Enhanced Magnification in Restorative Dentistry: Opinions of a Population of Nigerian Restorative Dentists

***Joan Emien ENABULELE, **Ayamma Udo UMANAH**

*[*Department of Restorative Dentistry, University of Benin, Benin City, Edo State, Nigeria; **Department of Conservative Dentistry & Prosthodontics, University of Port-Harcourt, Rivers State, Nigeria.]*

Correspondence

Dr Ayamma U. Umanah

Department of Conservative Dentistry & Prosthodontics, University of Port-Harcourt, Rivers State, Nigeria.

Email: ayamma.umanah@uniport.edu.ng

ABSTRACT

Background: The practice of restorative dentistry requires good perceptual and visual skills. Magnification aids excellent visualisation that the naked eye cannot provide. Various magnification devices abound and proper utilization will only occur based on adequate knowledge of available devices, their uses and availability. The restorative dentists would have their practice elevated by using various magnification devices.

Objective: To assess the awareness and attitudes of members of the Nigerian Society of Restorative Dentistry (NISORD) regarding dental magnification.

Methods: An e-questionnaire was developed and distributed to 118 NISORD members. The questionnaire consisted of, five sections that covered awareness, attitudes, and barriers to using dental magnification. Data were analyzed using IBM SPSS version 26, with descriptive statistics, counts, frequencies, and cross-tabulations.

Results: The response rate was 69.5% (n=82) and among the respondents, 42.7% were consultants, 28.0% were senior residents, and 61% specialized in conservative dentistry. Nearly all respondents (98.8%) were aware of magnification in restorative dentistry. The majority (75%) knew about various magnification devices, with dental loupes being the most recognized (96.3%). Uses of magnification for dentinal crack detection and endodontic surgery were equally acknowledged (95.1%). Of the 59.4% who used magnification, dental loupes were the most commonly used device (95.5%). Most respondents (65.5%) supported making magnification use a standard practice while 34.5% opposed mandatory enforcement. The primary barrier to routine use was the high cost of magnification devices (75.6%).

Conclusion: The study revealed high awareness and positive attitudes toward dental magnification among NISORD members and this is largely attributed to their postgraduate training. Most respondents agreed that magnification should be a standard in restorative dentistry but not mandatory. Dental loupes were the most recognized and utilized among the types of dental magnification while the high cost remains a significant barrier to routine use of dental magnification

Keywords: Restorative Dentistry, Magnification, Loupes, Awareness, Attitudes

Joan E. Enabulele
https://orcid.org/0000-0002-3799-9634
Ayamma U. Umanah
https://orcid.org/0000-0002-8667-1547

Received: 1-July, 2024
Revision: 15 Aug, 2024
Accepted: 16 Aug, 2024

Citation: **Enabulele JE, Umanah AU. Enhanced magnification in Restorative Dentistry: Opinions of a population of Nigerian Restorative Dentists *Nig J Dent Res 2024; 9(2):86-93.* https://dx.doi.org/10.4314/njdr.v9i2.6**

INTRODUCTION

The practice of restorative dentistry requires good perceptual and visual skills. Naked eye dentistry is believed not to provide the excellent visualisation that the use of magnification devices provides. [1] Due to the restricted operating field, it is difficult to obtain a direct vision, [2] hence numerous strategies have been adopted to improve visualisation and treatment outcomes. [3-5] The use of magnification devices has been proven to be important in restorative and endodontic treatment procedures, [6,7] by dentists of any age.[8] In endodontics, the treatment quality has been found to improve with the usage of magnifying devices,[8] as opposed to devastating effects such as missed canals that may result from poor visualisation. [9]

Magnification device use is associated with a clearer and larger view of the operating field,[10] thereby providing a more accurate diagnosis, better visualisation and more favourable prognosis[2]. Furthermore, their use has been reported to cause a reduction in procedure time [2] as well as have a positive effect on psychomotor skills.[11] Increased magnification tends to bring the operating field closer to the dentist with avoidance of inclination of the body and neck or misaligned spinal positions, [2] allowing for comfortable and ergonomic posture.[12]

