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Knowledge and attitude of dentists towards ocular complications of intra-oral local anaesthesia: A survey-based study in Riyadh

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ABSTRACT

Introduction: Local and systemic problems connected to local anaesthetic might occur despite appropriate patient evaluation, correct tissue preparation, and a meticulous administration process. *Materials and methods:* A survey questionnaire was used to perform cross-sectional research among dental surgeons in Riyadh, Saudi Arabia. In this study, 673 dentists in Riyadh were approached using social networking sites. *Results:* Findings revealed that 30 percent felt there were no ocular consequences from intraoral local anaesthetic, 31.9 percent had experienced ocular issues during clinical practice, and 40.1 percent had called an ophthalmologist in the event of a difficulty. *Conclusion:* Dental practitioners' general experience and awareness on the association with ocular problems related to local anaesthetic are on the low side.

Keywords: local anaesthesia, complications, ocular, knowledge.

1. INTRODUCTION

A decrease in the nerve ending stimulation or a pause in the conduction process in the peripheral nerves causes local anaesthesia, which is referred to as a loss of feeling in a specific region within the anatomy. Local anaesthetic medicines are often utilised for oral and maxillofacial surgical interventions. Rigorous client assessment, tissue preparation, and a precise treatment strategy, local and systemic complications associated with local anaesthetics may arise (Pragasm & Managutti, 2011; Mohapatra et al., 2019). Although thousands of cartridges are distributed each year around the world, difficulties are rather uncommon. When providing local anaesthetic, however, the inadequate anaesthetic can result from a lack of understanding of the local anatomy, leading to artery injury, intravascular, intra-glandular, or intramuscular injection, and nerve trauma. The ipsilateral middle ear and

ipsilateral ocular abnormalities were additionally being reported as distant manifestations. Both maxillary and mandibular anaesthesia can result in unexpected ophthalmic symptoms. Diplopia, fuzzy vision, amaurosis, mydriasis, ptosis and miosis, aberrant pupillary light reaction, retro-bulbar discomfort, nystagmus, and enophthalmos have all been described as signs of Horner syndrome (Steenen et al., 2012; Boynes et al., 2010; Kini et al., 2012).

A study in India assessed dentists' knowledge and attitudes about ocular complications, finding that dentists' understanding of ocular problems caused by the intra-oral anaesthetic is poor and needs to be improved. Despite appropriate awareness and application of preventive measures, specific instructions for dental practitioners in recognising as well as clinically addressing ocular consequences of intra-oral anaesthetic are needed (Patil et al., 2015). Another Iranian investigation found that dentists' awareness of ocular problems caused by anaesthesia is insufficient. Self-experience in clinical practice was cited as the primary source of knowledge by those dentists who were aware of the problem. Simultaneously, just 2.0 per cent said they learned about ocular issues from studies that were published (Kakooei et al., 2019).

According to Saudi studies of dental students and general practitioners, there was a significant lack of awareness among undergraduate students and dental interns. Specialists, on the other hand, as well as a significant percentage of general practitioners, demonstrated superior expertise. The findings revealed that the more clinic experience a dentist has, the better he or she understands local anaesthetic difficulties (Aburas et al., 2016). In most cases, ophthalmologic problems associated with intraoral local anaesthetic have a brief onset and diminish away as the anaesthesia wears off. The common most reason of these symptoms is anaesthetic solution spreading to the orbit or adjacent structures (Von Arx et al., 2014).

Need of the study

Dentists must be familiar with the ocular issues that can arise from intra-oral local anaesthetic and how to deal with them. Patients' safety will be ensured if they are aware.

Aims of the study

To evaluate dental practitioners' knowledge and attitudes towards intra-oral local anaesthetic ocular problems

To investigate the relationship between dental practitioners' knowledge and attitude and their job experience and qualifications

2. MATERIALS AND METHODS

Study Design

An online survey was used to conduct a cross-sectional study among dental surgeons in Riyadh, Saudi Arabia.

Study Sample

673 dentists from Riyadh were used in this study and were contacted using social media.

Study Duration

This study was completed in two months and twenty-three days (From February 10th 2021 to May 3rd 2021).

