Letter to Editor

The debate of Water Fluoridation

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Dear Sir;

Water fluoridation is one of preventive oral health interventions where people don't have to change their behavior to get the benefit [1]. The low fluoride intake has been linked to lower risk of dental caries. Dental caries is an infectious and multifactorial disease affecting most people in developed and developing countries. Fluoride reduces the incidence of dental caries and slows or reverses the progression of existing lesions. Water fluoridation is a whole population approach that will be directed to all individuals in the community.

Fluoride is considered beneficial when given systemically during tooth development and topically after the eruption of teeth. Centre of Disease Control (CDC) implies that water fluoridation is one of the best public health achievements in the 20th century [2]. However, a counterargument exists that water fluoridation may be harmful by causing dental fluorosis, if the individual takes another source of fluoride or the fluoride concentration in the water was higher than the recommended number by the World Health Organization (WHO). In the next few paragraphs, I will summarize the two sides of argument regarding water fluoridation as a public health intervention to reduce the risk of dental caries.

The CDC Stated that it has a great money saving to the USA, as "every dollar spent for community water fluoridation saves from $8 to $49 in treatment costs depending on the size of the community" and " it saves more than 4.6 billion annually in dental costs". CDC pointed to the benefit of fluoride to children and adults throughout their lives, as they will have stronger teeth, fewer cavities, less severe cavities, lesser need for fillings and removing teeth. Moreover, less pain and suffering because of tooth decay [3].

On the other side of the Atlantic, the public health in England when answered a question about the risk of fluoridation stated that the only potential negative impact is a greater risk of dental fluorosis and the PHE monitors the oral and general health of people in fluoridated and non-fluoridated areas. In 2013 almost (31%) of 5 years old and nearly half (46%) of 8 years old children had tooth decay. Poor oral health can also negatively impact a person's ability to sleep, eat, speak and socialize [4].

In areas lacking public water supplies and where fluoride is not naturally present in the well water, school fluoridation programs have been shown to be effective and safe. Reductions of up to 38.9% in the rate of dental decay have been reported. Higher levels of fluoride are used in the school water than in public water because of the limited time the children are in school. The relatively low cost of the necessary equipment and chemicals can easily be justified by taking into account the amount of dental decay that can be prevented [5].

Water fluoridation has two edges (i.e. when safe and adequate exposure for fluoride is exceeded, it becomes potentially toxic). For example, the consumption of levels between 0.5–1.0 ppm via drinking water is beneficial for prevention of dental caries, but its excessive consumption leads to the development of fluorosis. Further health issues like dental fluorosis, skeletal fluorosis, thyroid problems, neurological problems were reported profusely in some geographical residential areas. Drinking water naturally has high concentrations of F+ in southern Asia, the eastern Mediterranean, and some parts of Africa.

From an ethical side: The 'right' for an individual to drink water with no fluoride added to it. Some people argue that the local authority would be interfering with the right for an individual to drink water that has no fluoride added. Experts have responded by stating that the adjustment of the quantity of fluoride to an optimum level cannot be compared with adding to water a substance not found there naturally. Water fluoridation effectively replicates a naturally occurring benefit where fluoride is already present at the optimum level of 1 ppm, therefore, there is no

such thing as a 'right' to drink fluoridated water, only a personal preference.

From another ethical perspective: there is no right to ask for unfluoridated water because it's one of the water compositions they only adjust the concentration so they get the benefits rather than the side effects.

From my point of view, water fluoridation is the best way to overcome the inequality in dental caries, as it targets every individual person in the community. However, the increased use of bottled and filtered water as source of drinking water in our country could reduce the impact of fluoridated water supplied by other community resources. The policy makers should give more attention to water fluoridation as extreme approach that can lower the cost incurred by primary preventive measures and alleviate individual's need to the expensive secondary and tertiary interventions.

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Original article

Dental Implant Maintenance Experience: Testing Knowledge and Clinical Practices of Implant Clinicians in Libya

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ABSTRACT

Background: This study was aimed to survey clinicians in Libya for their routine approach of dental implant maintenance and to determine if a relationship exists between the formal undergraduate education and their previous attendance and interest in future implant related continuing education courses.

Methods: A survey of 35–questions specifically developed for this study was distributed to all implant clinicians attending a national continuing education course that was held in Tripoli on June/29/2018. All items on the survey reflected content found in publications that had addressed maintenance of dental implants.

Participants voluntarily completed and submitted their questions survey to the corresponding author before the end of the course.

Results: Targeting 60 participants, the response rate was 63.33% (n=38). Four (10.5%) reported that they have practiced for over 15 years, while Nine (23.6%) have practiced 11 to 15 years. Fourteen (36.8%) have practiced 5 to 10 years and Eleven (28.9%) have practiced 5 years or less. Fourteen (36.8%) reported that they have not received training in class room and clinic on implant care while attending dental school. 5 (13.1%) have not participated in any continuing education course on implant maintenance after school graduation. The majority (94.7%) of the implant clinicians expressed interest in continuing education courses to strengthen backgrounds in maintenance of dental implants.

Conclusions: Results indicated that additional knowledge need to be gained regarding dental implant care in order to guide patients' confidence toward the optimal most successful teeth replacement option. Furthermore, a well-established structured academic program might be necessary to teach implant maintenance at undergraduate and postgraduate levels both theoretically and practically.

Keywords: Dental Implants, Implant Clinicians, Oral Examination, Instrumentation, Dental Continuing Education

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INTRODUCTION

Dental implants have become the most commonly chosen tooth replacement option among partially edentulous Libyan patients, and the frequency of placement has rapidly increased during the last two decades [1]. Consequently, clinicians who provide implant surgical and/or Prosthodontics treatment should develop

and routinely provide patients' with a dental implant oral hygiene maintenance protocol to ensure the longevity of the treatment provided. In addition, implant patients themselves should be advised that maintaining peri-implant tissue health is a key factor related to the long-term survival of dental implants [2].

The importance of maintaining good oral hygiene around dental implants was emphasized in an early consensus conference when the lack of adequate oral hygiene measures actually was considered as a possible contraindication to implant therapy [3].

Dental implants oral hygiene protocol should include an initial assessment prior to surgery, immediately after surgery, and directly following completion of the prosthodontic phase of treatment. That protocol also should identify specific intervals for the long-term supportive (recall) appointments and include an effective patient-administered home care regimen to reduce the potential for implant loss through neglect [4]. Patient instruction in this protocol and the follow-up monitoring by office personnel must be elements central to an effective oral hygiene maintenance program.

Dental implant clinicians are routinely responsible for the continuity of patient education and maintenance of dental implants, years beyond initial placement. This care is referred to as the "*first line*" therapy or the nonsurgical approach [5]. However, there is a deficiency of evidence-based research regarding the best practices for implant maintenance, specifically by the implant clinicians. Graduates prior to the late 2000s may have had little to no formal education on implant care, yet they are treating patients with dental implants [1]. Implant clinicians are encouraged to actively seek standardized and comprehensive training via professional–centred postgraduate education. Professional continuing education may similarly fulfil this need.

In this current study, Libyan dental implant clinicians from diverse educational and practice backgrounds will be surveyed in order to assess their routine approach for dental implant maintenance. This study also sought to determine if a relationship exists between the formal education and the previous attendance and interest in future continuing education courses about implants.

MATERIALS AND METHODS

After an extensive review of the literature, the authors developed a 35–item paper survey specifically for this study (Supplementary File). All items on the survey reflected content found in publications that addressed maintenance of dental implants. Major part of our survey questions was based on that survey developed by RE based on Ward ST et al. (2012) [6] article that discussed the routine approach of dental hygienists in the United States towards the maintenance of dental implants. The need for ethics approval was deemed unnecessary and only the authors considered the questions and content validity of the survey. In addition, the ethical national guidelines for biomedical research in Libya is still under processing and organization. [7].

The questionnaire was distributed to all attendees of the national continuing education course that was held in Tripoli on June 29, 2018 (n=60). Participants were conveniently sampled and volunteered to submit their survey before the end of the course day. Surveys submitted after the day of the course were not included in this study. Completed surveys were returned to the continuing education staff members before the data collection deadline. Data were entered in a spreadsheet by RE and then independently verified by YE to ensure its accuracy.

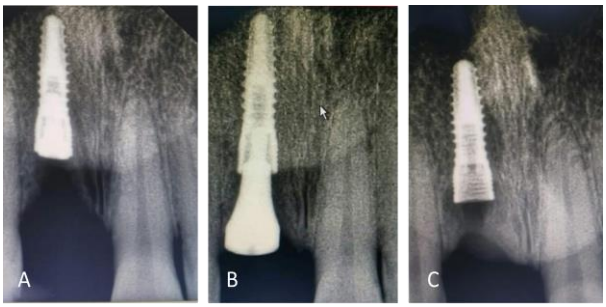

Figure 1:
A: Implant replacing tooth # 8 (US) after complete osseointegration.
B: Soft tissue former misfit due to using different system healing abutment.
C: Lost healing abutment lead to peri-implantitis.

RESULTS

The response rate was 63.3% (n=38). Four (10.5%) contributors reported practicing for over 15 years, while Nine (23.6%) have practiced for 11 to 15 years. Fourteen (36.8%) have practiced 5 to 10 years and Eleven (28.9%) have practiced 5 years or less.

Fourteen (36.8%) contributors reported that they have not received training in class room or clinic on implant care while attending dental school. Five (13.1%) have not participated in any continuing education course on implant maintenance after school graduation.

Chi–square test was used to determine if there is a relationship between the type of undergraduate education (formal education versus no formal education)

and post-graduate continuing education course attendance (attended course versus did not attend course). The results indicate that there is no statistically significant association between the type of undergraduate education and post-graduate continuing education course attendance (chi–square=1.21, df=1, p=0.25). There was no statistically significant difference in continuing education interest between clinicians whose formal education did or did not include dental implants. The majority (94.7%) of the implant clinicians expressed interest in continuing education courses to strengthen backgrounds in maintenance of dental implants.

A summary of the survey responses regarding procedures for dental implant maintenance is shown in Tables 1 through 6. (Table 1) summarizes responses regarding the maintenance intervals for dental implants after implant placement. Over 60% (n=23) of participants reported that they usuall schedule implant patients for maintenance during the first 3 months after implant placement, whereas 10.5% use to evaluate their implant patients during the first week after implant placement, and only 5 (13.1%) use to see their patients every two weeks after implant placement.

(Table 2) summarizes the responses regarding maintenance intervals for dental implants after the delivery of the prosthesis. About 65% (n=25) schedule their implant patients for follow up after prosthesis delivery and 21% (n=8) schedule implant patients only on individualized need for maintenance after prosthesis delivery.

(Table 3) summarizes the responses regarding clinical assessment of dental implants. Over 89% (n=34 to 38) of participants use to evaluate plaque/calculus deposits, exudate/bleeding, mobility and inflammation in their patients. Fewer than this (n=7, 44.7%), evaluate the presence of salivary percolation around the margin of crowns covering implants when slight finger pressure is applied. The majority of respondents probe around dental implants (n=34, 89.5%) and use a metal probe (n=27, 71.1%) while only (n=7, 18.4%) use a plastic probes. Over half (n=26, 68.4%) record the presence of bleeding on probing and the majority consider evaluating occlusion and recession around implants.

(Table 4) summarizes responses regarding the radiological assessment of dental implants. Only 6 respondents (15.7%) used to take radiographs of dental implants at least once per year; 15.7% (n=6) reported taking Periapical views as the most common type of radiographs taken, while 29% (n=11) are routinely taking panoramic radiographs of implants. Eleven participants do not check bone level surrounding the implant on a regular basis at maintenance appointments.

In (Table 5), the implant clinicians most commonly reported that they perform supra-gingival instrumentation around dental implants (n=20; 52.6%) whereas only 13 (34.2%) perform subgingival instrumentation. Only (n=7; 18.4%) use Stainless steel scalers during debridement, while a few (n=4, 10.5%) use plastic scalers on dental implants.