The magnification devices include an endoscope,[2] loupes and an operating microscope.[2,13,14] Magnification in dentistry was first introduced in the late 1970s while the dental operating microscope was introduced to endodontics in the late 1980s.[15] Over the last few years, the use of the dental operating microscope in dentistry has been reported to have doubled.[16] An increasing number of practitioners are opting for magnification systems in their practices to enhance vision for both clinical and laboratory procedures. Many dental schools are also making the use of these systems mandatory in their teaching curricula because of the improved visual acuity resulting from coaxial lighting, unobstructed vision, illumination, smaller instruments, minimal trauma, and ergonomic benefits.[14]

The widespread use of microscopes in endodontics is attributed to their good illumination and higher magnification power compared to loupes.[17] However, there still exists a fair amount of resistance among restorative dentists about the value of magnification and its incorporation into their dental practice.[1] The value of enhanced magnification has been well established and should be accepted.[1] However, this is not the case in Nigeria, hence this study sought to determine the opinion of restorative dentists in Nigeria with regards to the use of magnification in restorative dentistry, barriers to its use and ways to improve its use.

MATERIALS AND METHOD

This was a questionnaire-based cross-sectional study of registered members of the Nigerian Society of Restorative Dentistry. The link to the electronic questionnaire was sent to members with a note intimating them about the study and only those who gave informed consent participated in the study. Receipt of responses was allowed for 10 weeks with two-weekly reminders sent to members to respond to the questionnaire.

The questionnaire was developed by the authors from the review of literature on the subject matter [1,5,9,14,15,21]. The developed questionnaire was pre-tested on residents who are not restorative dentists but were undergoing posting in restorative dentistry as part of their residency training. This pre-test was to test for face validity of the questionnaire as well as enable the researchers to determine if the questionnaire will be able to gather the desired data and also measure what it is supposed to measure.

The questionnaire consisted of five sections. The first section elicited the sociodemographic characteristics of the participants. The second section consisted of five questions that sought to determine the level of awareness regarding use of magnification devices among the participants. The third section evaluated the knowledge of possible benefits of magnification in restorative dentistry among the participants. The fourth section assessed the use of magnification devices among the participants while the fifth section evaluated barriers to the use of magnification devices.

All data garnered was sorted, coded and analyzed using the IBM SPSS version 26.0. Data analysis was done using descriptive statistics in the form of counts, frequency and cross-tabulation. P was set at <0.05 and results are presented as tables and figures.

RESULTS

A total of 118 restorative dentists were sent links to the study questionnaire and 82 responses were received at the end of 10 weeks. The respondents were made up of 61.0% males and 39.0% females with the majority (86.6%) married. Consultants made up 42.7% of the respondents while 28.0% were senior residents. A higher proportion (42.7%) had practiced for >10 years and 61.0% of the respondents were in the subspecialty of conservative dentistry (Table 1).

Table 1: Sociodemographic characteristics of the respondents

Characteristics	Frequency	Percent
Age group (years)		
21-30	2	2.4
31-40	38	46.3
41-50	25	30.5
>50	17	20.7
Gender		
Male	50	61.0
Female	32	39.0
Marital status		
Single	9	11.0
Married	71	86.6
Divorced	2	2.4
Status		
Consultant	35	42.7
Senior Resident	23	28.0
Junior Resident	24	29.3
Specialty		
Prosthodontics	17	20.7
Endodontics	15	18.3
Conservative/Operative Dentistry	50	61.0
Length of practice (years)	16	19.5
<5	31	37.8
5-10	35	42.7
>10		
Total	82	100.0

Almost all (98.8%) of the respondents were aware that magnification can be used in restorative dentistry. Various sources of awareness were reported by the respondents with the most prevalent source being postgraduate training (81.75%), followed by undergraduate training (67.1%) and journals (65.9%). The least reported sources of awareness were social media (18.3%) and colleagues (39.0%) (Figure 1).

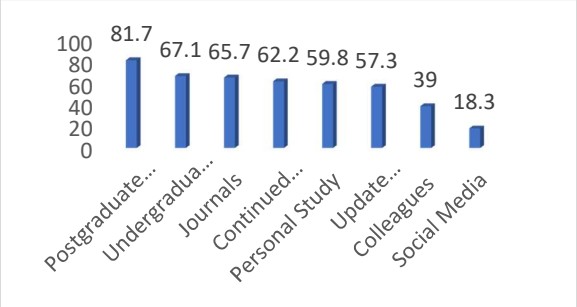

Figure 1: Sources of awareness regarding magnification in restorative dentistry

The majority (75.1%) of the respondents were aware of the different types of magnification systems that can be used in Restorative Dentistry while 64.6% claimed to be aware of the range of magnification in each system.

