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RESEARCH ARTICLE

KNOWLEDGE, ATTITUDES AND PRACTICE REGARDING OCULAR COMPLICATIONS DUE TO DENTAL INFECTIONS AMONG DENTAL STUDENTS IN QASSIM, SAUDI ARABIA

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Abstract

Objectives: The study aims to assess the knowledge, attitude and practice of dental students regarding the ocular complications that occur due to dental infection.

Methods: A cross-sectional questionnaire-based survey was conducted with a questionnaire consisting of 11 questions (six knowledge items and five attitude and practice items) was distributed among first-, second-, third-, fourth- and fifth year dental students via email. Of 120 questionnaires distribution, 102 questionnaires were filled by the students, hence the response rate of this study was 85%. All the items were in the format of multiple-choice questions. Based on the responses from 102 questionnaires, the frequencies and percentages for each item of the survey were analyzed.

Results: Nearly 63% of participants were aware of ocular complications resulting from dental infection. Discussion with colleagues and peers are the main source of information (56%) among the dental students. Three-fourths of the participants (75%) reported that these complications were under-reported in textbooks, curriculum and literature. More than 80% of the participants indicated that ocular complications should be considered seriously if not considered it may result in irreversible ocular damage, and 83% advocated research on ocular complications due to dental infections.

Conclusion: Even though the awareness of ocular complications due to dental infections was found to be adequate among our undergraduate dental students, there is a need of education and training about prevention and initial management of these sorts of complications associated with dental infections and post tooth extraction. Moreover, this awareness and early diagnosis of ocular complications and appropriate referral to ophthalmologists will improve the patient outcomes.

Introduction:-

Infections that originate in the mouth or sinuses can spread to other parts of the body. An example of how mouth or sinus infections can spread to the eye is orbital cellulitis, an ocular emergency that not only leads to

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blindness but can also lead to life-threatening complications such as cavernous sinus thrombosis, meningitis, and brain abscesses leading to long-term health complications if not treated promptly[1,2]. The American Academy of Ophthalmology (AAO) reports that more than 90% of orbital cellulitis is due to a bacterial sinus infection involving the ethmoidal sinus. An ocular infection can also result from the result from a dental infection, such as severely decayed teeth or an abscessed tooth spreads the infection to the orbital area by damaging the orbital septum area. Additionally, recent dental treatment may contribute to the development of orbital cellulitis[3].

Chang KC (2008) reported a case of orbital cellulitis in a 55-year-old man following tooth extraction. Computed tomography (CT) revealed extensive periorbital inflammation and medial displacement of the left lateral rectus muscle through an extended sub-periosteal abscess extending along the lateral orbital wall. Immediate intervention with intravenous broad-spectrum antibiotics and oral prednisolone, the patient achieved complete resolution of signs and symptoms. Therefore, dentists should be aware that orbital and ocular complications can occur after oral surgery, and the dentist should suspect an eye infection in a patient with a history of recent tooth infection or tooth extraction with preseptal signs[4]. Prasad SB et al., (2010) reported the occurrence of orbital cellulitis secondary to a dental infection followed by orthodontic extraction in a 16-year-old female presented with the symptoms of eye movement restriction, epiphora and proptosis. A CT scan showed abscess in the medial, lateral, superior and inferior walls of the orbit; therefore, drainage of pus was performed. Immediate regression of orbital swelling, epiphora and proptosis was observed with improved eye movement. Therefore, complete drainage from orbital cavity and para nasal air sinuses, and appropriate antibiotic coverage at the earliest are the mainstays of treatment.[5] According to Sharma V et al., (2013), odontogenic orbital cellulitis caused blindness in a 30-year-old man due to rapidly progressive orbital tension. Therefore, even the simplest dental problem requires special attention[6]. Some case reports have described a loss of vision due to an odontogenic complication, but the cases did not show typical findings of tension orbit and eyeball deformation caused by severe proptosis and optic nerve traction[5-7]. Dolman PJ et al., (1991) pointed out the possibility of direct spread of infection to the optic nerve, which can be considered as a possible cause of vision loss due to orbital cellulitis[8].

Pasqulae et al., (2016) found an association between dental infections and the development of open-angle glaucoma (OAG) which is degenerative eye degeneration resulting from increased intraocular pressure that damages the optic nerve fibers. Without prompt intervention, OAG can lead to progressive visual field loss, visual impairment and even blindness[9]. A new study by Polla D et al. (2017) show that a patient's number of natural teeth, an indicator of dental care, may play a role in the pathogenesis of several types of glaucoma that threaten vision[10].

There are many guidelines available to help doctors, dentists, nurses and allied healthcare professionals minimize the risk of cross infection. Dentists currently lack guidelines for the prevention, care and proper treatment of eye problems due to dental infections, necessitating the development of such guidelines as well as research to understand the ocular complications associated with dental/oral infections and to determine optimal therapeutic interventions. Therefore, we conducted this first survey in Saudi Arabia to assess the knowledge and attitudes of dental students regarding ocular complications resulting from dental infections.