As shown in (Table 6), nine participants (23.6%) indicated that they use medium prophy paste for coronal polishing of implant restorations, only 4 (10.5%) use toothpaste for polishing, and 12 (31.5%) reported polishing the implant post if visible.

Table 1: patients' responses regarding the maintenance intervals for dental implants after implant placement

Criteria	n =	%
Schedule implant patients for maintenance during 1st three months after implant placement	23	60.5%
Schedule implant patients for maintenance during 1st week after implant placement	4.0	10.5%
Schedule implant patients for maintenance every 2 weeks after implant placement	5.0	13.1%
Schedule implant patients for maintenance every month after implant placement	11	28.9%

Table 2: responses regarding the maintenance intervals for dental implants after the delivery of the prosthesis

Criteria	n =	%
Schedule implant patients after prosthesis delivery	25	65.8%
Schedule implant patients every 3 months for maintenance after prosthesis delivery	5.0	13.1%

Schedule implant patients every 6 months for maintenance after prosthesis delivery	10	26.3%
Schedule implant patients annually for maintenance after prosthesis delivery	4.0	10.5%
Schedule implant patients only on individual need for maintenance after prosthesis delivery	8.0	21.0%

Table 3: responses regarding the clinical assessment of dental implants

Criteria	n =	%
Evaluate amount of adjacent keratinized tissue	31	81.5%
Evaluate color of adjacent gingival tissue (inflammation present)	38	100%
Evaluate presence of stippling/tissue consistency	23	60.5%
Evaluate presence of exudate/bleeding	34	89.4%
Evaluate presence of deposits (plaque and/or calculus)	37	97.3%
Evaluate presence of salivary percolation when slight pressure is applied to the crown of an implant	17	44.7%
Evaluate mobility	36	94.7%
Evaluate occlusion	37	97.3%
Evaluate parafunctional habits (grinding, abrasion)	34	89.5%
Evaluate recession	38	100%
Probe around implants	34	89.5%
Use plastic probe	7	18.4%
Use metal probe	27	71.1%
Record the presence of bleeding on probing around the implant	26	68.4%

Table 4: responses regarding the radiological assessment of dental implants

Criteria	n =	%
Routinely takes periapical radiographs of implants	6	15.7%
Routinely takes bitewing radiographs of implants	5	13.1%
Routinely takes panoramic radiographs of implants	11	28.9%
Does not routinely take radiographs of implants	8	21%
Checks bone level surrounding the implant on a regular basis at maintenance appointments	22	57.9%
Does not check bone level surrounding the implant on a regular basis at maintenance appointments	11	28.9%

Criteria	n =	%
Takes radiographs of an implant once a year	6	15.7%
Takes radiographs of an implant every 6 months	2	5.2%
Takes radiographs of an implant every 3 months during the 1st year and every 6 months thereafter	6	15.7%
Takes radiographs of an implant every 3 months during the 1st year and annually thereafter	2	5.2%
Takes radiographs of an implant at a different established interval	4	10.5%
Takes radiographs of an implant at no set interval	11	28.9%

Table 5: responses regarding Scaling Instruments

Criteria	n =	%
Performs supragingival instrumentation around implants	20	52.6%
Performs subgingival instrumentation around implants	13	34.2%
Uses Ultrasonic scaleres during debridement around implants	8	21.0%
Uses Stainless steel scalers during debridement around implants	7	18.4%
Uses Plastic scalers during debridement around implants	4	10.5%
Uses Graphite scalers during debridement around implants	2	5.2%
Uses Teflon-coated scalers during debridement around implants	2	5.20%
Uses plastic Gold-tiped during debridement around implants	1	2.60%

Table 6: responses regarding Coronal Polishing

Criteria	n =	%
Uses fine prophy paste for polishing the implant/crown	4	10.5%
Uses medium prophy paste for polishing the implant/crown	9	23.6%
Uses tin oxide for polishing the implant/crown	Nil	Nil
Uses air polisher for polishing the implant/crown	Nil	Nil
Uses toothpaste for polishing the implant/crown	4	10.5%
Uses implants' prophy paste for polishing the implant/crown	Nil	Nil
Polishes the implant post if it is visible	12	31.5%

DISCUSSION

The long time gone since graduation may explain why almost half of the participants in this study did not receive formal training on dental implant maintenance. Dental implants may not have been part of their curriculum at undergraduate levels.

Humphrey noted that dental implants have become an integral part of dental reconstruction and quotes that approximately half a million dental implants are placed annually in the United States of America [8]. Although there are no available data estimating the exact number of dental implants integrated each year in Libya, it was reported that half of the partially edentulous Libyan patients opted for dental implants when a definitive tooth replacement modality was considered[1]. Accordingly, it is necessary that implant clinicians have the most current knowledge for the maintenance of dental implants.

One of the earlier articles to discuss implant oral hygiene maintenance appeared in 1990 and emphasized the importance of patient oral care throughout the

continuum of pre-surgical, surgical, and restorative/maintenance phases of treatment [9]. The authors emphasized that a thorough periodontal assessment should be performed prior to implant surgery. In addition, patients must be trained in an appropriate oral homecare program before the implants are placed, and then placed in a maintenance regimen at appropriate intervals after implant placement.

The rationale for this emphasis on proper oral care is a simple one. During the healing phase, for example, it is essential to prevent the development of an inflammatory response around both the natural teeth and any implant surgical site. An inflammatory process will interrupt the normal healing process and jeopardize osseointegration of the implants. At the first follow-up, during the first week following surgery, a plastic curette can be used to gently debride the adjacent teeth of plaque and Materia Alba to maintain a healthy biological environment.

When sutures are needed to secure soft tissue, additional instructions may need to be given to the patient, because sutures can make it more difficult to maintain oral hygiene. It may be very helpful to advice patients not to use a dental brush to clean the implant site. Instead, a Q-tip soaked in the chlorhexidine gluconate solution, can be used gently to wipe across the surgical area in a facio-lingual direction. It is advisable to record the number and type of sutures placed to ensure all suturing materials are removed at the appropriate post-operative appointment which usually takes place at the second follow-up ten days to two weeks after surgery.

In case of a single stage procedure, where healing abutments (Soft tissue formers) are projecting through the mucosa, the follow up visit should include evaluating the color and consistency of soft tissue around. Special instructions may be necessary when there is a limited mesio-distal space and the healing abutment is therefore located close to a natural tooth. This proximity may restrict access for hygiene procedures due to limited space between the abutment and adjacent tooth/teeth.

If a temporary restoration was immediately connected to the implant (Immediate Temporization), care should be taken if a motorized tooth brush is routinely used not to apply too much mechanical motion on crown. It may be wise to use manual gentle brushing and flossing instead. It is usually helpful at the 1 week follow up visit to verify tightness of the temporary abutment screw and that neither occlusal nor proximal contacts are encountered.

In this study, only 10.5 % (n=4) of clinicians schedule there patient for follow up during the first week of implant placement. It may be prudent to see patients of dental implant one week to 10 days after surgical integration to confirm proper hygiene measures and to maintain healthy peri-implant mucosa.

This study revealed that only 11 participants (28.9%) schedule implant patients for maintenance every month after implant placement. The main purpose of this appointment is to ensure oral hygiene procedures are being effectively implemented. If adjustments or oral hygiene reinforcement are required at this pre-prosthetic appointment, then it is prudent to schedule another 1-2 week visit before loading the implant with a definitive coronal restoration.

Following treatment completion, the patient should be seen several times during the first year since there are no guidelines regarding the time intervals of care that optimize peri-implant health [10].

This study has shown that only 25 (65.8%) of surveyed participants schedule there patient for implant maintenance after prosthesis delivery. However, patients should be seen during the first 1-2 weeks after crown placement. The main purpose of this appointment is to ensure oral hygiene procedures are being effectively implemented. This appointment also serves another purpose. It allows the restorative dentist to decide if desired occlusal relationships were attained or if additional modifications are necessary. While in the office, the patient should be encouraged to ask any questions that may have risen since the last visit and especially now that treatment is complete. This early post-prosthetic appointment is particularly important when crowns are cemented over abutments as invisible cement residues can serve as a documented cause of peri-implant disease, [11] this includes fistulas/fenestrations as well as bone loss and consequent implant loss.

Once the results of the initial post-prosthetic appointments were reasonable, the patient need only to be arranged for a 3-month follow-up dental hygiene appointment. This timing seems applicable because it has been shown that plaque-induced peri-implant mucositis can develop in a 21-day period, if no oral hygiene procedures are accomplished [12].

Therefore, if the patient's oral hygiene practices truly are inadequate during this first 3-month period, those signs will be detected early and corrective measures can be employed in a timely manner. Furthermore, a decision can be made as to the need for continuing a 3-month recall schedule or whether 6-month recall intervals can be used. If there is any doubt about the patient's maintenance practices, a 3-month recall schedule should be maintained. Our study revealed that only 10 (26.3%) of questioned clinicians schedule their patients for follow ups after 6 months of

prosthesis delivery. Despite the evidence-based data reporting that most implant losses occur during the first year of function, [13] only half of the participants schedule their implant patients for follow ups during this time interval.

Regarding the items to be evaluated at each recall appointment, a previous clinical review [14] has proposed that each periodic examination should include an assessment of medical and dental histories, soft tissue assessment, plaque score using either of the two implant-specific plaque indices [14], pocket depth, bleeding on probing, presence of suppuration, stability of soft tissue margins, presence of keratinized tissue, occlusion, mobility, and checking radiographs. This study has shown that 31 (81.5%) evaluate amount of keratinized tissue around dental implants. Minimal keratinized mucosa around implants may show increased mucosal recession, greater plaque accumulation, peri-implant mucositis, and increased bone loss. [15, 16]. However, no relationship was found between keratinized tissue widths and implant survival in two literature reviews [17, 18].

When keratinized mucosa is lacking around implants, the indications for the use of soft-tissue grafting are unclear [19]. Therefore, it has been stated that preventive surgery should be confined to situations where altered morphology of the peri-implant mucosa affects oral hygiene [20].

All of the participants (100%) reported that they evaluate recession around dental implants. Causes of recession may include overzealous brushing, absence of attached mucosa, high frenal attachment, and too buccally placed immediate implants [21].

Probing around implants should be considered a reliable and sensitive parameter for the long term monitoring of peri-implant mucosal tissues [22].

Disposable plastic probes and replaceable plastic probe tips that screw into autoclavable metal handles have been recommended over metal probes that are being used by more than 70% of Libyan implant clinicians according to this survey [23].

Probing depths typically are deeper at implant sites than they are at natural tooth sites. In one report, the average probing depths around healthy implants ranged from 1.3 - 3.8 mm [24].

A postoperative radiograph after implant placement is not pertinent with over 20% of the participants. In fact, postsurgical radiographs can serve multiple functions including base line for checking bone level around the implant at maintenance appointments, confirmation of implant positions and angulations, and verification of complete seating of cover screws, healing abutments, or coronal restorations if immediately loaded (Figure 1).

Periapical radiographs provide excellent information about the bone levels, particularly when paralleling devices are used. This study results showed that almost 29% (N=11) of clinicians do not check bone level surrounding the implant on a regular basis at maintenance appointments.

Some reduction in marginal bone height will usually be noted on a radiograph during the first year following implant placement with 0.9 mm being typical [13]. However there should be very little, if any, clinically perceptible change after that time.

Regarding scaling instruments, researches indicate that stainless steel metal hand scalers can damage titanium surfaces [25, 26] and, therefore, they are not recommended. In contrast, plastic scalers have proven to be safe and do not damage titanium components. [27].

An apparent paradoxical finding was reported in one study of plastic scalers where there was an increase in the recorded surface roughness due to deposits of plastic particles and debris on the surface of titanium abutments that altered the surface roughness readings [28].

While plastic scalers are kind to titanium surfaces, some clinicians find them to be somewhat bulky or too flexible to use in the removal of hard deposits. Unlike metal scalers, plastic tips lack sharpness which is believed to limit their effectiveness in dislodging larger, hard deposits.

Circumventing these limitations of plastic scalers has been achieved in different ways. When larger accumulations of hard deposits are present, some clinicians carefully use metal scalers initially. It is only after removal of the bulk deposits that they switch to plastic scalers for the final surface scaling. Others feel conventional metal scalers can be used to remove calculus and only leads to minor surface scratching of supra-mucosal surfaces when used carefully. However, there is no scientific evidence to support these concepts. These are considered empirical finding but, nonetheless, recommendations based on years of clinical experience. Some clinicians have also reported wrapping a metal scaler with gauze to remove calculus and in so doing reduce the risks of scratching or gouging of the implant surface.

Fiber reinforced graphite scalers (Premier® Implant Scaler; Premier Products Co., 1710 Romano Drive, Plymouth Meeting, PA 19462 ; www.premusa.com) have been found to produce significantly less roughness compared to stainless steel scalers, and they are deemed to be appropriate instruments to use for scaling procedures [29].

It has been shown that titanium hand scaling instruments removed very little substance from the head

of implants and from titanium abutments, leaving "virtually no traces of use" [30]. Nonetheless, it seems prudent to use care with any hand instrument made of material harder than plastic to remove deposits around single implants. Light pressure strokes should be applied along with careful adaptation of the instrument to the cervical contours of the crown. When used in accordance with these guidelines, titanium tipped curettes can remove adherent plaque and calculus deposits effectively without damaging the implant metal surfaces or causing excess soft tissue trauma.

Negative surface changes (scratches, depressions, removal of surface metal) have been found from using metal ultrasonic scaler tips on titanium, [31] whereas ultrasonic scalers with plastic tips [32, 33] and carbon tips [31, 33] produced no significant surface alteration to titanium surfaces. Therefore, when ultrasonic scalers are used, metal tips should be avoided.

It has been proposed [34] that a soft rubber tip, not brush, be used around implants in conjunction with an appropriate nonabrasive paste such as aluminum oxide, tin oxide, acidulated phosphate fluoride-free prophy paste, or low-abrasive dentifrice. According to one report, the use of a rubber cup with toothpaste did not affect the integrity of a highly polished titanium surface [26].

In another study, when a rubber cup and flour of pumice were applied to a machined titanium surface for five minutes, the microscopic grooves from the titanium machining process were removed, but the surface still was judged to be smooth [35].

Others found the use of a rubber cup and a fine abrasive paste to be a safe procedure for supragingival surfaces [36]. However, using a rubber cup with a coarse prophy paste for 30 seconds removed approximately one-half of a 0.11 mm high ridge of titanium on test samples [26].

The use of acidulated fluoride gels should be avoided around dental implants since it has been determined they produce surface degradation of titanium [37, 38]. For this reason, neutral pH fluoride gels should be used when caries prevention is needed in the mouths of patients with dental implants.

Conclusion: This study provided a descriptive summary of knowledge–seeking practices and clinical approaches used by dental implant clinicians in the maintenance of dental implants.

Results indicated that additional knowledge need to be gained regarding dental implant care in order to guide patients' confidence toward the optimal most successful teeth replacement option. Furthermore, a well-established structured academic program might be necessary to teach implant maintenance at undergraduate and postgraduate levels.

List of Abbreviations: Not applicable.

Declarations: Ethical Approval and Consent to participate: Not applicable. The need for ethics approval was deemed unnecessary and only the authors considered the questions and content validity of the survey. In addition, there are no clear ethical national guidelines for biomedical research in Libya. Furthermore, Libyan low on research policy, which adds another dimension to this sensitive and vital issue, does not require ethical approval to be attained prior to commencing a research project [7].

Consent for Participation: an informed verbal consent was obtained from all participants and participants were conveniently sampled and volunteered to submit their surveys. Libyan low on research policy does not require ethical written consent to be attained prior to participating in a research project.

Consent for Publication: I give my consent for my research study article titled Dental Implant Maintenance Experience: Testing Knowledge and Clinical Practices of Implant Clinicians in Libya to be published in Libyan Journal of Dentistry.

Availability of data and materials: The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Competing Interests: Not applicable.

Funding: This study was not funded by any organization or institute. No financial support was received at any step of the study conduction.

Authors' Contributions: the corresponding author RE developed a 35–item paper survey specifically for this study. All items on the survey reflected content found in publications that addressed maintenance of dental implants. Both Authors considered the questions and content validity of the survey .

Data were entered in a spreadsheet by RE and then independently verified by YE to ensure accuracy.

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Letter to Editor

Potential relationship between eye and oral diseases

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Dear Sir;

Research suggests that the oral diseases may play a role in many systemic conditions including eye diseases. There is a plenty of evidence in case histories of the direct etiological relation of foci of infection of the mouth to inflammatory disturbances of the eye. Dentists can often help in the diagnosis of the diseases that affect the eyes and oral cavity [1].

The relationship between infected teeth and eye diseases has been known for some time,

several centuries ago, as early as 1817 where a case of contraction of the visual field was managed by the extraction of carious tooth, many cases of defective vision were effectually relieved by removal of pathological conditions discovered in the mouth [2].

Anatomically the orbit connects the oral cavity via its anatomical borders, the inferior wall of the orbit that formed by the maxilla, palatine and zygomatic bones. The medial wall formed by the ethmoid, maxilla, lacrimal and sphenoid bones. This connection may affect the way of spread of the bacteria from the mouth. Extension of odontogenic infection into the orbit can occur through a variety of pathways, root apices are anatomically proximal to adjacent muscle, connective tissue and sinuses, the most common route of spread is through the maxillary sinus into the inferior orbit via the inferior orbital fissure or defect in the orbital floor. Infection ascending from the canine fossa to the orbit or retrograde spread through the ophthalmic vein. Infection of maxillary molars may become life threatening through airway compromise or threatened vision by rapid spread involving the orbital area that may cause orbital abscess, superior ophthalmic vein thrombosis and orbital abscess. Several hypotheses may be suggested to explain the potential association of periodontal disease with eye disease such as innate immunity involvement, similar risk factors for pathogenesis and changes in the eye choroid thickness [3].

There are many examples of eye diseases correlated to dental conditions such as uveitis- and glaucoma, even when factors such HTN, DM where taken out of the equation. Furthermore, researchers noticed that streptococcus bacteria was more commonly found in the mouth of glaucoma patients than people with healthy eyes [4].

In another way, dentistry is one of the professions in which the practitioners and patients both become exposed to eye related injuries which may result in ocular infections during daily routine [5]. A lot of dentists and dental personnel are at high risk of contracting eye infections during operative procedures involving aerosols [6]. Protective eyewear use can reduce the risk from blood-borne pathogens during procedures in which splatter or the use of aerosols might occur [7]. The subject become more important in the COVID-19 pandemic [8].

As the majority of dental procedures are accomplished with instruments being passed over or near the patient's face and with aerosols and chemicals frequently in close proximity, both patients and dentists should wear eye protection. Curing lights are also a potential hazard to those who place restorative resins due to phototoxic and photoallergic reactions originating from absorbed radiation [9,10].

A dental clinic may be a source of eye related injuries because of a constant risk of mechanical trauma as well as the possibility of being exposed to various chemical and electromagnetic activity. protective eyewear for patients can protect their eyes from spatter or debris generated during dental procedure [11].

In the view the present trend of dental thought and research toward the prevention of oral disease, there is a need to have in depth knowledge of the ocular complications due to dental infection and broadening prevention strategies toward ocular complications due to dental infections.

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Original article

Odontogenic cysts: A retrospective clinical analytic study of 632 cases diagnosed in Benghazi- Libya

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ABSTRACT

Background: Odontogenic cysts (OCs) are the most common cause of chronic swellings of the jaws as well as the most frequent lesions encountered in oral cavity. Clinical data about the OCs in the Libyan population is scant. Therefore, the objective of this study was to determine the prevalence of all histologically diagnosed OCs and demographics of OCs of Libyan sample over a 28-year period and to compare results with other international studies.

Material and Methods: All entries for odontogenic cysts occurring during 1990–2018 inclusive at oral Pathology department, faculty of dentistry, Benghazi University, Libya, were retrieved and analysed for demographic data; mainly sex, age and site.

Results: A total of 8995 oral biopsies, 7.03% were odontogenic cysts. Radicular cyst was the most common odontogenic cyst comprising 52.53% of cases, followed by dentigerous cyst (15.03%), odontogenic keratocyst (10.28%) and residual cysts (7.91%). There were 363 specimens for males (57.4%) and 265 for females (41.9%). Odontogenic cysts occurred in a a mean age of 30.2 years. The most common location was maxillary anterior-premolar region (35.9%).

Conclusions: These data are important to assess geographic differences in the prevalence of lesions and to allow clinicians to make realistic judgments in counselling patients before biopsy about the probability of diagnosis and risks associated with nonspecific clinical or radiographic lesions.

Keywords: odontogenic cysts, Libyan patients.

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INTRODUCTION

Odontogenic cysts (OCs) are unique as they only affect the oral and maxillofacial region only. According to the most recent World Health Organization classification, OCs are classified into two main groups inflammatory and developmental groups; reflecting their pathogenesis [1, 2].

Both developmental and inflammatory odontogenic cysts may develop from epithelium remnants of the

tooth forming apparatus that were entrapped centrally within the bone or peripherally in the gingival tissues [1-4]. The prevalence of odontogenic cysts has been investigated in many countries in the past including Libya [5-14]. Among jaw cysts, many share similar clinical and radiographic signs, however, some of these are known to have an aggressive behaviour and propensity to recur so correct diagnosis of these lesions is very essential [3-5].

For this reason, knowledge on the prevalence of odontogenic cysts, age distribution and their commonest affected site might help practitioners to determine a likely clinical diagnosis. Hence surgically excised tissue should be duly studied histopathologically and properly diagnosed to ensure appropriate treatment.

In Libya, data about odontogenic cysts is scanty [7] therefore, the aim of our study was to assess the prevalence of all histologically diagnosed odontogenic cysts along with the age, sex and anatomical location of the lesions over a period of 28 years and compare the findings with other studies carried out in Libya and in other parts of the world according to the new WHO classification. [1]

MATERIALS AND METHODS

The diagnoses of 632 consecutively accessioned oral biopsies from the files of the Oral Medicine, Oral Pathology, Oral diagnosis and Radiology department, of the University of Benghazi, Libya, from 1990 to 2018 were reviewed. All cases of odontogenic cysts were retrieved. The clinical data and histopathological diagnoses of all the cases for which there was any doubt about the listed diagnoses were reviewed. All odontogenic cysts were classified based on 2017 WHO typing. [1] These odontogenic cysts were assessed for age, sex, site distribution and the cyst association with impacted/unerupted tooth.

The following demographics and clinical data were obtained from medical files: sex, age, and lesion site. In this latter variable, both jaws (upper and lower) were divided into anterior zone and posterior zone. The anterior zone included the incisors, canines and premolars in case of maxilla or mandible; while the posterior zone consisted of the molars and ramus/tuberosity. For statistical analysis, all the descriptive and quantitative data analysis were performed using the Statistical Package for the Social Sciences (SPSS) software, version 21.0, SPSS Inc., Chicago, IL, USA).

RESULTS

During the 28-year period, a total of 8995 specimens were histopathologically examined in the department of Oral Medicine, Oral Diagnosis and Oral Pathology Department of the faculty of Dentistry, of the University of Benghazi from which 632 (7.03%) specimens were histopathologically diagnosed as odontogenic cysts. The prevalence of different types of OCs is shown in (Table 1).

The mean age of occurrence of (OCs) is 30 years, whoever, 110 (17.40 %) cases were diagnosed in children under 17 years whereas 499 (79%) were detected in adults of 17 years or above. The minimum age recorded in this series was 5 years and the maximum age was 84 years. There were 363 (57.4 %) specimens from males and 265 (41.9%) from females and in 4 cases (0.6%) the gender was not provided with the clinical data.

The most prevalent site of presentation was maxillary anterior-premolar region mesial to the first molar teeth forming 227 (35.9%), followed by mandibular posterior region 177 cases (28%), and in 19 cases (3%) the site was missing. (Table 1) displays the distribution of odontogenic cysts by frequency for all ages over the 28-year period. (Table 2) and (Table 3) summarize the distribution of all odontogenic cysts in paediatric and adult populations respectively.

With respect to histopathological type, radicular cyst was the most common odontogenic cyst forming 52.53% of odontogenic cysts. Dentigerous cyst was the second most common odontogenic cyst and accounted for 15.03% of odontogenic cysts. The largest group of patients was with radicular cyst (Table 1) which consisted of 332 cases (52.53%) of all odontogenic jaw cysts with a mean age at presentation of 30.2 years with male: female ratio of 1.2:1 (Figure 1).

Maxilla was the most commonly affected area with 213 cases (65.3%), of which 155 cases (47.5% of all radicular cysts) occurred in the anterior maxilla (Figure 2). Radicular cysts accounted for higher proportion in adults (272 cases, 86.1%) than in children (44 cases, 13.9%). Residual cysts accounted for 50 cases (7.91%) with a male: female ratio of 1.72:1 and the most common site of presentation in the maxillary molar region (44.9 %) followed by maxillary the anterior-premolar region (28.6%) (Figure 2).

There were 95 cases of dentigerous cyst (15.03%) with a mean age at presentation of 26.6 years and a male to female ratio of 1.53:1 (Figure 1). Ninety one cases (95.8%) of all OCs, the age were confirmed.

Dentigerous cysts were more common in adults (67 cases) than in paediatric patients (24 cases) accounting for 73.6% and 26.4% of the total cases respectively. Mandibular posterior region was the most common site (40.2%) followed by maxillary anterior-premolar region (37%) (Figure 2). OKC was the third most common diagnosed cyst with 65 (10.28%) cases with a mean age at presentation of 31.8 years and a male to female ratio of 1.09:1 (Fig. 1). Ten cases of OKC (15.38%) were diagnosed in paediatric patients; which accounted for 9.09% of all OCs in the patients of 16 years or younger (Table 2). The mandibular posterior region was the most site affected (Figure 2). Because of the lack of precise clinical information in many cases, 66 (10.44%) cysts were considered as unclassified odontogenic cysts due to histopathological diagnostic difficulties in differentiating between the true inflammatory and the inflamed developmental cyst. The remaining 24 odontogenic cysts (3.79%) included 11 (1.74%) calcifying odontogenic cysts, 3 (0.47%), LPCs, 3 (0.47%) paradental cysts, 3 (0.47%), Orthokeratinized odontogenic cysts, 3 (0.47%) glandular odontogenic cysts and 1 (0.16%) eruption cyst.

Table 1: Distribution of odontogenic cysts according to age, and sex 1990–2018

Diagnosis	All cases	%	Age known	Age range	Mean age	SD	No. of male	No. of female	M:F ratio
Radicular cyst	332	52.53	316	07-80	30.29	12.85	178	138	1.29
Dentigerous cyst	95	15.03	91	06- 66	26.63	14.63	55	36	1.53
odontogenic keratocyst	65	10.28	65	10-65	31.80	15.06	34	31	1.09
calcifying odontogenic cyst	11	1.74	11	13-34	21.45	7.37	8	3	2.67
Residual cyst	50	7.91	49	17-84	43.08	16.31	31	18	1.72
Unclassified cyst	66	10.44	64	05-73	25.08	15.78	36	28	1.29
Eruption cyst	1	0.16	1	00	11	00	1	0	
Glandular odontogenic cyst	3	0.47	3	18-67	48.33	26.50	1	2	0.5
Lateral periodontal cyst	3	0.47	3	18-42	33.33	13.3	2	1	2
Paradental cyst	3	0.47	3	08-23	17.00	7.94	2	1	2
Orthokeratinized odontogenic cyst	3	0.47	3	20-58	33.67	21.13	2	1	2
Total	**632**	**100**	**609**				**350**	**259**	

Table 2: Distribution of odontogenic cysts according to age, and sex in childeren 1990–2018

Diagnosis	Total	Age range	Age mean	Age SD	No. of	No. of	M:F ratio

		(years)			male	female	
Radicular cyst	44	7 - 16	13.3	2.51	28	16	1.75
Dentigerous cyst	24	6 - 16	11.50	3.15	17	7	2.43
odontogenic keratocyst	10	10 - 16	14.00	2.00	6	4	1.5
Residual cyst	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Unclassified cyst	25	5 - 16	11.24	3.23	14	11	1.27
Orthokeratinized odontogenic cyst	5	13 - 16	15.20	1.30	3	2	1.5
Total	**108**				**68**	**40**	

Table 3: Distribution of odontogenic cysts according to age, and sex in adult populations

Diagnosis	Total	Age range (years)	Age mean	Age SD	No. of males	No. of females	M:F ratio
Radicular cyst	272	17- 80	33.04	11.69	150	122	1.23
Dentigerous cyst	67	17 - 66	32.05	13.25	38	29	1.31
odontogenic keratocyst	55	18 - 65	34.58	14.40	28	27	1.04
Residual cyst	49	17 - 84	43.08	16.31	31	18	1.72
Unclassified cyst	39	17 -73	33.95	14.12	22	17	1.29
Orthokeratinized odontogenic cyst	6	19-34	26.67	5.96	5	1	5
Total	488				274	214	

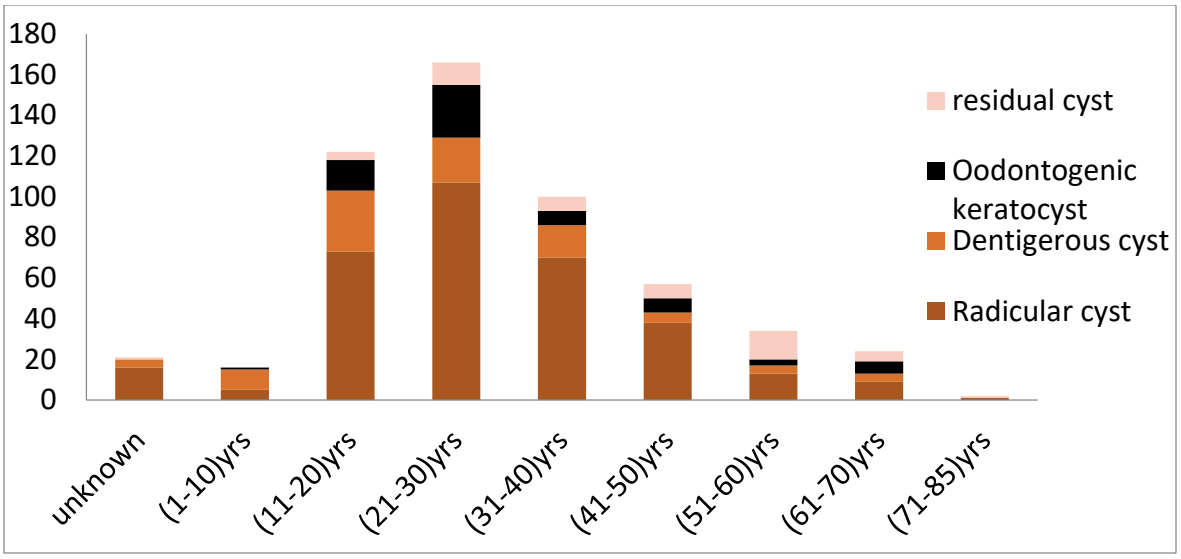

Figure 1: Age distribution of odontogenic cysts

DISCUSSION

Odontogenic cysts (OCs) are common jaw lesions derive their lining from tooth apparatus or its remnants. This study examined the distribution of odontogenic cysts which accounted for 632 of 694 jaw cysts in 8995 patients seen in this department over 28-year period. In a study carried out at the Oral and Maxillofacial Surgery of this faculty. [7] It has been reported that the total number of OCs operated on at this department in 15 years period was 326 lesions represented 14.8% of 2190 biopsies and surgical specimens accessioned during a 15 year period. In that report, radicular cyst was the most frequently encountered cyst (68.1%), followed by the dentigerous cyst (15%) and OKC (14.1%). In the present study, residual cyst constitutes 7.91% of all OCs. However, Jones et al [5] and Ochsenius et al, [8] had found that residual cyst make up to 8%, and 11.2% of the total number of OCs in their samples respectively. On the other hand, other previous studies by Mosqueda et al, [11] and Souza et al, [13] residual cyst represented only 2.2% and 4.9% of OCs respectively.

In this study, a total of 8995 submitted specimens from many sources received over 28 years period (1990-2018); among these, 632 odontogenic cysts were diagnosed in 7.03% of all biopsies. From the current literature, it's clear that odontogenic cysts account for 0.8% to 45.9% of all submitted specimens. [5] The relative frequency of OCs of relevant studies reported by Johns et al, [5] Mosqueda et al. [11], El Gehani et al, [7] and de Souza et al [13] are 12.8%, 11.5%, 14.8%, and 11% respectively.

Radicular cyst is the most common jaw cyst; as it comprised about 52.53% of all odontogenic cysts in this study. The proportion of 52.53% for radicular cysts lies within the range of 50.7% reported by Oschenius [8], 53.5% as it was reported by Meningaud [9] and 54.7% as reported by Açikgöz el al. [10]. Interestingly, Johns et al, [5] reported the same figure (52.3%). In Libya, Orofi et al [7] found that these cystic lesions represented 68.1% but it represented 61.4% by de Souza et al. Nevertheless, in this figure, residual cysts were included. In our series, the total of radicular and residual cysts was 60.44%. Radicular cysts occurred over a wide age range, with a peak of incidence in the third decade with male to female ratio of 1.3:1. The maxillary anterior area was the most common affected site (47.5%) followed by mandibular posterior area (21.5%). This distribution is comparable to that found by Orafi et al, (48.6%) [7] and Johns et al, (52.8%) [5].

Dentigerous cyst constitutes the second most common diagnosed lesion in our series with a total frequency of 15.03%, which is the same result from most studies (El Gehani 15%, Johns 18.1%, and Oschenius 18.5%). In contrast, higher frequencies were reported by Mosqueda (33%), [11] Daley et al (24.08%) [6] and Açikgöz (26.6%), [10] dentigerous cyst is detected over a wide age range, with a peak of incidence in the second and third decades. In our series, the mandibular posterior region was the most common site (40.2%) followed by the anterior maxilla (37%). This is perhaps not a surprising finding given the fact that lower third molar and upper canine are the most commonly impacted teeth [3,4]. Eruption cyst was relatively rare odontogenic cyst with only one case (0.16%) occurred in a child under 16 years

of age (Table 1).

Odontogenic keratocyst has previously been designated as a neoplasm and included as keratocystic odontogenic tumour. [15, 16] According to the new WHO classification, [1] this lesion is redesignated as benign developmental cysts and has restored the term odontogenic keratocyst. In the current study, odontogenic keratocysts was the third most common diagnostic lesion (n=65) (10.28%). Previous studies [5,11] reported prevalence rates of odontogenic keratocysts ranging from 4.8% to 21.5%. The distribution in the present study (10.28%) was most similar to those reported by Jones, El Gehani, and Oschenius [5, 7, 8]. Gorlin and Goltz syndrome was diagnosed in 5 patients.

Calcifying odontogenic cyst (COC) is a member of the "family" of ghost cell lesions. The most significant change affecting odontogenic cysts was the reincorporation of COC in the new cyst classification when it had been defined in 2005 as benign cystic neoplasm of odontogenic origin [1, 17, 18]. The previous studies demonstrated that the COC counted for less than 1% [5,19]. In the present series, calcifying odontogenic cysts comprise about 1.74% of all odontogenic cysts.

Three cases of lateral periodontal cyst were identified. Lateral periodontal cyst (LPC) is an uncommon development odontogenic cyst, representing about 0.47% of all OC. It develops in the alveolar bone along the lateral root surface of an erupted and vital tooth. [5, 20] In our series, the relative frequency for lateral periodontal cysts was 0.47%.

Paradental cyst was a term first fully described by Craig in 1976 [21, 22]. It is an inflammatory odontogenic cyst occurring on the lateral root surface of a partly erupted vital tooth, and arising secondary to inflammatory stimulus associated with pericoronitis. In the present series, only three paradental cysts were diagnosed.

The orthokeratinized odontogenic cyst (OOC) is an uncommon developmental odontogenic cyst, which has always been regarded as a variant of OKC [2, 4, 23] under the new WHO Classification, OKC has now finally been recognised as a distinct entity [1, 7]. only three OOCs were diagnosed, representing (0.47%) of all specimens. The glandular odontogenic cyst is uncommon lesion representing 0.2% of all odontogenic cysts. Our study revealed three cases, making this cyst a rare lesion relative to other odontogenic cysts. One out of 3 was located peripherally. The present study is the largest series of OOCs of Libyan population described in the literature.

Conclusion: This study presents a series of OCs in a sample of Libyan population, where the prevalence of jaw cysts accounts for (7.03%) which is within the range that reported in many other studies worldwide. Dental team should be aware of the incidence of odontogenic cysts and their clinic-pathologic features, including most common site and age distribution. This knowledge would allow for early and accurate diagnosis and treatment of these lesions.

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Hypodontia and Hyperdontia among Libyan Orthodontic Patients

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ABSTRACT

Background: it is not uncommon for orthodontist to come across patients with dental anomalies such as disturbances in teeth number. Hypodontia is a developmental absence of one or more teeth excluding the third molars, while hyperdontia (supernumerary teeth) is the presence of additional tooth in the normal series.

Objectives: The purpose of this study was to investigate the prevalence of hypodontia and hyperdontia in Libyan patients with different types of malocclusion.

Material and Method: This is retrospective review of the pretreatment dental casts of consecutive patients attending at the department of Orthodontics in the University of Benghazi as well as their panoramic radiographs (OPGs) to look at the disturbances in the tooth number in the study group which was comprised 516 Libyan patients with an age range of 10 years to 34 years at the time of investigation.

Results: A total of eighteen patients had either hypodontia or hyperdontia. The former was detected in 10 (1.76%) cases, 5 (0.88%) lateral incisors, 3 (0.53%) premolars and 2 (0.35%) third molars, while hyperdontia was detected in another 8 cases, 4 (0.70%) mesiodenses, 2 (0.35%) premolar and 2 (0.35%) of 3rd molar.

Conclusion: The number of patients with hypodontia and hyperdontia in this sample was apparently different from those previously reported worldwide figures. However, further large scale studies are required to ascertain their true prevalence and impact on Libyan population.

Key words: Hypodontia, supernumerary, Hyperdontia, Libyan, Orthodontics Patients.

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INTRODUCTION

Developmental dental anomalies generaly due to complex interactions between genetic, epigenetic and environmental factors during the process of dental development (particularly during the morph-differentiation or histodifferentiation stages) [1]. Dental anomalies are usually congenital malformation that can happen either as isolated finding or as part of a syndrome. Environmental factors could have more important influence on the prevalence of dental anomalies in every population [2].

The present investigation have focused on the association between dental anomalies (the number of teeth) and malocculsion. Dental anomalies in tooth number is usually results in many problems in maxillary and mandibular arch length and occlusion, which may greatly influence orthodontic treatment planning and can complicated orthodontic treatment [3,4]. The etiology of these conditions is largely attributed to certain genes in additions to some phenotypic etiological events in prenatal and postnatal periods that may result in anomalies in tooth number [5].

Hypodontia is a congenitally missing teeth with no radiographical signs of crown calcification. It is a common development anomaly of the human dentition with the third molars represent the most affected teeth, followed by the mandibular second premolars, the maxillary lateral incisors then the maxillary second premolars while *oligodontia* is the missing of six or more permanent teeth excluding the third molars. *Anodontia* is a complete absence of

teeth.

Hypodontia present unfavourable dental appearance, insufficient alveolar bone growth less chewing ability, in articulated pronunciation, space in the arch, extruded and other problems [6].

Hyperdontia or (supernumerary teeth) is a developmental anomaly where there is an additional tooth in the normal series. It may be found in any region of the dental arch associating or not associating with syndromes [2]. The etiology is by large unknown. The most common hyperdontia anomaly is mesiodens, which occurs in the middle of the maxilla, which can be presented as a single, double or multiple. The third molar and second premolar can also be the site for a hyperdontia which may be unilateral or bilateral with variable morphology [3-5].

For accurate diagnosis of dental anomalies a careful clinical examination and radiographic evaluation are required. Hence this study involved the records of clinical examination augmented by radiological screening of the patients' records to explore the prevalence of hyperdontia and hypodontia in Libyan orthodontic patients.

MATERIALS AND METHODS

This study is based on the pretreatment dental casts and good quality of OPG that have been taken as part of routine orthodontic treatment planning records are studied for hpodontia or hperdontia in the faculty of Dentistry of Benghazi University between 2003 and 2018. Only those records satisfied the inclusion criteria were included in this study. Only patient aged between 10 and 34 years with all the set permanent teeth in both jaws present were included. Patients with systemic disease or any evidence of tooth loss attributable to dental caries, periodontal, disease or trauma were excluded. Pretreatment dental casts and OPGs were reviewed for the presence of either hypodontia or hyperdontia and number of teeth involved. The radiographs were examined with standardized screen brightness and resolution while the dental casts were visualized by the same examiner for assessment of any disturbance in the number of teeth.

RESULTS

The total number of the patients in this sample is 568 (males 114 and females 454), their age ranged from 10-34 years with a mean age of 22 years (Figure 1). The examined panoramic radiographs and dental casts revealed that 18 (3.16%) patients in the sample had dental anomalies in regard to the number of teeth. Twelve (2.11%) females and 6 (1.05%) males. Hypodontia was detected in 10 (1.76%) cases, 5 (0.88%) lateral incisors, 3 (0.53%) premolars and 2 (0.35%) third molars, whereas hyperdontia was detected in another 8 cases, 4 (0.70%) mesiodenses, 2 (0.35%) premolars and 2 (0.35%) third molars as shown in (Table 1).

Table 1: The number of cases with hyperdonia and with hypodontia

Anomaly	Site	Male	Female	Total number	% of the total	% of anomalies
Hypodontia	None	112	446	558	98.24%	
	Lateral incisors	1	4	5	0.88%	
	First premolars	1	2	3	0.53%	10 (1.76%)
	Third molars	0	2	2	0.35%	
Hyperdontia	None	0	0	560	98.60%	
	Premolars	1	1	2	0.35%	8 (1.40%)
	Mesodens	3	1	4	0.70%	

	Third molars	0	2	2	0.35%	
	Total	4	4	568	100%	18 (3.16%)

Table 2: Prevalence of hypodontia and hyperdontia in some worldwide studies

Study	*Country*	*Number of patients*	*Hypodontia n (%)*	*Hyerdontia n (%)*
Montasser and Taha (2012)	*Egypt*	509	12 (2.4%)	14 (2.8)%
Tantanaporkul (2015),	*Thailand*	638	87 (13.7%)	16 (2.6%)
Anis et al. (2015)	*Malaysia*	370	26 (7.03%)	10 (2.7%)
Yassin et al. (2016)	*Saudi Arabia*	1252	121 (9.7%)	44 (3.5%)
Yoshyuki et al. (2016)	*Japan*	9584	364 (3.8%)	6 (0.06%)
Dong et al (2017)	*Australia*	1050	45 (4.28%)	3 (0.28%)
Pallikaraki et al. (2019)	*Greece*	1200	77 (6.4%)	12 (1%)
Aldhorae et al. (2019)	*Yemen*	1676	125 (7.48%)	16 (0.99%)
Gokkaya et al (2020)	*Turkey*	2348	176 (7.5%)	21 (0.9%)
Present study (2021)	*Libya*	568	10 (1.76%)	8 (1.40%)

DISCUSSION

Hypodontia is one of the most commonly encountered dental anomalies in many studies and has a negative impact on both the look and function of dentition. It rarely occurs in primary teeth and most commonly affects the permanent second premolars and the upper lateral incisors. It usually occurs as a part of a syndrome that involves other abnormalities as well and usually requires multidisciplinary treatment [2-4].

In this sample which was composed of 568 subjects, there were 18 (3.16%) patients with either hypodontia or hyperdontia. In this study, hypodontia was the most commonly encountered anomalies in orthodontics. It has been detected in 10 (1.76%) subjects (with the maxillary lateral incisor was the most commonly missing tooth), while supernumerary teeth was found in another 8 (1.40%) subjects (mostly mesiodens). These findings are in consistent with the findings of the previously reported figures worldwide [3-5].

Hypodontia has much more lower figure in comparison with the findings of Pallikaraki and co-associates (who studied a sample of 1200 Greek orthodontic patients), where oligodontia was the most prevalent dental anomaly in that study (6.4%) and the supernumerary teeth were detected in only (1%) of those patients.

In another study, Tantanaporkul (2015), had evaluated the prevalence and distribution of dental

anomalies in pre treatment panoramic radiographs in a Thai sample of 638 orthodontic patients aged 13-30 years, missing teeth were detected in (13.17%) of the patients, while supernumerary teeth was detected in (2.6%) of them [5]. Yoshyuki and co-associates in (2016) had investigated dental anomalies of permanent dentition in 9584 Japanese subjects and found that hypodontia was present in (3.8%) of them and supernumerary teeth was found in (0.06%) of the boys and (0.02%) of the girls [6].

A recent study from Yemen carried out by Aldhorae and co-associates in (2019) screened 1676 digital OPGs of dental patients aged between 9-52 years and found that hypodontia was existed in (7.48%) of the patients, while hyperdontia was seen in (0.99%) of the patients.

Montasser and Taha (2012) had studied a sample of cephalometric radiographs of 509 Egyptian orthodontic patients and found that the total prevalence of hypodontia (excluding third molars) and hyperdontia was 2.4% and 2.8%, respectively, with almost similar distributions in females and males [7]. Gokkaya et al (2020) had studied 2,348 Turkish patients and found that the prevalence of hypodontia and hyperdontia were 7.5% and 0.9% respectively [8].

Yassin et al. (2016) had assessed 1252 clinically and radiologically and reported that in one Saudi Arabia hospital, hypodontia has represented about (9.7%) of the cases and it was the most common dental anomaly in Saudi children, followed by hyperdontia (3.5%) [9]. Dong et al in (2017) found dental agenesis in (4.28%) of 1050 Australian people and (0.28%) had supernumerary teeth [10].

On comparison with the findings of the abovementioned studies (Table 2), it is clear that the prevalence of hypodontia in the present sample is much lower than that was previously reported by most of the worldwide studies, whereas the prevalence of hyperdontia is almost comparable with these studies findings. This can only be explained on terms of racial and environmental factors.

Conclusion: the number of patients with hypodontia and hyperdontia in this sample was apparently different from those previously reported worldwide figures. However, further large scale studies are required to ascertain the true prevalence and its impact on Libyan population.

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Original article

Reasons for Tooth Extraction among Libyan Adults: Multi-Center Cross-Sectional Study

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Abstract

Background: Tooth loss can be due to many causes, which results in many bad consequences on the dentition function and esthetics.

Aims: This study was aimed to assess reasons and patterns of tooth extraction among Libyan adults.

Subjects and Methods: This cross-sectional study was conducted in six Libyan cities (Benghazi, Derna, Misurata, Tripoli, Zintan, and Hoon) representing different geographical provinces of the country. Data was collected over 6-month period (from September 2016 to March 2017) using an especially designed form recruiting Libyan patients aged ≥17 years of age who visited the participating dental practices and who provided a verbal consent to take a part in the study. The reasons for tooth extraction were classified as: dental caries, severe periodontitis, trauma, impaction, orthodontics reasons, prosthodontics reasons, associated with a pathological lesions (such as cysts), failed root canal treatment, and retained primary or supernumerary teeth. Variables studied were patient's age, gender, educational level, occupation status and type of dental clinic. SPSS software were used for data analysis and the appropriate statistical tests were applied at (p value set at 0.05).