The most common magnification device that can be used in restorative dentistry as reported by the respondents was dental loupes (96.3%) followed by operating microscope (85.4%) and the least reported devices were endoscopes and handheld lenses reported by 56.1% and 51.2% respectively.

Various uses of magnification devices in restorative dentistry were stated by the respondents. The most prevalent use reported was detection of cracks in dentin (95.1%), followed by facilitating visualization during surgical endodontic procedures (95.1%) and non-surgical endodontic procedures (90.2%). The least reported use of magnification devices in restorative dentistry was cavity preparations (67.1%), identification of incipient caries (67.1%) and promotion of high aesthetic quality of dental restorations (57.3%) (Table 2).

Table 2: Uses of magnification devices in Restorative Dentistry among the respondents

Uses of magnification devices in Restorative Dentistry	Frequency	Percent
Detection of cracks in dentin	78	95.1
Facilitating visualization during surgical endodontic procedures	78	95.1
Facilitating visualization during non-surgical endodontic procedures	74	90.2
Improving visualization of finish lines for fixed prosthodontics	71	86.6
Contributing to restorative decision making	71	86.6
Bringing ergonomical advantages such as increased comfort regarding work posture	67	81.7
Preservation of musculoskeletal health	58	70.7
Identification of incipient caries	55	67.1

Cavity preparations	55	67.1
Promotion of high aesthetic quality of dental materials	47	57.3

More than half (54.9%) reported using one form of magnification device or the other. The majority (73.3%) of those who reported use of magnification devices stated that they used the devices sometimes, while 20.0% and 6.7% rarely use and always use respectively. The most frequently used magnification device by the respondents was dental loupes (95.5%) while 11.1% claimed to have used operating microscope, 2.2% endoscope and 35.5% handheld lenses.

Less than two-thirds (64.6%) of the respondents opined that use of magnification devices be enforced or made mandatory in restorative dentistry while 35.4% did not think so. Majority (90.2%) of the respondents were of the opinion that all fully registered dentists, house officers and dental students should use magnification devices in Restorative dentistry. A few (2.4%) felt only consultants should use magnification devices.

With regards to when magnification devices should be used, 36.6% stated that they should be used routinely, 24.4% reported it should be used for all procedures while 8.5% opined that it should be used for endodontic procedures only (Figure 2).

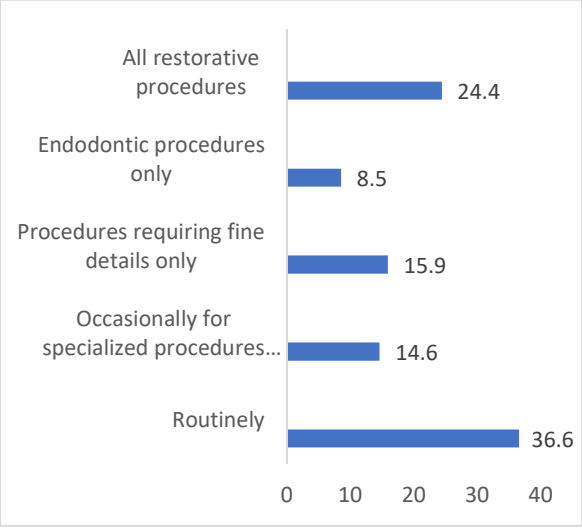

Figure 2: Opinion of respondents regarding when magnification devices should be used

The most prevalent reasons adduced to the non-use of magnification devices routinely by the respondents were: expensive devices (75.6%), non-availability (69.5%) and required training for device use (57.3%). However, the least reported reasons for non-use were; associated health issues, the devices add no value to treatment and more cost to the dentist (each 1.2%) (Table 3)

Table 3: Reasons for non-use of magnification devices among the respondents

Reasons	Frequency (N)	Percent (%)
The devices are expensive	62	75.6
Use of the device requires training	47	57.3
The devices are not necessary	3	3.7
It will cause some health issues	1	1.2
The devices are not readily available	57	69.5
The devices add no value to treatment	1	1.2
I already do great work without it	6	7.3
It is difficult to use	5	6.1
My eyes are perfect	3	3.7
I have better vision without it	4	4.9
It will make my eyes tired	4	4.9
Side effects are associated with its use	2	2.4
The devices are large and cumbersome	14	17.1
Their use increases treatment time	6	7.3
It will increase the cost of treatment	18	22.0
More cost to the dentist	1	1.2

There was no statistically significant association between the sociodemographic characteristics and the respondents' awareness of the different types of magnification systems that can be used in Restorative Dentistry and the range of magnification in each system (Table 4).

Table 4: Relationship between sociodemographic characteristics and respondents' awareness of the different types of magnification systems that can be used in Restorative Dentistry and the range of magnification in each system.

Characteristics	Awareness of the different types of magnification systems		Awareness of the range of magnification in each system		
	Yes (N/%)	No N/%)	Yes (N/%)	No (N/%)	Total
Gender	P=0.6		P=0.2		
Male	47 (94.0	3 (6.0)	35 (70.0	15 (30.0	50 (100)
Female	31 (96.9	1 (3.1)	18 (56.3	14 (43.8	32 (100)
Age group (years)	P=0.6		P=0.2		
21-30	2 (100.0	0 (0.0)	1 (50.0	1 (50.0	2 (100)
31-40	35 (92.1	3 (7.9)	22 (57.9	16 (42.1	38 (100)
41-50	24 (96.0	1 (4.00	15 (60.0	10 (40.0	25 (100)
>50	17 (100.0	0 (0.0)	15 (88.2	2 (11.8	17 (100)
Sub-specialty	P=0.4*		P= 0.1		
Prosthodontics	17 (100.0	0 (0.0)	9 (52.9	8 (47.1	17 (100)
Endodontics	15 (100.0	0 (0.0)	13 (86.7	2 (13.3	15 (100)
Conservative	46 (92.0	4 (8.0)	31 (62.0	19 (38.0	50 (100)
Status	P= 0.1		P= 0.3		
Junior resident	21 (87.5	3 (12.5	13 (54.2	11 (45.8	24 (100)
Senior resident	23 (100.0	0 (0.0	14 (60.9	9 (39.1	23 (100)
Consultant	34 (97.1	1 (2.9	26 (74.3	9 (25.7	35 (100)
Years of practice	P= 0.8		P= 0.3		
<5	15 (93.8)	1 (6.3	10 (62.5	6 (37.5	16 (100)
5 – 10	29 (93.5)	2 (6.5	17 (54.8	14 (45.2	31 (100)
>10	34 (97.1)	1 (2.9	26 (74.3	9 (25.7	35 (100)
Total	78 (75.1)	4 (4.9	53 (64.6	29 (35.4	82 (100)

- Fischer's exact

In like manner, there was no statistically significant association between the sociodemographic characteristics and the use of magnification devices in respondents' clinical restorative practice (Table 5).

Table 5: Relationship between sociodemographic characteristics and respondents' use of magnification devices in their clinical restorative practice

Characteristics	Do you employ magnification devices in your clinical restorative practice		Total
	Yes (N/%)	No (N/%)	
Gender			P=0.8
Male	28 (56.0)	22 (44.0)	50 (100.0)
Female	17 (53.1)	15 (46.9)	32 (100.0)
Age group (years)			P=0.4
21-30	2 (100.0)	0 (0.0)	2 (100.0)
31-40	18 (47.4)	20 (52.0)	38 (100.0)
41-50	15 (60.0)	10 (40.0)	25 (100.0)
>50	10 (58.8)	7 (41.2)	17 (100.0)
Subspecialty			P=0.2
Prosthodontics	7 (41.2)	10 (58.8)	17 (100.0)
Endodontics	11 (73.3)	4 (26.7)	15 (100.0)
Conservative	27 (54.0)	23 (46.0)	50 (100.0)
Status			P=0.4
Junior resident	11 (45.8)	13 (54.2)	24 (100.0)
Senior resident	12 (52.2)	11 (47.8)	23 (100.0
Consultant	22 (62.9)	13 (37.1)	35 (100.0
Years of practice			P=0.9
<5	8 (50.0)	8 (50.0)	16 (100.0)
5-10	18 (58.1)	13 (41.9)	31 (100.0)
>10	19 (54.3)	16 (45.7)	35 (100.0)
Total	45 (54.9)	37 (45.1)	82 (100.0)

DISCUSSION

Contemporary dentistry is led by the spate of technological advances which help clinicians with adequate training to incorporate the finest skills and equipment in day-to-day practice, thus enhancing

their existing skills and knowledge and delivering the most ideal outcomes with utmost precision.[14] Limited studies have evaluated the opinion of restorative dentists towards enhanced magnification in their practice despite indications that magnification is very useful in endodontics and restorative oral care as well as assessment of restorative procedures. [18]

The high level of awareness that magnification can be used in restorative dentistry recorded in this study is not surprising as various literature have indicated that enhanced magnification is required mostly for procedures in endodontics and restorative dentistry,[1,19-21] and has been declared to be a gold standard for the practice of endodontics.[22]

Various sources of awareness and information regarding magnification were reported in this study, a finding similar to previous studies.[9,20,21] On the sources of information, while other studies [21] cited continuous medical education and colleagues as the most prevalent sources and academic training as the least source, ours was the converse. Academic training was the most prevalent source identified in this study and this was similar to a study conducted in India. [9]

Various types of magnification systems can be used in restorative dentistry with a range of magnification in each system. Wide ranges of magnifications are available in loupes, ranging from × 1.5 to × 10.[23] The respondents in this study claimed to be aware of these ranges a finding similar to previous reports.[1,21]

Dental loupe is the most widely used magnification device in dentistry[1,9,21] substantiating the findings of this study that the most common magnification device that can be used in restorative dentistry is the dental loupes.

The applications of magnification devices in restorative dentistry and dentistry at large have been reported.[14] The most prevalent use reported in this study was the detection of cracks in dentin followed by facilitating visualization during surgical endodontic procedures and non-surgical endodontic procedures. This is in line with reports of previous studies that reported endodontic procedures,[14,19,21] root visualization in periodontal surgery, applications in mucogingival surgery, microsurgery in implant therapy, adhesive dentistry, preparation of crown margins,[14] surgical treatment, prosthodontics, diagnosis.[21]

The prevalence (54.9%) of the use of magnification device in this study is higher than that reported among dental students and residents at King Abdulaziz University[1] but lower than that reported in Jeddah, Saudi Arabia among dental practitioners[21] and the dental faculty and students in Qassim University, Saudi Arabia.[24] Usage of magnification devices was irregular among the respondents in this study with only 6.7% using them routinely. This finding is similar to a report among postgraduates and paedodontists in Ahmedabad city[19] and among dental professionals in Saudi Arabia.[20] The devices are not readily available to dentists in developing countries due to cost, hence affecting demand and usage of these devices.

The most frequently used magnification device by the respondents was dental loupes, a finding similar to previous reports.[19-21,25] The prevalence of the use of operating microscopes and magnifying lenses recorded in this study was higher than that reported in a previous study.[21]

The majority of the respondents thought that the use of magnification devices be enforced or made mandatory in restorative dentistry for all fully registered dentists, house officers and dental students. A common way to achieve better vision is to effectively magnify the area of interest,[26] thus mandatory use of magnification is expected to enhance visual details and treatment outcome. This is a good way to enhance visual details and subsequently improve treatment outcomes. Furthermore, this will increase the use and demand for magnification devices as observed in other climes. [20,24,27,28]

Various factors have been shown to influence the use of magnification and shortcomings have also dissuaded its use.[28] Cost remains the most prevalent reason for the non-use of magnification devices,[9,21,25] a finding observed in this study supporting a previous assertion that the costs of loupe and microscope are considered unrealistic, particularly amidst developing nations[28]. Another barrier to its use is the lack of training, a finding similar to previous reports.[19,20,25,29] Dental students were reported to have a positive perspective on the use of magnification but time was required for them to adapt and adjust to the technical features.[29] Improper training or lack of practice may lead to inadequate coordination between the surgeon's eyes and hands, and reduction of tremors, achieving ergonomically beneficial positions may be difficult to achieve as a learning curve of a minimum of 6 months may be needed.[14]

Some respondents were worried about these devices having adverse effects on one's health, a finding

similar to previous reports.[19,20] Loupes have been associated with visual fatigue when used for long[2,12] as the optical system they utilise is convergent leading to eye strain.[2] It is always ideal to adapt to magnified vision by initially using loupes, which enable the operator to adjust to the eye training exercise and changes in hand-eye coordination. