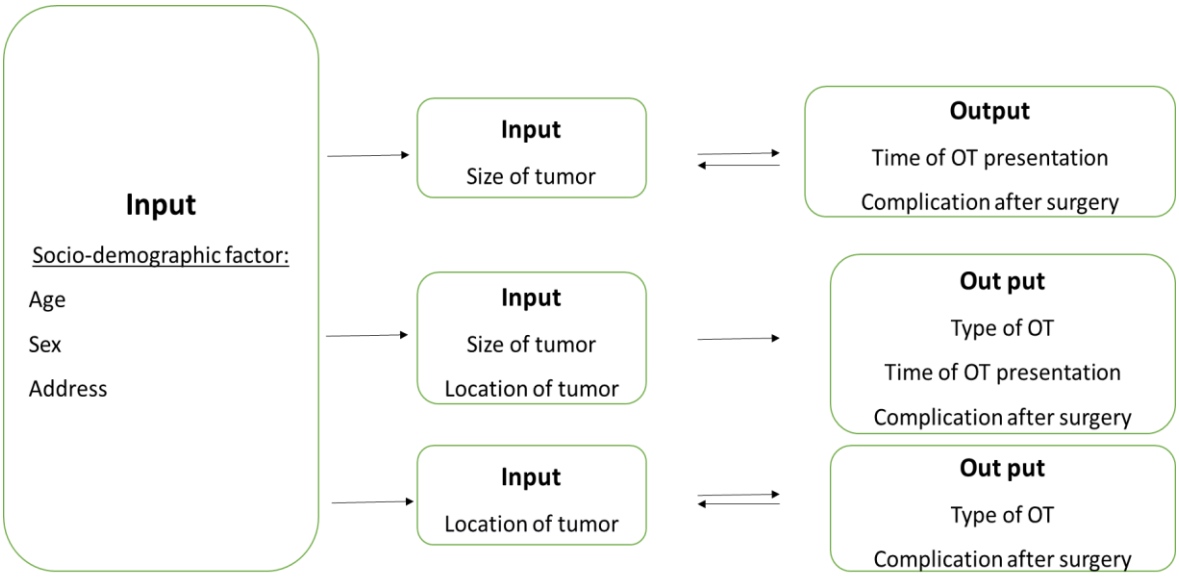

Figure-4. Conceptual framework

Annex II - References

1. J Bánóczy, PE Petersen, AJ Rugg-Gunn. Milk fluoridation for the prevention of dental caries. Geneva, 2009.
2. Abdulai AE et al. Jaw Tumors in Ghanaian Children and Adolescents: A Retrospective Study. World J Surg Med RadiatOncol, 2012; 1: 83-90.
3. Akram S, Naghma, Ali MA, Shakir MM. Prevalence of Odontogenic Cysts and Tumors in Karachi, Pakistan. J Dow Uni Health Sci, 2013; 7(1): 20-24.(18).
4. H.-Y.Lou, T.-J. Li .Odontogenic tumors: A study of 1309 cases in a Chinese population. Oral Oncology, 2009;45: 706–711.
5. Jing et al. odontogenic tumors: a retrospective study of 1642 cases in Chinese population. Int. J. Oral Maxillofac Surg, 2007;36: 20–2 doi:10.1016/j.ijom.2006.10.011.
6. Barnes L, Eveson J, Reichart P, Sidransky D World Health Organization classification of tumors (Pathology and genetics of head and neck tumors)**.** In: IARC Press, Lyon 2005; 285.
7. Moridani *et al.* a 7 year retrospective study of biopsied oral lesions in 460 biopsied oral lesions in 460 Iranian patients. RSBO, 2014;11(2):118-24.
8. Guerrisi M., Piloni M.J, Keszler A. Odontogenic tumors in children and adolescents: A 15-year retrospective study in Argentina. Med Oral Patol Oral Cir Bucal, 2007; 12:E180-5.
9. LB BORGES et al. Odontogenic lesions of the jaw: a clinical-pathological study of 461*cases*. RGO, 2012; 60(1): 71-78.
10. LA Gaita´n-Cepeda et al. Reclassification of odontogenic keratocyst as tumor: Impact on the odontogenic tumors prevalence. Oral Diseases, 2010; 16: 185–187.
11. Ramachandran S, Rajeshwari GA, Ali IM, Sree GV. Odontogenic keratocyst – A silent tumor. JPBMS 2013; 32(32): 1292-1298.
12. N.R. Johnson et al. Systematic review of odontogenic cysts and tumors. Journal of Investigative and Clinical Dentistry, 2014;5: 9–14.
13. Khajeh AS, Rahpeyma A. Central Odontogenic Fibroma of the Mandible. JDMT, 2012; 1(2): 70-73.