Study Instrument

The online questionnaire included questions about personal, professional, and demographic information, as well as knowledge and attitudes towards ocular problems caused by local anaesthetic.

Instrument Validity and Reliability

The survey was sent out to 20 people as part of pilot research. Using Cronbach's coefficient alpha, the data was entered into SPSS version 22 to test the reliability (value: 0.712). The questionnaire's validity was checked by sending it to REU's experienced researchers, although no modifications were needed.

Statistical Analysis

SPSS version 22 was used to analyse the data, which comprised descriptive and inferential statistics. With a significance threshold of less than 0.05, the Chi-square test was performed to draw comparisons between groups.

Ethical Approval

This study received an ethical approval from the Research Center of Riyadh Elm University with the # FRP/2021/326/392/377

3. RESULTS

A total of 673 Riyadh based participants filled the survey, which included 61.4% males and 38.6% females, 82.6% Saudis and 17.4% Non-Saudis, 84.8% general dentists and 15.2% specialists, 91.9% were from the central region, 71.8% with 1-3 years of experience, 17.4% from 3-6 years, and 10.8% with 6 or more years (Table 1). Table 2 shows the participants' overall responses with their frequencies, which revealed that 30% believed there are no ophthalmic problems because of intraoral local anaesthesia, 31.9% had encountered ocular complications during their clinical practice, and 40.1% reported having contacted the ophthalmologist following any complications. 45.2% believed that infraorbital, 32.1% believed all of the above nerve blocks could cause complications, 44.6% reported that local complications and 4.9% reported systemic complications could occur due to intraoral local anaesthesia, while 34.4% reported both. Regarding the attitudes, 58.4% revealed they would stop the intended dental procedure if any complications were encountered, and 95.4% reported needing more information about ocular complications.

Table 1 Demographics of the study participants

Demographic Variables	Responses Frequencies (%)
Gender	Males: 413 (61.4%) Females: 260 (38.6%)
Nationality	Saudi: 555 (82.6%) Non-Saudi: 117 (17.4%)
Region	Eastern Region: 2.7 (3.1%) Western Region: 20 (3.4%) Middle Region: 533 (91.9%) Northern Region: 7 (1.2%) Southern Region: 2(0.3%)
Qualification	General dentist: 571 (84.8%) Specialist/Consultant: 102 (15.2%)
Work experience	1-3 years: 483 (71.8%) 3-6 years: 117 (17.4%) 6+ years: 73 (10.8%)

Table 2 Survey questions related to knowledge, experience, and attitude with their responses.

Survey Questions	Responses (%)
Knowledge & Experience Questions	
Do you know that ophthalmic problems occur due to intraoral local anaesthesia?	Yes: 56.9% No: 30% Do not know: 13.1%
If yes, source of information?	Personal experience: 23.9% Colleagues: 25.5% Textbooks: 42.1% Journals: 8.5%
Did you encounter any ophthalmic problems during or after the administration of intraoral local anaesthesia?	Yes: 31.9% No: 68.1%

If yes, what were the symptoms did you notice in a patient?	The blurring of vision: 43.1% Double vision: 8.7% Squinting: 3.7% Transient dizziness: 9.1% Loss of vision: 7.4% Difficulty in reading: 3.2% Drooping of the upper eyelid: 17.4% Decreased sensation on the lateral aspect of the upper and lower eyelid: 7.4%
How long the symptoms lasted?	Few seconds: 9.1% Few minutes: 9.7% Few hours: 18% Few days: 4.3% Do not know: 58.9%
Did you consult an ophthalmologist for ophthalmic problems?	Yes: 40.1% No: 59.9%
Do you know that sometimes ophthalmic problems due to intraoral local anesthesia cause permanent blindness?	Yes: 46.2% No: 53.8%
Do you think that ocular problems resulting from intraoral local anesthesia have been stated in the research?	Underreported: 81.6% Adequately reported: 16.5% Over reported: 1.9%
Which intraoral nerve block can cause maximum ophthalmic problems?	PSA: 9% Infraorbital: 45.2% Inferior alveolar: 8.8% All of the above: 32.1% None of the above: 4.9%
Do you know what type of ophthalmic difficulties due to intraoral local anaesthesia may occur?	Local complications: 44.6% Systemic complications: 4.9% Both: 34.4% Do not Know: 16.1%
Attitude Questions	
If you encounter ophthalmic problems during or after the administration of intraoral local anaesthesia, what would be your immediate reaction?	Reassurance to the patient and stop the intended dental procedure: 58.4% Call medical emergency: 21% Call ophthalmologist: 11.7% Shift patient to hospital care: 6.8% Ignore and proceed with the intended dental procedure: 2.1%
Prevention of ophthalmic problems due to intraoral local anaesthesia is by?	Knowing accurate anatomy of the nerve block area: 14.4% Aspirate before the injection and avoid injecting into blood vessels: 6.4% Follow accepted injection techniques and procedures: 5.5% All of the above: 72.4% None of the above: 1.3%

When do you consult an ophthalmologist if you encountered ophthalmic problems during or after administration of intraoral local anaesthesia?	Immediately: 38.5% After completing the intended dental procedure: 6.8% After 24h: 10.7% If signs and symptoms of ocular complications persist for more than 4h: 42.2% I will never consult an ophthalmologist: 1.8%
Do you think a dentist should be severe about ophthalmic problems due to intraoral local anaesthesia?	Yes, because if neglected sometimes it may cause irreversible damage: 80.5% No, because most of the ocular complications are transient: 6.5% Do not know: 13%
Do you think more research and review should be carried out on ophthalmic problems due to intraoral local anaesthesia?	Yes: 96% No: 4%
Do you think more information should be published in the journals/books about ophthalmic problems due to intraoral local anaesthesia?	Yes: 95.4% No: 4.6%
Do you want to prevent ophthalmic problems due to intraoral local anaesthesia?	Yes: 98.1% No: 1.9%

Figure 1 shows the source of information among the participants and majority (42.1%) chose text books. Figure 2 discloses that 45.2% thought infraorbital nerve block can cause maximum ocular complications. Figure 3 reveals that 18% of the participants reported their patients' symptoms lasted for few hours. Figure 4 reports that 81.6% participants' believed ocular complications due to intraoral local anesthesia have been underreported in the literature. Figure 5 show that 44.6% respondents reported local complications as a result of intraoral local anesthesia. Figure 6 reveals that 96% of the participants were in the favor of more research and review to be carried out on ocular complications due to intraoral local anesthesia. Finally, figure 7 reports that 98.1% participants wanted to prevent ocular complications due to intraoral local anesthesia.

Tables 3 and 4 have described the comparisons of survey responses based on the qualification and work experience of the study participants. A Chi-square test was done to retrieve the p-value. Any difference showing a value less than 0.05 was considered statistically significant, which is the case with the majority of the survey questions.

Table 3 Comparison of survey responses based on qualification

Survey Questions	General Dentists	Specialists/Consultants	p-value
Knowledge & Experience Questions			
Do you know that ophthalmic problems occur due to intraoral local anaesthesia?	Yes: 60% No: 30% Do not know: 10%	Yes: 71% No: 13% Do not know: 16%	.001
If yes, source of information?	Personal experience: 20% Colleagues: 31% Textbooks: 42% Journals: 7%	Personal experience: 37% Colleagues: 11% Textbooks: 32% Journals: 20%	.000
Did you encounter any ophthalmic problems during or after the administration of intraoral local anaesthesia?	Yes: 31% No: 69%	Yes: 52% No: 48%	.001

If yes, what were the symptoms did you notice in a patient?	No Statistically Significant Association		.094
How long the symptoms lasted?	Few seconds: 9% Few minutes: 9% Few hours: 16% Few days: 4% Do not know: 62%	Few seconds: 4% Few minutes: 16% Few hours: 37% Few days: 4% Do not know: 39%	.000
Did you consult an ophthalmologist for ophthalmic problems?		No Statistically Significant Association	.390
Do you know that sometimes ophthalmic problem due to intraoral local anaesthesia causes permanent blindness?		No Statistically Significant Association	.090
Do you think that ophthalmic problems due to intraoral local anaesthesia have been reported in the literature?		No Statistically Significant Association	.384
Which intraoral nerve block can cause maximum ocular complications?		No Statistically Significant Association	.510
Do you know what type of ophthalmic problems due to intraoral local anaesthesia may occur?		No Statistically Significant Association	.393
Attitude Questions			
If you encounter ophthalmic problems during or after the administration of intraoral local anaesthesia, what would be your immediate reaction?	Reassurance to the patient and stop the intended dental procedure: 64% Call medical emergency: 20% Call ophthalmologist: 9% Shift patient to hospital care: 6% Ignore and proceed with the intended dental procedure: 1%	Reassurance to the patient and stop the intended dental procedure: 55% Call medical emergency: 12% Call ophthalmologist: 21% Shift patient to hospital care: 9% Ignore and proceed with intended dental procedure:3%	.030
Prevention of ophthalmic problems due to intraoral local anaesthesia is by?		No Statistically Significant Association	.589
When do you consult an ophthalmologist if you encountered ophthalmic problems during or after administration of intraoral local anaesthesia?		No Statistically Significant Association	.254
Do you think a dentist should be severe about ophthalmic problems due to intraoral local anaesthesia?		No Statistically Significant Association	.359
Do you think more research and review should be carried out on ophthalmic problems due to intraoral local anaesthesia?		No Statistically Significant Association	.550

Do you think more information should be published in the journals/books about ophthalmic problems due to intraoral local anaesthesia?	No Statistically Significant Association	.877
Do you want to prevent ophthalmic problems due to intraoral local anaesthesia?	No Statistically Significant Association	.124

Table 4 Comparison of survey responses based on work experience

Survey Questions	1-3 years	3-6 years	6+ years	p-value
Knowledge & Experience Questions				
Do you know that ophthalmic problems occur due to intraoral local anaesthesia?	Yes: 52% No: 38% Do not know: 10%	Yes: 77% No: 15% Do not know: 8%	Yes: 62% No: 23% Do not know: 15%	.000
If yes, source of information?	Personal experience: 14% Colleagues: 35% Textbooks: 45% Journals: 6%	Personal experience: 46% Colleagues: 18% Textbooks: 29% Journals: 7%	Personal experience: 32% Colleagues: 3% Textbooks: 34% Journals: 31%	.000
Did you encounter any ophthalmic problems during or after the administration of intraoral local anaesthesia?	Yes: 25% No: 75%	Yes: 61% No: 39%	Yes: 46% No: 54%	.000
If yes, what were the symptoms did you notice in a patient?	No Statistically Significant Association			.067
How long the symptoms lasted?	Few seconds: 7% Few minutes: 7% Few hours: 14% Few days: 3% Do not know: 69%	Few seconds: 13% Few minutes: 16% Few hours: 33% Few days: 3% Do not know: 35%	Few seconds: 8% Few minutes: 21% Few hours: 29% Few days: 10% Do not know: 32%	.000
Did you consult an ophthalmologist for ocular complications?	Yes: 39% No: 61%	Yes: 53% No: 47%	Yes: 44% No: 56%	.043
Do you know that sometimes ophthalmic problem due to intraoral local anaesthesia causes permanent blindness?	Yes: 44% No: 56%	Yes: 60% No: 40%	Yes: 58% No: 42%	.009
Do you think that ophthalmic problems due to intraoral local anesthesia have been reported in the literature?	No Statistically Significant Association			.234

Which intraoral nerve block can cause maximum ocular complications?	PSA: 5% Infraorbital: 50% Inferior alveolar: 6% All of the above: 35% None of the above: 4%	PSA: 22% Infraorbital: 35% Inferior alveolar: 10% All of the above: 32% None of the above: 1%	PSA: 8% Infraorbital: 54% Inferior alveolar: 8% All of the above: 23% None of the above: 7%	.000
Do you know what type of ophthalmic problems due to intraoral local anesthesia may occur?		No Statistically Significant Association		.277
Attitude Questions				
If you encounter ophthalmic problems during or after the administration of local anesthesia, what would be your immediate reaction?	Reassurance to the patient and stop the intended dental procedure: 67% Call medical emergency: 18% Call ophthalmologist: 9% Shift patient to hospital care: 5% Ignore and proceed with the intended dental procedure: 1%	Reassurance to the patient and stop the intended dental procedure: 57% Call medical emergency: 26% Call ophthalmologist: 14% Shift patient to hospital care: 3% Ignore and proceed with the intended dental procedure: 0%	Reassurance to the patient and stop the intended dental procedure: 48% Call medical emergency: 10% Call ophthalmologist: 19% Shift patient to hospital care: 17% Ignore and proceed with the intended dental procedure: 6%	.000
Prevention of ophthalmic problems due to local anesthesia is by?	Knowing accurate anatomy of the nerve block area: 10% Aspirate before the injection and avoid injecting into blood vessels: 4% Follow accepted injection techniques and procedures: 4% All of the above: 80% None of the above: 2%	Knowing accurate anatomy of the nerve block area: 19% Aspirate before the injection and avoid injecting into blood vessels: 14% Follow accepted injection techniques and procedures: 8% All of the above: 58% None of the above: 1%	Knowing accurate anatomy of the nerve block area: 17% Aspirate before the injection and avoid injecting into blood vessels: 4% Follow accepted injection techniques and procedures: 12% All of the above: 65% None of the above: 2%	.001
When do you consult an ophthalmologist if you encountered ophthalmic problems during or after administration of local anesthesia?	Immediately: 36% After completing intended dental procedure: 6% After 24h: 9% If signs and symptoms of ophthalmic problems persist for more than 4h: 49% I will never consult an ophthalmologist: 0%	Immediately: 43% After completing intended dental procedure: 9% after 24h: 14% If signs and symptoms of ophthalmic problems persist for more than 4h: 33% I will never consult an ophthalmologist: 1%	Immediately: 23% After completing intended dental procedure: 10% After 24h: 25% If signs and symptoms of ophthalmic problems persist for more than 4h: 37% I will never consult an ophthalmologist: 5%	.000

Do you think a dentist should be severe about ophthalmic problems due to local anesthesia?	Yes, because if neglected sometimes it may cause irreversible damage: 88% No, because most of the ocular complications are transient: 3% Do not know: 9%	Yes, because if neglected sometimes it may cause irreversible damage: 82% No, because most of the ocular complications are transient: 7% Do not know: 11%	Yes, because if neglected sometimes it may cause irreversible damage: 63% No, because most of the ocular complications are transient: 21% Do not know: 16%	.000
Do you think more research and review should be carried out on ophthalmic problems due to local anesthesia?		No Statistically Significant Association		.134
Do you think more information should be published in the journals/books about ophthalmic problems due to local anesthesia?	Yes: 97% No: 3%	Yes: 99% No: 1%	Yes: 90% No: 10%	.423
Do you want to prevent ophthalmic problems due to intraoral local anesthesia?		No Statistically Significant Association		.675

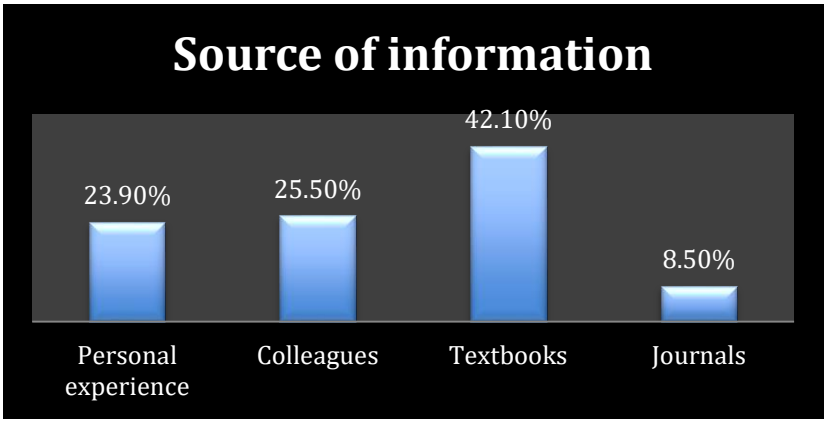

Figure 1 Source of information as mentioned by participants

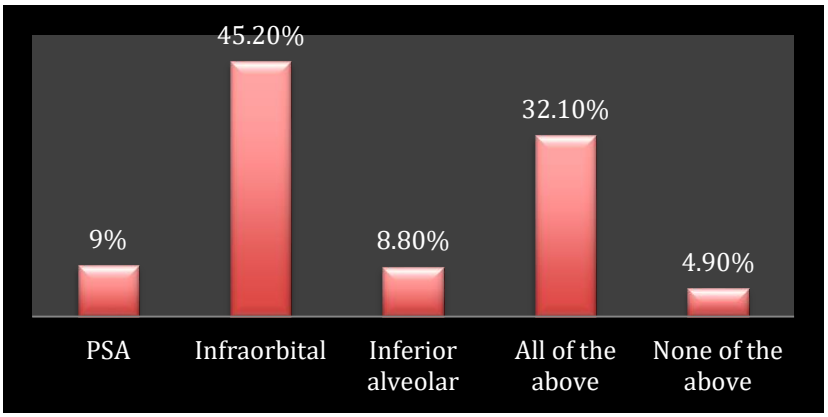

Figure 2 Which intraoral nerve block can cause maximum ophthalmic problems?

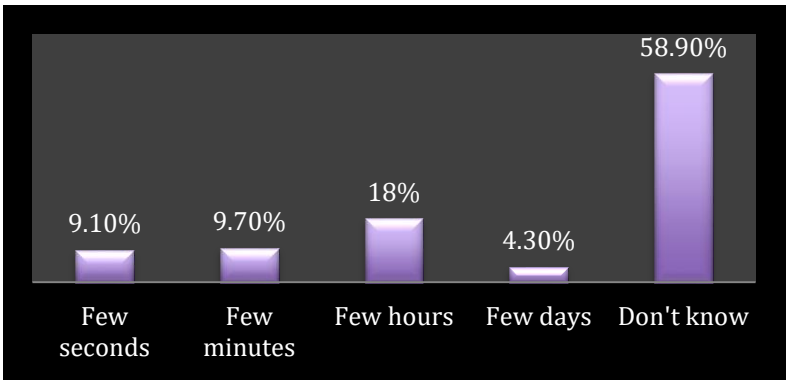

Figure 3 Participants' response on how long the symptoms lasted?

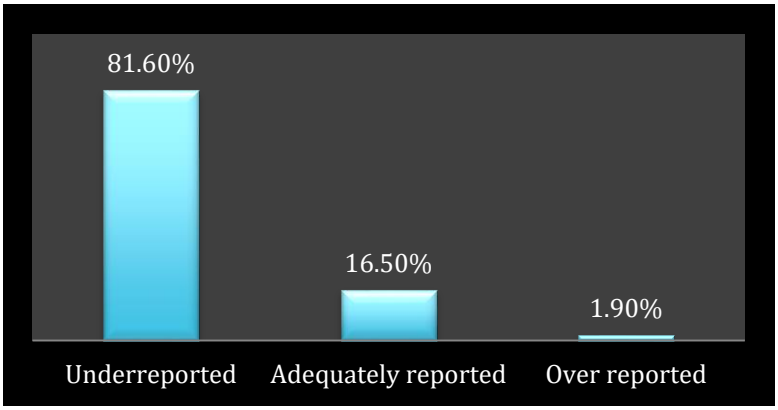

Figure 4 Participants' response on ophthalmic problems because of local anesthesia has been stated in previous research?

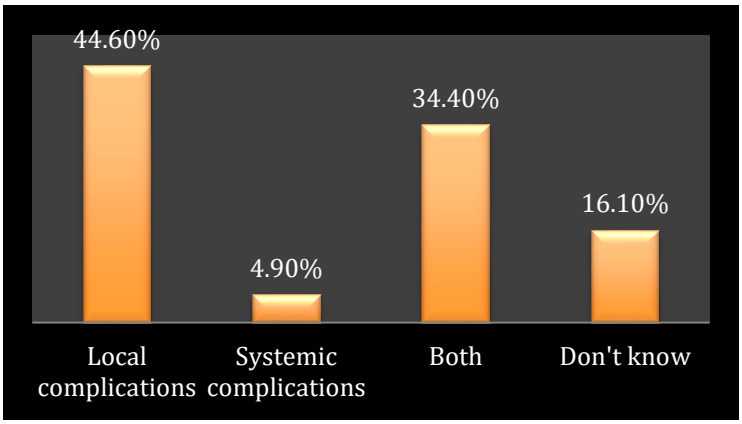

Figure 5 Participants' response on what type of ophthalmic problems because of local anesthesia may occur?

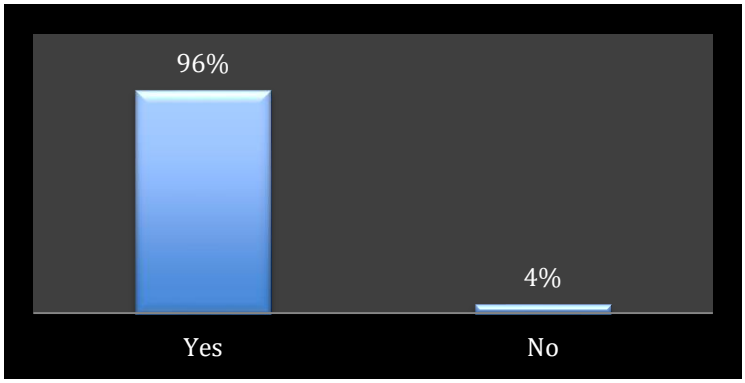

Figure 6 Participants' response on if more research and review should be carried out on ophthalmic problems because of intraoral local anesthesia?

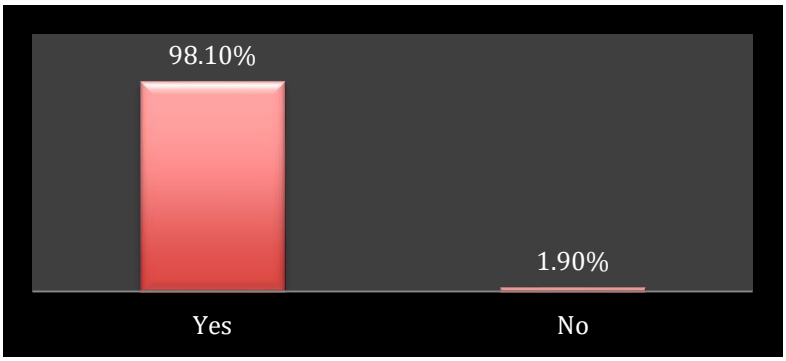

Figure 7 Participants' response on if they want to prevent ophthalmic problems because of local anesthesia?

4. DISCUSSION

The goal of the research was to find out what dental practitioners in Riyadh knew, had experienced, and thought about the ocular problems related to intraoral local anaesthetic. Limited studies have been conducted regarding this topic, which was observed during the comprehensive literature search in various databases. According to a study conducted in India, approximately 39 percent of graduates and 14% of postgraduate dentists were aware of ocular problems. Both groups used journals as their primary source of information. 8.3 per cent of graduates and 17.6 per cent of postgraduate dentists reported having ocular issues (Patil et al., 2015).

Surprisingly, the majority of graduates and postgraduates said ocular problems in the literature are under-reported. More studies on ocular problems should be conducted, according to 90.5 per cent of graduates and 84.3 per cent of postgraduates. The prevention of ocular problems was favoured by 98.3 per cent of postgraduates and 97.3 per cent of graduates. When comparing these findings with our study, it was observed that 60% of general practitioners and 71% of specialists knew about the ophthalmic problems due to intraoral local anaesthesia, which is higher than the study mentioned earlier. 31% of general dentists and 52% of specialists had encountered an ophthalmic problem before, which is higher than the earlier study. Similarly, 96% of participants reported that further investigation should be conducted on this topic, which is higher than the compared study (Patil et al., 2015).

When assembling the results of our study, we discovered that blurring of vision was reported by 43.1 per cent of the participants as the most prevalent symptom encountered by these dental practitioners. At the same time, complete loss of vision was only experienced by 7.4 % of the participants, which shows its low incidence. The majority of the issue was a double vision, according to Alamanos et al., (2016). Permanent functional impairment was 8 per cent. Complete permanent blindness was not reported (Alamanos et al., 2016).

According to an Iranian study, 7.6percent of the total participants were unaware of ophthalmic problems following local anaesthetic injections, and 10.7% said no eye problems had occurred following dental anaesthesia. Those who were aware of the issue cited self-experience in clinical practice as the primary source of their knowledge. In contrast, only 2.0 per cent said they learned about the ophthalmic problems from the research that was published. Furthermore, regular dentists had a greater lack of knowledge than specialists. Specialists had personally some information. When comparing these data to our findings, it was discovered that 13.1% of respondents had no notion if local anaesthetic was linked to ocular problems, which is higher than the study mentioned above. 68.1% of our participants never experienced any ocular complication, which is very high compared to the Iranian study. For those who had some information, text books were the most common source, which is not the case with the compared study (Kakooei et al., 2019).

Amongst the most often asked issues by patients undergoing extraction, particularly in rural areas, is if the treatment may cause problems with their eyes. Ophthalmic problems following regular maxillary molar extractions, on the other hand, are nearly unheard of. They can be quite unsettling for both the patient and the surgeon when they occur. Individuals are susceptible to panic, making it difficult for the clinician to appraise the circumstance. This makes it very important for dental practitioners to focus on this rare but highly crucial issue (Ghosh et al., 2015).

Limitations of this research include the reality that questionnaire-based studies are occasionally related to participants being uneasy in delivering answers that present themselves in an undesired manner. Furthermore, due to a loss of recall or disinterest, study participants might not have been completely conscious of their motivations for any specific reaction or feedback.

5. CONCLUSIONS

The overall experience and knowledge of dental practitioners regarding the link between local anaesthesia and ocular complications are on the low side. However, their attitude seems to be promising. Knowledge seemed to be higher among specialists as compared to general practitioners. Knowledge and experience were significantly lower among low experienced practitioners.

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Author Contributions

Hussain S, Assaf A: Study concept and design and analysis/interpretation. Bader M, Khalid B, Firas N: Collecting the data, Wrote the manuscript, critically revised it. Shahzeb H: Gave final approval to the article.

Ethics statement

This study fulfilled all the ethical requirements including data collection and confidentiality of study participants.

Funding

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Conflict of interests

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

REFERENCES AND NOTES

1. Aburas H, Al-Ali N, Al-Omair T, Al-asmari A, Al-jrais M, Al-rizqi M. Awareness and knowledge of neurological complications while administering local anesthesia among the dental professionals of Riyadh. Pediatr Dent Care 2016; 1(128):2.
2. Alamanos C, Raab P, Gamulescu A, Behr M. Ophthalmologic complications after administration of local anesthesia in dentistry: a systematic review. Or Surg Or Med Or Pa 2016; 121(3):e39-50.
3. Boynes SG, Echeverria Z, Abdulwahab M. Ocular complications associated with local anesthesia administration in dentistry. Dent Clin 2010; 54(4):677-86.
4. Ghosh A, Vaibhav N, Raut R, Venkatesh A. Ophthalmic complication following posterior superior alveolar nerve block for tooth extraction! a rare occurrence. J Maxillofac Surg 2015; 14(3):862-5.
5. Kakooei S, Kakoei S, Parirokh M, Nekouei AH, Mostafavi M. The knowledge of the dentists in dental clinics in Kerman City, Iran, about ocular complications after local anesthesia. J Oral Health Oral Epidemiol 2019; 8(3):117-23.
6. Kini YK, Kharkar VR, Kini AY. Transient diplopia with ipsilateral abducent nerve palsy and ptosis following a maxillary local anesthetic injection. J Maxillofac Surg 2012; 16(4):373-5.
7. Mohapatra U, Mohanty S, Acharya S, Singh B. Modifications of Local Anesthesia in Medically Compromised Patients: A Review. J Public Health Res Dev 2019; 10(11).
8. Patil K, Kumar V, Munoli K. Knowledge and attitude of dental surgeons in India toward ocular complications of intra-oral local anesthesia. J Nat Sci Biol Med 2015; 6(2):286.
9. Pragasm M, Managutti A. Diplopia with local anesthesia. Natl J Maxillofac Surg 2011; 2(1):82.
10. Steenen SA, Dubois L, Saeed P, de Lange J. Ophthalmologic complications after intraoral local anesthesia: case report and review of literature. Or Surg Or Med Or Pa 2012; 113(6):e1-5.
11. Von Arx T, Lozanoff S, Zinkernagel M. Ophthalmologic complications after intraoral local anesthesia. Swiss Dent J 2014; 124(7-8):784-806.