Materials and Methods:-

Study design and location:

This study was an observational cross-sectional survey that aimed to investigate the level of Knowledge, Attitude, and Practice (KAP) about the ocular manifestations of dental infections among the 120 dental students in the Qassim region of Saudi Arabia. The study was conducted in the College of Dentistry, Qassim University over a three-month period from January–March, 2022. All the dental students who attended the college of dentistry during the assessment period were included in the study.

Inclusion and exclusion criteria:

Each participant was informed about the aim of the study and gave informed consent. Students who did not consent were unable to participate, or did not submit completed questionnaires were excluded from the study.

Questionnaires:
A semi-designed questionnaire was obtained from Hunsigi et al. 2017[14]. The final questionnaire in the form of multiple-choice questions was designed by the principal investigator and was reviewed for its validation and reliability by dental and ophthalmology experts via a back-translation technique wherein the questionnaire was translated twice to Arabic and then back to English to prevent a language barrier. The two translated copies were compared to ensure that they conveyed the same meaning. Totally 120 standardized self-administered questionnaires were sent out by E-mail to first-, second-, third-, fourth and fifth-year dental students. The self-administered questionnaire included demographics, knowledge about the occurrence of ocular complications, source of information about ocular complications due to dental infections, occurrence of ocular symptoms, duration of symptom, consultation with an ophthalmologist, knowledge about ocular infections and cavernous sinus thrombosis due to untreated dental infections, which type of dental infection is more likely to lead to ocular complications, how to prevent these ocular complications due to oral infections, when to consult or refer to an ophthalmologist for ocular complications, how seriously dentists should take ocular complications due to dental infections, whether there is a need for further research and review on ocular complications due to dental infections.

Ethical approval and consent to participate:
Prior to data collection, an ethical approval for this study was obtained from the Dental Ethical Committee, Dental research chair, Qassim University (EA/M-2020-3021). The study was conducted in accordance with Declaration of Helsinki. Informed consent was obtained electronically as a part of the survey from each participant after explaining the nature of the study and keeping their responses and identity anonymous. Completion of the informed consent form and questionnaire was considered as consent to participate in the study. Confidentiality was maintained throughout the study and respondents were assured that their responses would only be used by the researchers for research purposes.

Data Analysis
Data were analyzed and coded using SPSS (Statistical package for social services) for windows (version 20, Chicago, IL) statistical software package. Frequency tables were generated for all variables. The demographic variables of the study sample were presented using descriptive statistics such as means, standard deviations, and percentages. The sample size was calculated using EPI INFO (Epidemiological Information Package) version (21) 3.5.3 statistical packages at a confidence interval of 95% and power of 80%.

Results:-
Of 120 questionnaires sent by e-mail, a total of 102 dental students from all the academic years responded to all questionnaires, and the response rate was 85%. Of the 102 respondents, 11 (10.8%) were first-year students, 11 (10.8%) were second-year students, 11 (10.8%) were third-year students, 36 (35.3%) were fourth-year students, and 33 (3.23%) were fifth-year students. The study participants' level of knowledge about ocular complications due to dental infections was satisfactory i.e., nearly 63% and they had a relatively positive attitude toward prevention, which would enable them to provide better prevention to their patients when it was needed.

Knowledge of ocular complications among dental students:
Around 62.7% of participants were aware of occurrences of ocular complications resulting from dental infections, while 18.6% of participants were unaware of complications and 18.6% of participants responded that ocular complications do not happen due to dental infections (Figure 1 a). The level of awareness about ocular complications resulting from dental infection was found to be higher among fourth- and fifth-year students when compared with first-, second-and third-year dental students (Table 1). Of the 62.7% of respondents who knew about ocular complications due to dental infections, 56% said colleagues as an important source of information, while 16% indicated that textbooks were their source, 21.4% expressed that the personal experience of ocular complications from their clinical practice, and 20% of respondents mentioned that the combination of colleagues, personal experiences and textbooks was their prime source of information (Figure 1b).

Table 1:- Responses to Questionnaire on Knowledge of Dental Students to Eye Complications Caused by Dental Infections.

Knowledge questions	Academic year				
	First (n=11) n (%)	**Second (n=11) n (%)**	**Third (n=11) n (%)**	**Fourth (n=36) n (%)**	**Fifth (n=33) n (%)**

• Do you aware that ocular complications occur due to dental infections • Yes • No • Don't know	3 (27) 2 (18) 6 (55)	6 (55) 1 (9) 4 (36)	5 (45) 5 (45) 1 (9)	24 (67) 7 (19) 5 (14)	26 (79) 4 (12) 3 (9)
If yes, then what is the source of information? • Colleagues • Texbooks • Personal experience • All of the above	2 (20) 1 (20)	4 (11) 1 (10) 1 (8)	4 (11) 1 (10)	15 (42) 1 (10) 3 (60) 5 (38)	13 (36) 5 (50) 5 (20) 7 (54)
• Did you notice any ocular complications in a patient due to dental infection? • Yes • No • May be	5 (14) 3 (5) 3 (60)	5 (14) 6 (10)	3 (8) 8 (13)	10 (27) 25 (42) 1 (20)	14 (38) 18 (30) 1 (20)
If yes, what were the signs and symptoms did you notice in a patient? • Vision loss • Visual field defects • Ophthalmia • Orbital cellulitis	2 (11) 1 (10) 1 (50) 1 (17)	4 (21) 1 (17)	 2 (20) 1 (50)	5 (26) 4(40) 1 (17)	8 (42) 3 (30) 3 (50)
How long the symptoms lasted? • Few minutes to hours • Few days • Few months	3 (14) 1 (8) 1 (25)	3 (14) 2(17)	2 (10) 1 (25)	4 (19) 4 (33) 2 (50)	9 (43) 5 (42)
Did you make your patient to get consulted an ophthalmologist for ocular complication? • Yes • No	1 (5) 4 (22)	1 (5) 4 (22)	2 (11) 1 (6)	4 (21) 6 (33)	11(58) 3 (17)
• Could untreated tooth infection lead to eye complications? • Yes • No • Don't know	5 (7) 3 (27) 3 (13)	3 (4) 2 (18) 6 (25)	9 (13) 1 (9) 1 (4)	26 (39) 2 (18) 8 (33)	24 (36) 3(27) 6 (25)
• Do you aware that ocular complication due to tooth infections leads to cavernous sinus thrombosis sometimes? • Yes • No • Don't know	4 (8) 4 (21) 3 (10)	1 (2) 2 (11) 8 (26)	3 (6) 7 (37) 1(3)	24 (46) 3 (16) 9 (29)	20 (38) 3 (16) 10 (31)
• How the ocular complications due to dental infections are reported • Over-reported • Under-reported • Adequately-reported	5 (50) 6 (8)	1 (10) 8 (10) 2 (13)	2 (20) 7 (9) 2 (13)	2 (20) 30 (39) 4 (27)	 26 (34) 7 (47)
• Which tooth infection is more prone for ocular complication? • Maxillary molars • Maxillary premolars • Maxillary anterior teeth • Mandibular molars	2 (5) 5 (19) 2(9%)	4 (10) 4 (17)	4 (10) 4 (15) 1 (4)	16 (41) 8 (31) 9 (39) 1 (100)	13 (33) 9 (35) 7 (30)

• Mandibular premolars		2 (100)			
• Mandibular anterior teeth	1 (33)			1 (33)	1(33)
• All of the above	1 (13)	1 (13)	2 (25)	3 (13)	3 (38)

Figure 1a: Knowledge on ocular complications due to dental infections

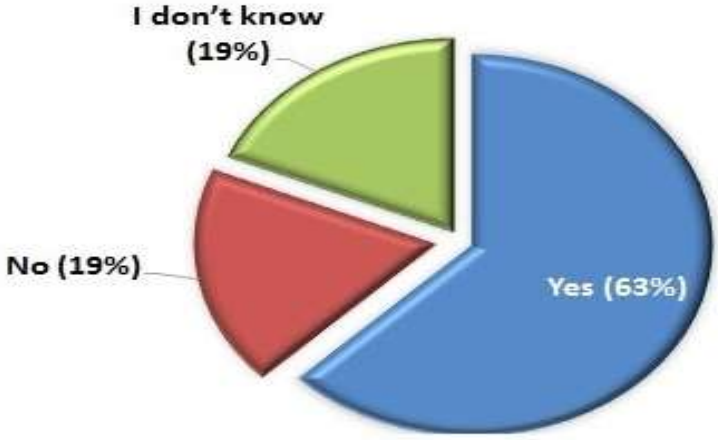
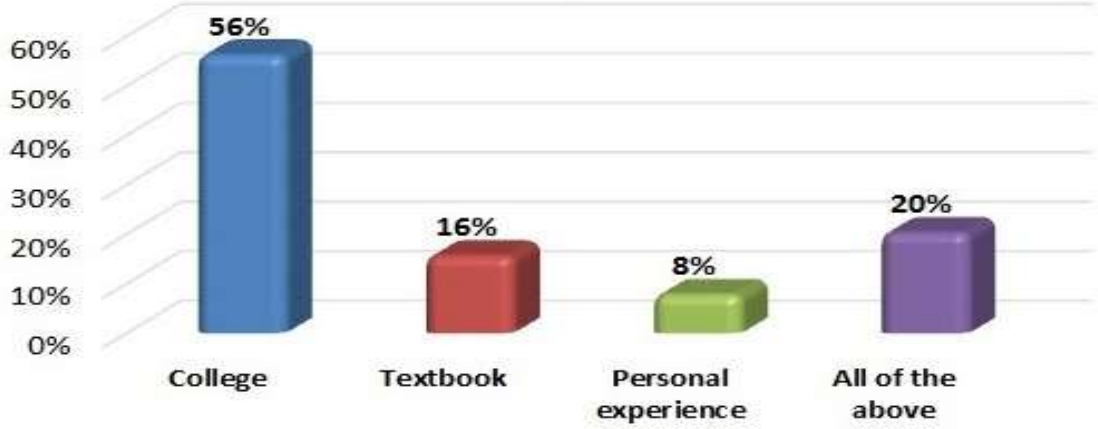
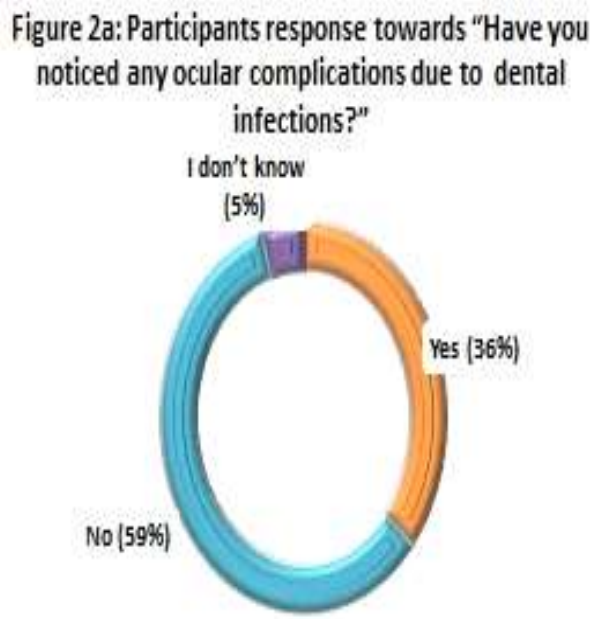
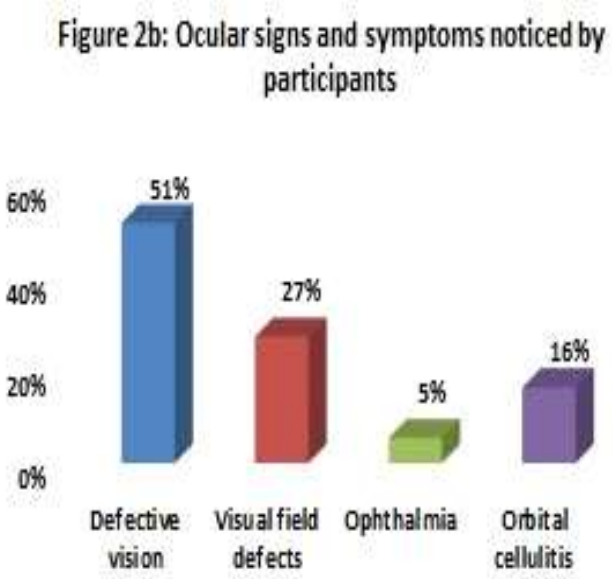


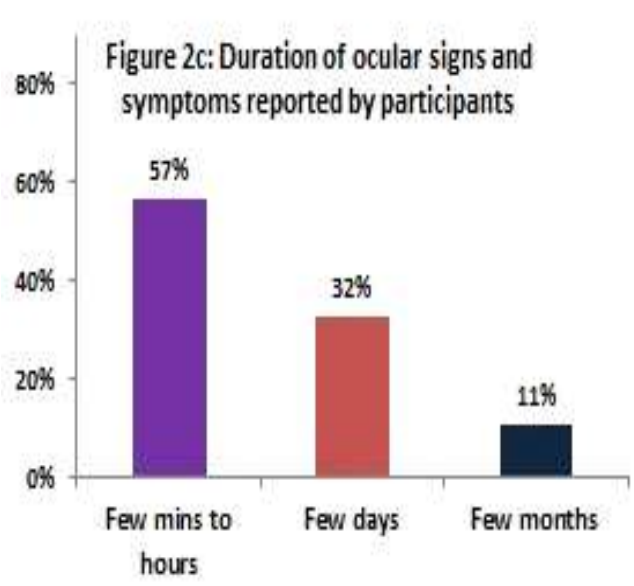
Figure 1b: Source of information about ocular complications due to dental infections

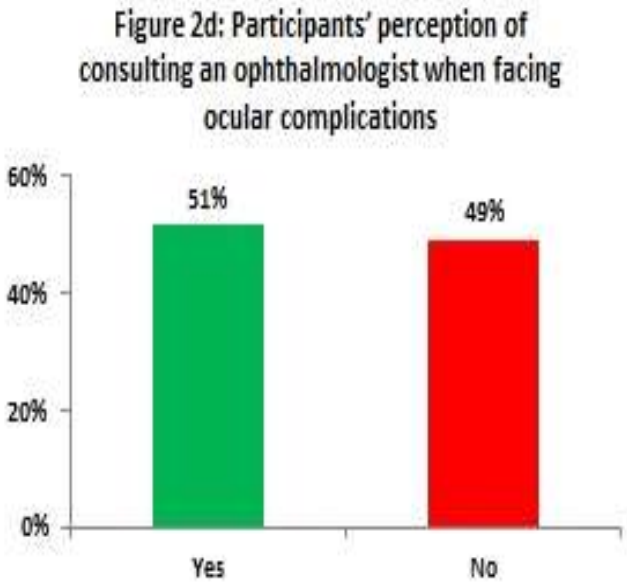


Among 62.7% who had knowledge about ocular complications, 36% of participants expressed that they have noticed ocular complications in dental infection patients, 59% of participants reported that not encountered any ocular complications and 5% of respondents said that they don't know what ocular complication was noticed during the examination (Figure 2 a), with the most common symptoms being defective vision (51%), visual field defect (27%), orbital cellulitis (16%) and ophthalmia (5%) as shown in Figure 2b. Fifty-seven percent of respondents outlined that ocular symptoms remained for "few minutes to hours", 32% of students reported "few days" and 11 % said the ocular symptoms lasted for "few months" (Figure 2c); 51% of dental students make their patient consult an ophthalmologist for better management of these complications, whereas 49% said not made an attempt to ophthalmologists consultation (Figure 2d). Table 1 contains details on types of ocular signs and symptoms, duration of symptoms, and management by dental students by academic year.

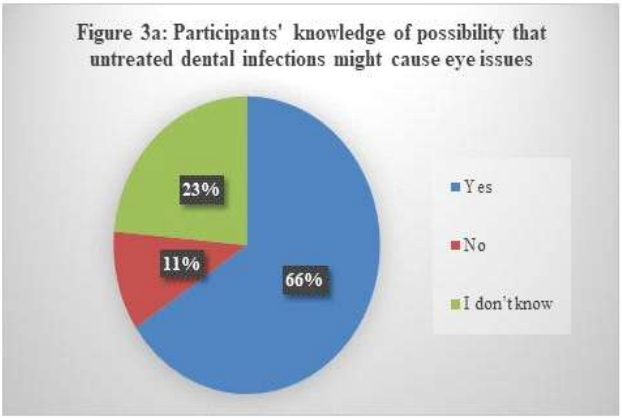


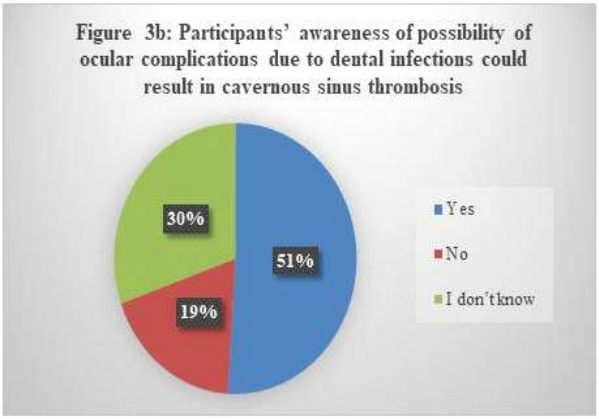


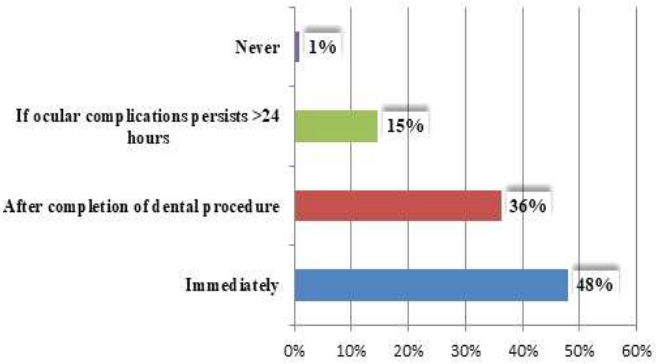


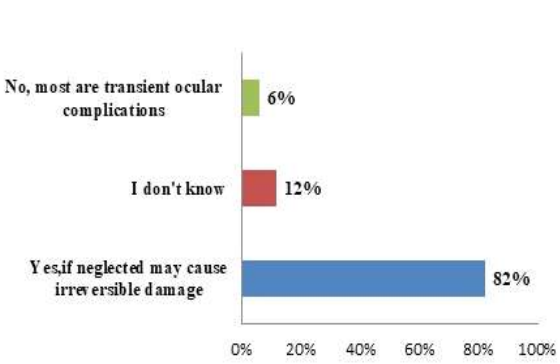


Sixty six percent of dental students responded that untreated tooth infection leads to ocular complications, whereas 11% responded that no ocular complication occurs due to untreated tooth infection, and 23% were unaware about the untreated tooth infection and ocular complications, as shown in Figure 3a. Around 51% of the undergraduate students indicated that ocular complications due to dental infection leads to cavernous sinus thrombosis, 19% said no, and 30% were unaware of ocular complications leads to cavernous sinus thrombosis (Figure 3b).

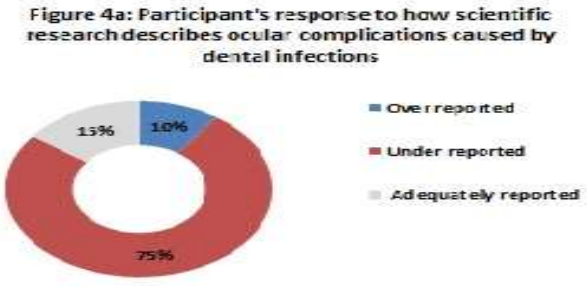


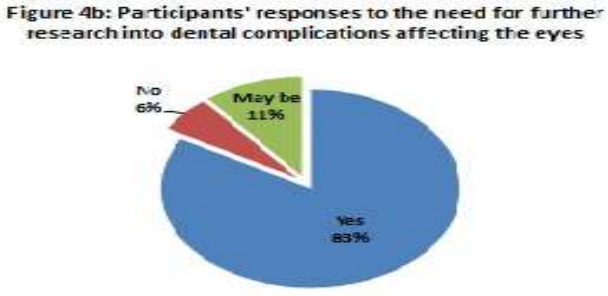






Nevertheless, 75.7% of the dentists believe that ocular complications caused by dental infections were underreported in the scientific research and literature, whereas 10% believed that it is over-reported, while 15% felt that it is adequately reported (Figure 4a).

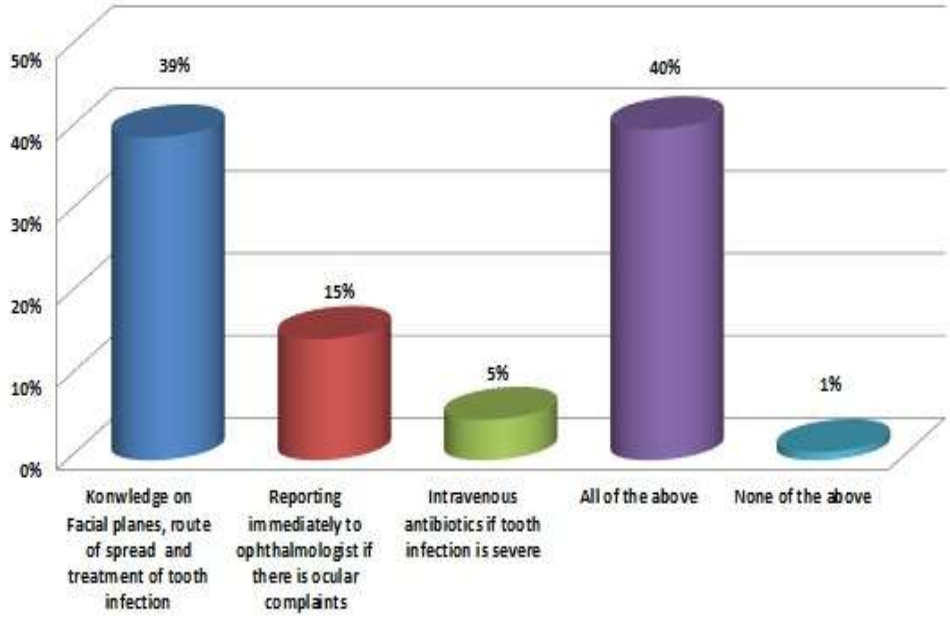




Thirty-eight percent of participants indicated maxillary molars teeth infections are more prone for ocular complications, 25% responded maxillary premolars, 23% said maxillary anterior teeth, 3% indicated mandibular anterior teeth, 1% opted mandibular molars, 2% said mandibular premolars. Remaining 8% said that all teeth infections are prone for ocular complication. Academic year wise distribution about knowledge items and its responses about the ocular complications due to dental infections by the dental students is shown in Table 1.

The attitude of dental students regarding ocular complications due to dental infection:
Regarding the prevention of ocular complications, 39% expressed that it can be prevented by knowing the facial planes and route of spread of tooth infection and treating dental infection immediately, 15% preferred to report immediately to ophthalmologist if patient complains of visual problems, 5% opted for institution of intravenous (IV) antibiotics in case of severe tooth infection, 40% respondents answered that it can be prevented by all above methods, and only 1% of the respondents preferred for none of the above option (Figure 5).

Figure 5: Participants' response towards how to prevent ocular complications due to dental infection



More than half of the participants (55%) dental students responded that their immediate reaction on facing with ocular complication is reassurance to the patient, treat dental infection and call the ophthalmologists, 22% opted for summoning to medical emergency, 13% reported shifting the patient to hospital care, 10% indicated calling the ophthalmologists, and 1%indicated to ignore and proceed with intended dental procedure. Majority of respondents (48%) preferred an immediate ophthalmologist's consultation if there is any signs and symptoms of ocular problem, 36% said that they will consult an ophthalmologist after completion of the intended dental procedure, 15% reported if ocular signs and symptoms last for >24 h then consult ophthalmologists, 1% were not inclined to consult ophthalmologist (Figure 3c). In response to the question "When dentists should take ocular complications seriously," 82% of respondents responded that ocular complications are serious, 6% indicated that they are not, and 12% did not know (Figure 3d).

Most respondents (83%) agreed that more research and review should be conducted on ocular complications caused by dental infections. Only 6% said it was not necessary, while 11% expressed inconclusive opinions (Figure 4b). Academic year wise distribution about attitude and practice items, and its responses about the ocular complications due to dental infections by the dental students is shown in Table 2.

Table 2:- Answers to the Questionnaire on Attitudes of Dental Students to Eye Complications Caused by Dental Infections.

Attitude questions	Academic year				
	First (n=11) n (%)	**Second (n=11) n (%)**	**Third (n=11) n (%)**	**Fourth (n=36) n (%)**	**Fifth (n=33) n (%)**
• If you encounter an ocular complication due to dental infection, what would be your immediate reaction?					
• Shift patient to hospital care	3 (23)	1 (8)		6 (46)	3 (23)
• Call ophthalmologist	2 (20)	2 (20)		1 (10)	5 (50)
• Reassure the patient, treat the dental infection and then call ophthalmologist	4 (7)	1 (2)	7 (13)	22 (39)	22 (39)
• Summon medical emergency	1 (5)	7 (32)	4 (18)	7 (32)	7 (14)
• Ignore the complication and proceed with intended dental procedure	1 (100)				
• How do you prevent ocular complications due to dental infections?					
• Knowledge about facial planes and route of tooth infection spread and treating dental infection immediately	6 (15)	1 (3)	6 (15)	15 (38)	12 (30)
• Reporting immediately to ophthalmologist when the patient has visual complaints		4 (27)	2 (13)	6 (40)	3 (20)
• Intravenous antibiotics if tooth infection is severe	1 (20)	1 (20)	1 (20)	1 (20)	1 (20)
• All of the above	4 (10)	5 (12)	2 (5)	13 (32)	17 (41)
• None of the above				1 (100)	
• If you encounter with ocular complications due to dental infection, when do you consult ophthalmologist?					
• Immediately	5 (10)	4 (8)	3 (6)	20 (41)	17 (35)
• After completing intended dental procedure	4 (11)	4 (11)	6 (16)	11 (30)	23 (32)
• If signs and symptoms of ocular complications persists for >24 hours	2 (13)	2 (13)	2 (13)	5 (33)	4 (27)
• I will never consult ophthalmologist		1 (100)			
• Do you feel a dentist should take seriously about ocular complications due to dental infection?					
• Yes, if neglected sometimes it may cause irreversible damage	9 (11)	7 (8)	8 (10)	30 (36)	30(36)
• No, because these ocular complications are transient		1 (17)	1 (17)	3 (50)	1 (17)
• Don't know	2 (17)	3 (25)	1 (17)	2 (25)	1(17)
• Do you think more research and literature needed on ocular complications due to dental infection?					
• Yes	9 (11)	9(11)	7 (8)	31 (36)	29 (34)
• No			2 (33)	4 (67)	
• May be	2 (18)	2 (18)	2 (18)	1 (9)	4 (36)

Discussion:-

Ocular complications after a dental infection are not uncommon. However, it can cause significant anxiety for both the patient and the dentist. It is a completely unexpected event from the patient's point of view and can be extremely alarming. Clinicians may misdiagnose such events if they were unfamiliar with the nature of these complications, and may also attribute it to a more serious ocular event, like blindness or an irreversible ocular damage. It is therefore essential that the dentist understand the etiology and pathogenetic mechanism of these complications. Studies examining perception, perspective and practice regarding ocular complications from dental infections and ocular anesthesia have concluded that continuing education is a must for both dental students and practicing dentists[11-13].

Hunsigi P, et al (2017) showed that only 24.2% of the participants' surveyed participants were aware of eye complications due to dental infections and concluded that the level of knowledge was insufficient among undergraduate and post-graduate dental students in India, but the study participants had a relatively positive attitude towards provision of better prevention to the patients when needed[14]. In contrast, our study assessed the level of knowledge and attitudes of undergraduates of dentistry regarding ocular complications due to dental infection, indicating the level of satisfactory knowledge (> 60% were aware of occurrence of ocular complications) among dental students, reflecting a somewhat adequate understanding of ocular complications due to dental infections. The higher the academic year, the greater the knowledge about ocular complications occurs due to dental infections. Twenty seven percent of first-year students, 55% of second-year students, 45% of third-year students, 67% of fourth-year students, and 79% of fifth-year participants were aware of the occurrence of ocular complications due to dental problems. This may be due to their level of education in anatomy, physiology and route of infection, and the amount of clinical exposure to such cases. Therefore, dentistry students need to be aware of all these complications that will guide them for their future practice. It is important that the dentistry students and dentists are fully equipped with the latest information, treatment modalities and resource knowledge on a daily basis.

In the present study, discussions with colleagues (56%), textbooks (16%) and personal experiences during the clinical practice (8%) were the main sources of information on ocular complications in patients with dental infection, where a study from India showed that > 50% of the source of information comes from the Internet and journals. Therefore, we propose to conduct further research studies in this area, and reliable information from textbooks on the prevention and timely treatment of these complications will allow the dentists to effectively treat these conditions in the clinic.

Eight-two percent of dentistry students strongly recommend taking ocular complications from dental infections seriously, about 6% said ocular complications are transient and of non-serious nature. In contrast, 20% of the participants appreciated the severity of the ocular complications due to dental infections, about 10% of the dentists said that the ocular complications are not serious in nature, but the vast majority (70%) of the dentists were not aware of the severity of the ocular complications in India[14]. The level of perception about the severity of ocular complications was high in our study compared to the published literature (82% vs 20%). The belief that ocular complications are very rare and only last for a shorter period of time could be the reason for a lower severity among the dental professionals. Several studies around the world have reported serious ocular complications due to dental infections[11,12,15-17]. Odontogenic causes of orbital inflammation are rare. In a study by Gans et al., (1974), only two percent of 190 patients with orbital inflammation had an odontogenic cause. The predisposing factor for orbital cellulitis was acute sinusitis, confirmed by many authors[18]. Therefore, dentists should understand the severity of the ocular complications due to the dental infections and strive to prevent complications by addressing the dental infection at an early stage.

Although ocular complications are transient and rare, there are few published clinical cases showing permanent vision loss and blindness in patients with odontogenic orbital cellulitis leading to blindness and orbital cellulitis followed by orthodontic extraction[6].Root apices are anatomically proximal to adjacent muscles, connective tissue and sinuses. The most common route of spread is through the maxillary sinus to the inferior orbit via the inferior orbital fissure or an orbital floor defect[15-17]. Less common routes include spread through the pterygopalatine regions,[19,20] infection ascending from the canine fossa to the orbit,[16] or retrograde spread through the ophthalmic vein[21].

In our study, over 50% of respondents reported that vision loss was the main complication, followed by visual field defects (27%), orbital cellulitis (16%) and ophthalmia (5%), while a study of undergraduate and postgraduate

students reported that about 60% have been found that odontogenic orbital cellulitis (OCC) is often seen as an ocular complication due to a dental infection. OOC is a rare complication of dental infection, but a serious infection with a high risk of vision loss. This infection may require intensive monitoring, serial imaging, multidisciplinary care, and surgical intervention[22,23].

In our study, over 50% of respondents reported that they will immediately consult ophthalmologist in the pretext of preventing ocular complications which is a good indicator for improving and expanding prevention services to the community. Therefore, dentistry students have demonstrated adequate preventive monitoring and treatment of ocular complication due to dental infections as well as a satisfactory level of knowledge.

The dental curriculum lacks the strategies such as the severity of ocular complications due to dental infections, its prevention and its importance for the timely treatment of these ocular complications. To identify and manage initial ocular complications, there is a need for proper guidelines in dental curriculum, general education for dental professionals, special education through continuing dental education, workshops, and symposiums to provide appropriate initial care for ocular complications due to dental infections in the clinics.

Conclusion:-

Although there are no guidelines in the dental curriculum for the prevention and management of ocular complications due to dental infections, research on ocular complications due to dental infection is very scarce. Ophthalmology and dentistry must work together to understand the need for eye-care. Dentists should be educated about the eye complications and the importance of proper care and treatment methods. The initial management of ocular complications should be a part of the university dental curriculum. The incorporation of appropriate guidelines for the prevention and primary management of ocular complications due to dental infections is therefore considered a necessity in the dental curriculum. Also, more information should be made available to dentists through research, continuing dental education, workshops and symposia. There is also a need for future research to examine the perception, perspective and practice of dentists towards ocular complications secondary to dental infection in the Kingdom of Saudi Arabia to gain the better knowledge in this area of interest.

Limitations:

The main limitation of this study was the small sample size (participants) at each academic level. Other factors like recall accuracy, personal biases, etc may also have influenced the results of our study in some way.

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Conflicts of interest:

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