14. Tanrýkulu R, Erol B, Haspolat K. Tumors of the maxillofacial region in children: retrospective analysis and long-term follow-up outcomes of 90 patients. Turk J Pediatr, 2004; 46: 60-66.
15. Peter E. Larsen, Arden K Hegtvedt. Chapter 78: Odontogenesis and Odontogenic Cysts and Tumors. Accessed from: http://famona.tripod.com/ent/cummings/cumm078.pdf on December, 2014.
16. Lawal AO, Adisa1 AO, Popoola BO. Odontogenic tumors in children and adolescents: a review of forty-eight cases. Ann Ibd. Pg. Med, 2013; 11(1):7-11.
17. F. M. A. Butt *et al.* 19-year audit of benign jaw tumors and tumor-like lesions in a teaching hospital in Nairobi, Kenya. Open Journal of Stomatology,2012; 2:54-59.
18. Linard RA1, Azoubel AA,Santana T de S ,Sávio E deSA, Dourado E. Odontogenic tumors: clinicaland pathology study of 238cases. Rev Bras Otorrinolaringol, 2008; 74(5):668-73.
19. Santos JN, Pereira pinto L, Figueredo CRLV de, Souza LB de. Odontogenic tumors: analysis of 127 cases. PesquiOdontol Bras, 2001; 15(4):308-313.
20. Sharif FNj, Oliver R, Sweet C, Sharif MO. Interventions for the treatment of keratocystic odontogenic tumours (KCOT, odontogenic keratocysts (OKC)).Cochrane Database Syst Rev, 2010; 8(9):CD008464. doi: 10.1002/14651858.CD008464.pub2.
21. Malheiro P, Feio L, Costa H. Unicystic Plexiform Ameloblastoma. Revista de saúde amato lusitano, 2013; 32:52-54.
22. Anyanechi CE, Saheeb BD. A review of 156 odontogenic tumors in calabar, Nigeria. Ghana Medical Journal, 2014; 48(3):163-167.
23. Varkhede A, Tupkari JV, Mandale MS, Sardar M. Odontogenic tumors: a review of 60 cases. J ClinExp Dent, 2010; 2(4):e183-6.
24. Ladeinde et al. Odontogenic tumors: A review of 319 cases in a Nigerian teaching hospital. Oral Surg Oral Med Oral Pathol Oral RadiolEndod, 2005;99(2):191-5
25. Simon ENM, Stoelinga PJW, Vuhahula E, Ngassapa D. Odontogenic tumors and tumors like lesions in Tanzania. East African Medical Journal, 2002;79(1):3-7.
26. IramNaz et al. Clinicopathological Evaluation of Odontogenic Tumors in Pakistan - A Seven Year Retrospective Study. Asian Pac J Cancer Prev, 2014;15 (7): 3327-3330.

27. Accessed from: https://www.us.elsevierhealth.com/media/us/samplechapters/9780443100536/9780443100536.pdf on December, 2014.
28. F. Çizmeci şenel, e. H. Dayisoylu, ş. Ersöz, n. Yilmaz altintaş, e. Tosun c. Üngör, f. Taşkesen. The relative frequency of odontogenic tumors in the Black Sea region of Turkey: an analysis of 86 cases. Turk J Med Sci, 2012; 42 (Sup.2): 1463-1470.
29. Ajayi OF, L LadeindeAL, AdeyemoWL, OgunleweMO. Odontogenic tumors in Nigerian children and adolescents- a retrospective study of 92 cases. World Journal of Surgical Oncology, 2004; 2:39 doi:10.1186/1477-7819-2-39
30. Bassey GO, Osunde OD, Anyanechi CE. Maxillofacial tumors and tumor-like lesions in a Nigerian teaching hospital: an eleven year retrospective analysis. African Health Sciences, 2014;14(1): 56-63 http://dx.doi.org/10.4314/ahs.v14i1.9
31. Costa DOP, Maurício AS, Faria PAS, Silva LE, Mosqueda-Taylor A, Lourenço SQC. Odontogenic tumors: A retrospective study of four Brazilian diagnostic pathology centers. Med Oral Patol Oral Cir Bucal, 2012 May 1; 17 (3):e389-94.
32. Ebenezer V, Ramalingam B. A Cross-Sectional Survey of Prevalence of Odontogenic Tumours. J. Maxillofac. Oral Surg, 2010; 9(4):369–374. DOI 10.1007/s12663-011-0170-8.
33. Kowkabi M, Razavi SM, Khosravi N, Navabi AA. Odontogenic tumors in Iran, Isfahan: A study of 260 cases. Dent Res J, 2012; 9: 725-9.
34. Robles P &Roa I. Keratocystic odontogenic tumor: Clinicopathological aspects and treatment. J Oral Res 2014; 3: 249-256.
35. Yigzaw kebede. Cigarette smoking and khat chewing among college students in North West Ethiopia. ethiop.J.healthDeve, 200216:9-17.

Annex III - Checklist for data collection

JIMMA UNIVERSITY

Department of Dentistry, Oral and Maxillofacial surgery unit

Students Research Program

Checklist to assess the pattern and trend of odontogenic tumors in a single center, 10 years retrospective study in Ethiopia, 2014 E.C.

Instruction for data collectors:

1. Identify the card number of patient's with the diagnosis of OT from the registration book of Dentistry Department, St. Paul hospital from 1997-2006.
2. By using these card numbers, collect all the medical cards from the card storage room of St. Paul's hospital.
3. Check for the completeness of medical records from all identified cards by ticking on the checklist under "data present" column. If any of the data is missing, exclude the card.
4. Fill in the checklist accordingly.

Ser. N^{o}	Date Present	Information to be filled	Proposed response	Coded response
01		Code number		
02		Card number		
03		Age		
04		Sex	1. Male	
			2. Female	
05		Present address		
06		Duration of the lesion		
07		Location of the lesion	1. Posteriormandible	
			2. Anteriormandible	
			3. Posteriormaxilla	
			4. Anteriormaxilla	
			5. Others ----------	

08		Size of the tumor		
09		Histopathological result	1.Keratocysticodontogenic tumor	
			2. Ameloblastoma	
			3. Odontoma	
			4. Odontogenicmyxoma	
			6. Calcifying cystic odontogenic tumor	
			7. Cementoblastoma	
			7. Central odontogenic fibroma	
			8.Calcifying epithelial OT	
			9. Others	
10		Treatment	marginal resection e-block resection hemi-mandiblectomy hemi-maxiloectomy complete maxilloectomy other _____	
11		Complication after surgery	Malocclusion Paraesthesia Facial nerve injury Other_____	