Results: The mean age of participants was 38.6 years with standard deviation (SD) of 14.83. A total of 2958 permanent teeth were extracted. The main reason for tooth extraction was dental caries 1912 (64.6%), followed by severe periodontitis 270 (9.1%), tooth impaction 231 (7.8%), prosthodontic reasons 172 (5.8%) and failed root canal treatment 157 (5.3%). The most common teeth extracted were the lower right third molar 235 (7.9%), lower left third molar 227 (7.75) and lower left first molar 187 (6.3%) respectively. The most common age group of female patients was 21-30 years as they had 779 (26.3%) teeth extracted. Low education level was the most frequent risk factor for tooth extraction 1663 (57.2%) in this group of patients.

Conclusion: The result of this study indicated that dental caries and periodontal diseases still the major causes of tooth loss among Libyan adults

Key Words: Dental Extraction; Dental Caries; Libyan Patients; Clinical Study.

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INTRODUCTION

Due to increased life expectancy and the consequent need to keep healthy dentition to maintain normal personal health, good esthetic and function through maintaining healthy dentition until old ages has been brought to attention by many epidemiological studies that showed that dentate population is increasing [1-3]. Tooth extraction to manage dental pain is an easy option, but should be considered as the last option in the treatment list. However, the rate of teeth extraction in developing countries was disastrous [4,5,6,7], which can lead to changes in the dietary habit of the individuals and negatively affect the general health, oral health and their related quality of life (QOL) [8].

Identifying the reasons of tooth extraction is the first step in assessing the health needs to inform dental health policies. Several studies have been carried out worldwide to determine the reason of tooth extraction (Table 1). The main reason of permanent tooth extraction in many countries was dental caries and its sequels, followed by periodontal disease [9-15], which have almost the same proportion in Greece, Brazil, Japan and Kuwait as the prime causes of tooth extraction [16, 17, 18, 19]. However, dental caries and its sequels are generally the main reasons for tooth extraction in many young aged people while periodontal disease was main reason for tooth extraction in people over 40 years old [20, 21, 22, 23, 24].

In Libya there were two studies that have been carried out to evaluate the reason and pattern of tooth extraction. The first study was done by Hassan et al 1998 [25] who reported that dental caries (54%) was the most common reason for tooth extraction and the periodontal disease (41%) was the second reason for permanent tooth extraction in Sebha city. The second study was carried out by Byahatti and Ingafou, 2008 [15] where the dental caries (55.9%) was also the main reason for tooth extraction and periodontal disease (34.4%) was the second cause in Benghazi city. However, these data were collected from one city for each study in Libya. Almost one decade has been passed since their reports and there might have been some changes since then. In addition, to the best of our knowledge there is no published nationwide study so far assessed the epidemiological reasons for tooth extraction among Libyan adults. Therefore, the aim of this study was to assess the reasons and the patterns of tooth extraction among Libyan adults.

MATERIALS AND METHOD

Study subjects

Verbal consent was obtained from each participant after they get information about the objectives of this study. Participation was voluntary, and no incentive was offered. In all phases of the study, patient privacy and confidentiality were fully respected and maintained. This Multi-center Cross-sectional study was conducted in six Libyan cities over a period of six months (from September 2016 to March 2017). Libya is an oil-rich country with about 5.922 million estimated populations in 2012 [26]. The dental care services in Libya have public and private sectors, which contained the majority of practicing dentists. The dental services in the public sector in majority provide the basic dental services such as tooth extraction, scaling, and few of them extend their services to dental fillings. Libya has three major parts (West, East and South parts). The majority of Libyan people live in the coastal cities of the Mediterranean. Six cities were selected in this study (Tripoli, Misurata, Zintan, Benghazi, Derna and Hoon). This selection was primarily based on Geographic location, the size of population. This study included patients aged 17 years or above, who presented to the dental clinic in the selected cities with the presenting complaint of *"I want to remove (extract) my tooth*" were included in this study, while it excluded the patients below 17 years, or those with mental and physical problems unable to carry out their self-tooth care.

Sampling and data collection procedures

All consecutive patients came to the dental clinic in the selected cities with a complaint of "*I want to remove my tooth*" were included in this study until the minimum sample size was achieved. Each participated dentist provided instructions on the objective of the study, the methods to be used of data collection and how to fill the forms. Dental examination was done in a dental unit under good dental chair light, using mouth mirror and dental explorer. No diagnostic aid such dental x-ray was used in this study.

Data were collected through clinical examination and interviews using especially designed form contained information on patient's demographic variables such as age; gender; education level; dental attendance pattern; occupation; place of birth; type of dental clinic; type of tooth and the reason for its extraction. The reasons for tooth extraction was categorized as:

1 Economic considerations (tooth can be restored but the patient is unable to pay for the treatment).
2 Availability of the treatment in public clinic (Tooth can be restored but treatment is not available).
3 Non restorable decayed tooth.
4 Incurable periodontal diseases (tooth become loose due to reasons such as severe bone loss).
5 Trauma.
6 Impaction.
7 Orthodontic reasons.
8 Prosthodontic reasons.
9 Pathology such as cystic lesions.
10 Failed restoration such as bridge or failed RCT.
11 Retained primary teeth.
12 Supernumerary teeth.
13 Other reasons.

Data analysis

The collected data were analyzed using SPSS software Version 25. Numbers and percentages were used to describe the distribution of study sample, reason of tooth extraction. Binary Logistic regression models were fitted at (p value =0.05), to compare gender differences in different age groups.

Table 1 result of national wide studies of reasons for extraction

Country	Year of	% Extracted	% Extracted for	Author |(s)
Pakistan	2016	85.3	7.6	Haafsa Arshad et al.

Iran	2016	74.5	29.5	Seyed Ahmed et al.
India	2016	43.9	31.3	Laxman et al.
Nigeria	2014	77.9	13.3	Olanrewaju et al.
Greece	2013	37.3	35.0	N.A Chrysanthakopoulos et al.
Iran	2013	51	14.4	M. Jafarian et al.
Saudi Arabia	2013	50.2	8.24	Khalil Alesia et al.
Jordan	2013	57	12	Hind F. Nsour et al.
Nigeria	2013	55.2	23.1	Anyanechi C
Sudan	2012	66.9	21.9	Nadia Khalifa et al.
Brazil	2012	38.4	32.3	Andreia Affonso et al.
Libya	2011	55.9	34.42	Byahatti S.M et al.
Saudi Arabia	2010	53	22	Reghunathan et al.
Nepal	2010	45.7	39	L.P. Dixil et al.
South Africa	2009	47.9	22.6	RR Lesolang et al.
Japan	2006	43.4	41.8	Jun Aida
Kuwait	2006	43.7	37.4	K F. Al-Shammari et al.
South Wales/UK	2005	59	20.1	W. Richards et al.
Kenya	2004	52.6	27.6	B.O. Sanya et al.
Brazil	2003	70.3	15.1	Arnaldo de Franc et al.a
Scotland	2001	54.7	16.7	L.K. McCaul et al.
Libya	2000	54	41	A.K. Hassan et al.

RESULTS

Demographic variables

The Demographic variables of our patients are presented in (Table 2). The mean age was 38.6 years with SD of 14.83 in which a total of 2958 permanent teeth were extracted. The number of female patients was 1556 (52.6%) and they had had more teeth extractions than their male counterparts 1402 (47.4%) tooth extractions. Most of extractions were carried out in public dental clinics 1567 (53.0%) compared to private dental clinics 1391 (47.0%). The majority of patients attended to dental clinic for tooth extract were new patients 2008 (67.9%). General dentists mostly carried out these tooth extractions (68.7%). More than half of the participants 1663 (57.2%) had low educational level. Tooth extractions were predominately common in the age groups 21-30 years 779 (26.3%) and 31-40 years, 711 (24.0%).

Reasons for tooth extraction

The reasons of tooth extraction among patients are presented in table (3). It was shown that dental caries and its sequels are the most common reason for tooth extraction 1912 (64.6%) followed by sever periodontitis 270 (9.1%), tooth impaction 231 (7.8%), prosthodontic reasons 172 (5.8%) and failed RCT in 157 patients (5.3%).

The number of individual tooth extraction

The numbers of tooth extraction for individual tooth are presented in table (4). It shown that the most common tooth extracted was lower right third molar 235(7.9%) followed by lower left third molar 227 (7.75) and lower left first molar 187 (6.3%).

The relationship between the number of tooth extractions within different age groups in

both gender is presented in Table (5). It shows that with controlled gender, patients aged (21-30 years old) had 3.48 times tooth extraction experience than the patients aged (17-20 years old) with p-value (0.000) and (95% CI 2.43-4.99).

The risk factors for tooth extractions

As shown in table (6), female patients had more tooth extraction 1556 (52.6%) for different reasons than male patients 1402 (47.4%). However, the male patients had more tooth extraction due to sever periodontitis and trauma 181 (6.1%); 39 (1.3%)) respectively, than female patients. On the other hand, tooth extraction due to server periodontitis was common in the age group of (over 40 years 239 (20.2%), than the age group below 40 years 31 (1.8%). Low educated patients had more tooth extraction 1663 (57.2%) than high educated patients 1245 (42.8%), However, the higher educated patients shown more tooth extraction due to Trauma, impacted teeth, failed RCT reasons 27 (0.9%), 140 (4.8%), 90 (3.1%)) respectively, compared to low educated patients 23 (0.8%), 88 (3.0%), 67 (2.3%)). Tooth extraction for Orthodontics reason s were more common among female patients 62 (2.1%) than male patients 20 (0.7%), also, student 61 (2.1%) had more tooth extraction for orthodontic reasons than other occupation status. Although, most of tooth extraction procedures were done in public clinics 1567 (53.0%) than in private clinics 1391 (47.0%), it shown that tooth extraction due to impaction, orthodontics, pathological and filed RCT reasons (171 (5.8%), 65 (2.2%), 33 (1.1%), 93 (3.1%)) respectively, more than in public clinics than in private clinics (60 (2.0%), 17 (0.6%), 22 (0.7%), 64 (2.2%) respectively. Also, specialist dentists had more tooth extraction for impacted reasons 143 (58.0%) compared to general dentists 97 (42.0%).

The distribution of the causes of tooth extraction among individual tooth numbers

As shown in (Table 7), despite of the fact that the lower right third molar is the most common tooth extracted within the different causes of tooth extraction (235/2958), in our study, the lower left first molar was the most common teeth extracted due to dental caries (151/1912) than others. For sever periodontitis, the upper right first molar was the most common tooth extracted (23/270). Moreover, the first molars are the most common teeth extracted due to failed RCT (65/157). Also, it shown that upper premolar teeth were mostly extracted for orthodontic reasons (47/82) than lower premolars (13/82).

Table 2: Demographic variables

Variable	Frequency	Percent	Variable	Frequency	Percent
Dentist			> High School	1245	42.8%
Specialist	927	31.3%	***Occupation***		
General Dentist	2031	68.7%	Employee	1259	42.6%
Patient status			Un-employed	645	21.8%
New	2008	67.9%	Self-employed	321	10.9%
Regular	693	23.4%	Retired	168	5.7%
Referred	257	8.7%	Unknown	124	4.2%
Age Group			Student	438	14.8%
17-20	271	9.2%	***Cities***		
21-30	779	26.3%	Tripoli	613	20.7%
31-40	711	24.0%	Misurata	505	17.1%
41-50	608	20.6%	Zintan	407	13.8%
51-60	322	10.9%	Hoon	269	9.1%
≥61	254	8.6%	Benghazi	504	17.0%
Gender			Derna	660	22.3%
Female	1556	52.6%	***Permanent Residence***		
Male	1402	47.4%	Urban	2729	92.3%
Dental Clinic			Rural	229	7.7%
Public	1567	53.0%	***Place of Birth***		
Private	1391	47.0%	Urban	2599	88.1%
Educational Level			Rural	352	11.9%
≤ High School	1663	57.2%			

Table 3: Frequency distribution for reason of tooth extraction

Causes	Frequency	Percentages

Dental caries & its sequels	1912	64.6%
Sever periodontitis	270	9.1%
Tooth impaction	231	7.8%
Prosthodontics reasons	172	5.8%
Failed RCT	157	5.3%
Orthodontics reasons	82	2.8%
Pathological lesion	55	1.9%
Trauma	51	1.7%
Retained primary tooth	10	0.3%
Other reasons	18	0.6%

Table 4: Frequency distribution of individual tooth extraction

Tooth type	**Frequency**	**Percentage**	**Maxillary Arch**		**Mandibular Arch**	
			Right	***Left***	***Right***	***Left***
Centeral incisor	102	3.4%	36	26	20	20
Lateral incisor	107	3.6%	40	26	23	18
Canine	143	4.8%	48	40	30	25
First premolar	333	11.3%	127	99	55	52
Second premolar	339	11.5%	107	99	85	48
First molar	640	21.6%	143	142	168	187
Second molar	491	16.6%	111	124	125	131
Third Molar	792	26.8%	155	175	235	227
Retained primary	11	0.4%	5	3	2	1
Total	2958	100.0%	772	734	743	709

Table 5: The relationship between numbers of teeth extracted and age in both gender

Age groups	**Male**	**Female**	**Total**	**Percentage**	**P-Value**	**OR**	**95%CI**	
							Lower	**Upper**

17-20	93	178	271	9.2%	0.000			
21-30	358	421	779	26.5%	0.000	3.488	2.43	4.99
31-40	328	383	711	24.1%	0.000	2.143	1.59	2.87
41-50	278	330	608	20.6%	0.000	2.128	1.58	2.86
51-60	174	148	322	10.9%	0.000	2.163	1.59	2.92
≥61	164	90	254	8.6%	0.011	1.55	1.10	2.17
Total	1395	1550	2945	100%				

Variable	Dental Caries%	Periodontal Diseases %	Trauma%	Impacted Teeth %	Orthodontic Reasons %	Prosthodontic Reasons %	Pathological Reason%	Failed RCT%	Retained primary teeth%	Other reason%	Total
Sex											
Male	906(30.6%)	181(6.1%)	39(1.3%)	78(2.6%)	20(0.7%)	82(2.8%)	21(0.7%)	61(2.1%)	4(0.1%)	10(0.3%)	1402(47.4%)
Female	1006(34.0%)	89(3.0%)	12(0.4%)	153(5.2%)	62(2.1%)	90(3.0%)	34(1.1%)	96(3.2%)	6(0.2%)	8(0.3%)	1556(52.6%)
Age in Year											
17-20	166(5.6%)	2(0.1%)	1(0.0%)	24(0.8%)	55(1.9%)	1(0.0%)	4(0.1%)	12(0.4%)	4(0.1%)	2(0.1%)	271(9.2%)
21-30	541(18.4%)	4(0.1%)	23(0.8%)	129(4.4%)	19(0.6%)	2(0.1%)	20(0.7%)	31(1.1%)	3(0.1%)	7(0.2%)	779(26.5%)
31-40	523(17.8%)	25(0.8%)	10(0.3%)	53(1.8%)	3(0.1%)	21(0.7%)	15(0.5%)	52(1.8%)	3(0.1%)	6(0.2%)	711(24.1%)
41-50	377(12.8%)	93(3.2%)	10(0.3%)	15(0.5%)	0(0.0%)	60(2.0%)	9(0.3%)	41(1.4%)	0(0.0%)	3(0.1%)	608(20.6%)
51-60	190(6.5%)	59(2.0%)	6(0.2%)	9(0.3%)	5(0.0%)	39(1.3%)	3(0.1%)	16(0.5%)	0(0.0%)	0(0.0%)	322(10.9%)
≥61	103(3.5%)	87(3.0%)	1(0.0%)	1(0.0%)	5(0.2%)	49(1.7%)	4(0.1%)	4(0.1%)	0(0.0%)	0(0.0%)	254(8.6%)
Education level											
≤High school	1054(36.2%)	192(6.6%)	23(0.8%)	88(3.0%)	58(2.0%)	143(4.9%)	26(0.9%)	67(2.3%)	6(0.2%)	6(0.2%)	1663(57.2%)
>High school	816(28.1%)	74(2.5%)	27(0.9%)	140(4.8%)	24(0.8%)	29(1.0%)	29(1.0%)	90(3.1%)	4(0.1%)	12(0.4%)	1245(42.8%)
Occupation											
Unemployed	460(15.6%)	63(2.1%)	3(0.1%)	37(1.3%)	7(0.2%)	24(0.8%)	11(0.4%)	39(1.3%)	0(0.0%)	1(0.0%)	645(21.8%)
Employee	818(27.7%)	100(3.4%)	35(1.2%)	91(3.1%)	9(0.3%)	99(3.4%)	18(0.6%)	76(2.6%)	2(0.1%)	11(0.4%)	1259(42.6%)
Self employed	221(7.5%)	30(1.0%)	8(0.3%)	19(0.6%)	5(0.2%)	9(0.3%)	8(0.3%)	17(0.6%)	1(0.0%)	2(0.1%)	321(10.9%)
Retired	68(2.3%)	65(2.2%)	2(0.1%)	1(0.0%)	0(0.0%)	28(0.9%)	3(0.1%)	1(0.0%)	0(0.0%)	0(0.0%)	168(5.7%)

Unknown	84(2.8%)	9(0.3%)	0(0.0%)	13(0.4%)	0(0.0%)	12((0.4%)	2(0.1%)	3(0.1%)	1(0.0%)	0(0.0%)	124(4.2%)
Student	259(8.8%)	2(0.1%)	3(0.1%)	70(2.4%)	61(2.1%)	0(0.0%)	13(0.4%)	21(0.7%)	6(0.2%)	3(0.1%)	438(14.8%)
Pts. Status											
New Pts	1400(47.3%)	188(6.4%)	34(1.1%)	131(4.4%)	24(0.8%)	72(2.4%)	28(0.9%)	109(3.7%)	7(0.2%)	15(0.5%)	2008(67.9%)
Regular pts	397(13.4%)	66(2.2%)	14(0.5%)	51(1.7%)	19(0.6%)	83(2.8%)	19(0.6%)	40(1.4%)	2(0.1%)	2(0.1%)	693(23.4%)
Refereed pts	115(3.9%)	16(0.5%)	3(0.1%)	49(1.7%)	39(1.3%)	17(0.6%)	8(0.3%)	8(0.3%)	1(0.0%)	1(0.0%)	257(8.7%)
Clinic Type											
Public	1068(36.1%)	179(6.1%)	25(0.8%)	60(2.0%)	17(0.6%)	120(4.1%)	22(0.7%)	64(2.2%)	5(0.2%)	7(0.2%)	1567(53.0%)
Private	844(28.5%)	91(3.1%)	26(0.9%)	171(5.8%)	65(2.2%)	52(1.8%)	33(1.1%)	93(3.1%)	5(0.2%)	11(0.4%)	1391(47.0%)

Table 6: The risk factor for tooth extractions

Table 7: Distributions of the causes of tooth extraction among individual tooth number

FDI tooth	**CAUSES**	**Total**

number	Dental caries	Periodontitis	Trauma	Impaction	Orthodontic reasons	Prosthodontics	Pathology such as cystic lesion	Failed RCT	Retained primary tooth	Other reasons	
11.0	8	9	8	0	0	11	0	0	0	0	36
12.0	15	13	2	0	1	6	2	1	0	0	40
13.0	26	10	2	2	0	7	0	1	0	0	48
14.0	76	7	2	0	22	7	3	10	0	0	127
15.0	71	14	4	0	0	7	3	8	0	0	107
16.0	94	23	2	0	0	6	2	14	0	2	143
17.0	85	10	0	0	1	5	2	6	0	2	111
18.0	113	5	1	29	1	4	1	0	0	1	155
21.0	7	6	1	0	0	7	1	4	0	0	26
22.0	14	1	1	0	0	8	0	2	0	0	26
23.0	16	7	5	3	2	5	0	2	0	0	40
24.0	58	4	2	1	25	7	0	2	0	0	99
25.0	78	5	0	0	1	6	2	7	0	0	99
26.0	104	17	1	0	0	4	3	12	0	1	142
27.0	99	11	3	0	0	4	3	3	0	1	124
28.0	127	9	2	29	1	4	0	0	0	3	175
31.0	3	12	1	0	0	4	0	0	0	0	20
32.0	6	7	0	0	0	5	0	0	0	0	18

	CAUSES										Total
FDI tooth number	**Dental caries**	**Periodontitis**	**Trauma**	**Impaction**	**Orthodontic reasons**	**Prosthodontics**	**Pathology such as cystic lesion**	**Failed RCT**	**Retained primary tooth**	**Other reasons**	
33.0	7	7	1	0	1	7	1	1	0	0	25
34.0	33	5	0	0	6	7	1	0	0	0	52
35.0	34	5	1	0	0	4	2	2	0	0	48
36.0	151	3	1	0	0	1	9	22	0	0	187
37.0	104	13	0	0	0	1	3	10	0	0	131
38.0	127	4	2	81	4	3	2	4	0	0	227
41.0	5	6	0	0	1	8	0	0	0	0	20
42.0	7	6	2	0	0	6	0	2	0	0	23
43.0	11	8	0	1	2	6	0	2	0	0	30
44.0	30	9	1	0	7	6	0	2	0	0	55
45.0	51	14	1	0	2	6	3	8	0	0	85
46.0	131	10	2	0	0	2	3	17	0	3	168
47.0	97	4	3	0	0	2	5	14	0	0	125
48.0	124	6	0	85	4	6	4	1	0	5	235
52.0	0	0	0	0	1	0	0	0	0	0	1
53.0	0	0	0	0	0	0	0	0	1	0	1
55.0	0	0	0	0	0	0	0	0	3	0	3

	CAUSES										Total
FDI tooth number	**Dental caries**	**Periodontitis**	**Trauma**	**Impaction**	**Orthodontic reasons**	**Prosthodontics**	**Pathology such as cystic lesion**	**Failed RCT**	**Retained primary tooth**	**Other reasons**	
63.0	0	0	0	0	0	0	0	0	2	0	2
65.0	0	0	0	0	0	0	0	0	1	0	1
75.0	0	0	0	0	0	0	0	0	2	0	2
85.0	0	0	0	0	0	0	0	0	1	0	1
Total	1912	270	51	231	82	172	55	157	10	18	2958

DISCUSSION

This study shows that dental caries and periodontal diseases are still the main reasons of tooth extraction (74%). According to the present study dental caries and its sequels are the most common reason for tooth mortality (64.6%), within different age groups, gender, education level and others variables. This finding is in an agreement with other studies conducted elsewhere [27, 28]. However, younger and middle aged patients lost their teeth due to dental caries than other age groups, which is in agreement with previous studies [29, 30].

In an agreement with other studies [31, 32], severe periodontitis (9.1%) was the second most common cause of tooth extraction. However, in patient's age group over 40 years it was shown that they had more tooth extraction due to periodontitis than patient less than 40 years' age group for the same reason. This observation is in line with other studies [33]. Male patient had more tooth extractions due to severe periodontitis than female patients, which explained by fact that male people have more risk factors such as smoking than females. Interestingly, however, the number of teeth extraction were more in females (52.6%) than males (47.4%), as a reflection of the fact that females are more likely to consume sugary foods which is a primary cause of dental caries, and the usually use more dental services. However, this remains a hypothesis which requires further assessment in the Libyan context.

Tooth extraction for orthodontic reasons was recorded as a second reason for tooth extraction in age group 17-20 years, with the premolar teeth being the more frequent teeth to be extracted fo this reason, which is not surprising and is in line with previous studies [34, 35].

Tooth extraction due to dental caries was carried out mainly for the lower first molar teeth than any other tooth, which might be explained on the fact that the mandibular teeth are more susceptible to dental caries than maxillary teeth. Conversely, Tooth extraction due to severe periodontitis was more observed among upper first molars than the rest of other maxillary teeth. It also noted that public dental clinics had more tooth extraction procedures than private clinics and this finding could be attributed to the low economic status of the dental patients using public health services.

Conclusion: the results of this study has indicated that dental caries and periodontal diseases are still representing the major cause of tooth loss among Libyan population despite of the advances in technology that used in dentistry and the increased number of dental practitioners in Libya.

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Case report

Lateral Odontogenic Keratocyst Clinically Diagnosed as a Dentigerous Cyst (A case report and literature review)

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ABSTRACT

Odontogenic keratocyst (OKC) has been an area of considerable research over the last decades owing to its unique behavior, debated origin, distinctive tendency to recur, and argued nature. In 2005, WHO has adopted the designation of keratocystic odontogenic tumor (KCOT) because of its aggressive nature and tendency to recur, so, it has been long been considered as a benign jaw neoplasm rather than a cyst, though the last classification has returned the OKC back to cyst category. It is not uncommon for OKC to be clinically and radiographically identical to dentigerous cyst which makes the initial diagnosis rather confusing; however, in our reported case another interesting and an unusual feature was the arrival of an intact cyst attached to the neck of an impacted tooth which has further drawn the attention toward the dentigerous cyst, particularly the lateral type. The final diagnosis was made following the microscopic examination of the surgical specimen which was almost convincing and consistent with OKC. The clinical, radiological and histological features of this pathological entity along with brief relevant studies have been discussed.

Key words: odontogenic keratocyst, odontogenic tumor, dentigerous cyst

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INTRODUCTION

Odontogenic keratocyst (OKC) is a developmental odontogenic cyst which has an epithelial origin. It was first identified in 1876 and further characterized by Phillipsen in 1956 [1].

Compared to other odontogenic cysts; the odontogenic keratocysts (OKCs) may exhibit tumor like behavior; hence the other name is keratocystic odontogenic tumor (KCOT). The tumor-like nature of the OKC is manifested in the aggressive clinical course of some cysts, the significantly high recurrence rate, and its association with nevoid basal cell carcinoma syndrome (NBCCS) [2].

Importantly, some OKCs may be misdiagnosed as dentigerous cysts especially those arising in dentigerous relationship, hence microscopic examination must be carried out to get accurate diagnosis [3].

This article presents a silently growing OKC that was initially diagnosed as a dentigerous cyst based on its radiographic appearance, though OKC was considered as a differential diagnosis; even though, the whole cyst tissue was received intact in the laboratory which is rare for the OKC because of its thin and folded wall.

CASE REPORT

A 25 years old female Libyan patient attended the department of oral pathology, medicine, diagnosis and radiology, faculty of dentistry-Benghazi university. The patient was concerning about a missing wisdom tooth, she had no pain, swelling, discharge, or any other symptoms. On examination the patient was looking well, and had no extra oral swelling. Intraoral examination revealed missing right and left wisdom teeth with no swelling or bulging being detected.

Macroscopic features:

The cyst was received intact along with the impacted third molar tooth, attached to its cervical region just like a lateral dentigerous cyst (Figure 2). An abundant yellowish cheesy material was released from the specimen upon cutting of the cystic mass.

Histological examination:

Hematoxylin and eosin stained histological sections demonstrated a thin (about six to eight cell) layer, rather uniform lining of para-keratinized stratified squamous epithelium with corrugated surface, the basal cell layer is well defined showing palisading columnar cells with hyperchromatic nuclei. Cyst wall is made up of fibrous connective tissue with scattered fibroblasts, and moderately infiltrated by chronic inflammatory cells. Cyst wall is loosely attached to the lining epithelium with foci of detachment being detected along the basal cell layer. The cyst lumen contains abundant keratin and cellular debris. (Figures 1-3).

Radiographic findings:

Orthopantomograph (OPG) revealed an elliptical, unilocular radiolucency in the right mandibular third molar region closely related and attached to the neck of the mandibular third molar, with no evidence of perforation or expansion of the cortical plate. (Figure 4).

Differential diagnosis

Based on the clinical, radiographic, and macroscopic findings, the lesion was initially diagnosed as a dentigerous cyst; though OKC has also been suggested. However, the histopathological features were almost conclusive, and consistent with those of OKC.

Outcome and follow up

The Patient was asymptomatic following three years of treatment. Because of the high recurrence rate, patient should be reviewed at least after five years.

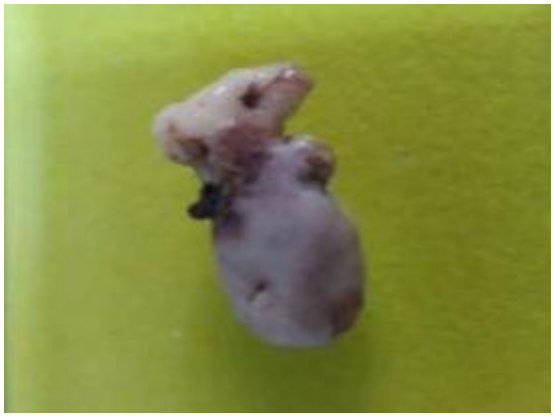

Figure 1: intact cyst wall attached to an impacted molar tooth

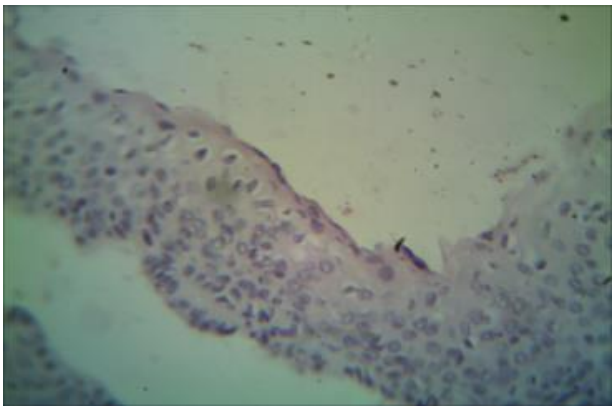

Figure 2: parakeratininzed stratified squamous epthelial lining with currugated surface (40×10)

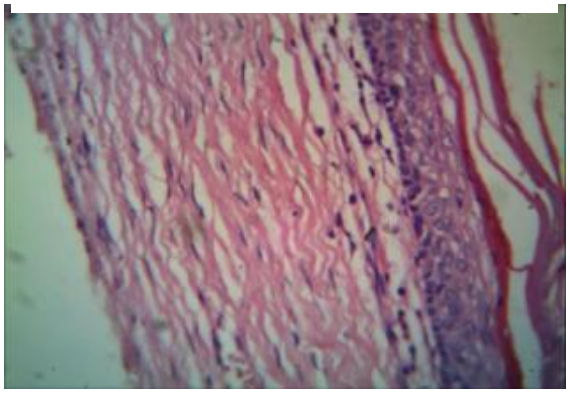

Figure 3: Figure 3: fibrous cyst wall with moderate inflammatory infiltration (40×10)

Figure 4: Orthopantamograph showing unilocular radiolucent lesion attached to the third molar tooth extending to the ramus of mandible

DISCUSSION

The odontogenic keratocyst (OKC) has been an area of considerable research by many authors for long time owing to its disputed nature, and aggressive behavior. Many are arguing that the OKC should be classified as a benign neoplasm rather than a cyst [3], which was lastly confirmed by Ahlfors and his colleagues in (1984) who proposed that OKC should be considered as a benign cystic tumor [4]. This notion was further confirmed in 2005 where WHO moved the OKC from cyst list to tumor category and gave the designation of keratocystic odontogenic tumor (KCOT) instead of odontogenic keratocyst (OKC) [5]. However; the updated WHO classification of odontogenic tumors in (2017) has moved the OKC from tumor category back to cyst category due to lack of sufficient evidence [6,7]. The term 'odontogenic keratocyst' was first invented by Philipsen (1956), and has been defined as *"a benign developmental odontogenic tumor with many distinguishing clinical and histologic features*". Among them are: a potential for locally destructive behavior, a relatively high recurrence rate, and designation as a consistent finding in the nevoid basal cell carcinoma syndrome, or Gorlin Goltz syndrome [8].

The origin of OKC has been an area of great debate for many years until 1967 where Soskolne and Shear provided an evidence supporting the origin of OKC from primordial odontogenic epithelium, particularly the remnant of dental lamina [9]. Moreover; a second source of the epithelial lining of OKC was proven to be the basal cell extensions of the overlying epithelium [10].

The odontogenic keratocyst accounts for 4–12% of all odontogenic cysts, and occurs over a wide age range with a peak of incidence in the second and third decades of life, and with slight male predilection [1]. Rare cases were reported as early as the first decade, and as late as the ninth decade of life [11]. The lesion could be discovered anywhere in the jaw; however, about (65–83%) were found in the mandible, particularly the molar region and the ascending ramus [8].

The clinical signs and symptoms of OKC involves: pain, swelling, teeth displacement, and occasionally paresthesia; however, in many cases cysts were discovered accidently on routine radiographic examination, or may go undetected until they reach huge size involving the whole ramus or the maxillary sinus. This is due to the tendency of OKC to grow and expand antero-posteriorly through the bone marrow [1].

Considerable research has been conducted to explore the unique microscopic features of OKC accounting for its aggressiveness and tumor-like behavior. The capsule of OKC is invariably thin and fragile, and almost collapsed during surgical enucleation, that is why such lesions are more likely to recur. The lining epithelium is either ortho or para- keratinized with characteristic morpho and functional differentiation of epithelial cells from the basal cell layer to the surface corneal cell layer. This feature is not found in the other jaw cysts, even when keratinization occurs [1]. Another distinguishing feature proven to account for the possibility of OKC to recur was the presence of small micro-cysts (satellite cysts) in their capsules [7].

Furthermore, an agreement has been made about the significant association between nevoid basal cell syndrome and OKC (about 75%), particularly the Para keratinized type [2].

Further evidence provided by molecular studies concluded that there is increased expression of tumor markers; mainly, PCNA and Ki 67, as well as, mutation of NBCCS gene, and PTCH gene especially in syndrome associated OKCs. All of these findings provided supportive evidence that the OKC might be considered a benign tumor and should be treated accordingly [1]. Even though, some researchers were discreet regarding considering the OKC as a benign neoplasm though they acknowledge the previously mentioned theory. Actually, many oral pathologists agreed that the evidence was not convincing, especially those related to PATCH gene mutation, as mutation has been demonstrated also in non-neoplastic lesions particularly; dentigerous cyst. So the new WHO classification (2017) reverted back to the original and the widely accepted classification of OKC under cyst category [7].

Many OKCs arise in dentigerous relationship making the diagnosis rather confusing, so carful and comprehensive investigations should be conducted as the treatment and the behavior of the two lesions are quite different. Dentigerous cysts are not aggressive and simple enucleation is considered the treatment of choice and recurrence is rare. On the other hand, OKCs are aggressive, may invade the adjacent structure, and are more likely to recur [11]. In 2013, Chaudhary and his colleagues reported a case of OKS which was initially suspected as a dentigerous cyst due to the unusual clinical and radiographic presentations, but the histopathological examination was consisting with OKC [12]. Likewise, in our current study, dentigerous cyst was the first diagnosis which has been made according to the radiographic appearance; the cyst appeared as a unilocular radiolucency associated with crown of an impacted tooth, which is a common feature for the dentigerous cyst [1]. The attention was further drawn toward the dentigerous cyst when the cyst lining along with an impacted tooth was received intact in the laboratory which is rare for the OKC due to its thin scalloped capsule [2].

However, the microscopic examination was almost convincing and conclusive; the cyst lining was made up of keratinized stratified squamous epithelium with corrugated pattern, supported by thin fibrous capsule which is consistent with OKC. Moderate inflammatory infiltrates were detected both in the epithelium and the connective tissue capsule; this raises the question whether the inflammatory infiltrate has altered some of the features of the lesion enabling its complete enucleation without fragmentation. This proposal was made according to the widely accepted theory that the unique characteristic features of the OKC could be greatly altered by the presence of inflammation in its capsule or epithelial lining [13].

In conclusion, OKCs may impede the eruption of related teeth resulting in a radiographic appearance of dentigerous cyst; such lesions are usually misdiagnosed as dentigerous cysts. Our reported case was an OKC attached to an impacted tooth resembling a dentigerous cyst. So, carful and comprehensive examination should be carried out; this will involve thorough clinical and radiographic examination, as well as, carful microscopic evaluation of the surgical specimen. Thus, an appropriate diagnosis and subsequently a proper treatment plane will be established.

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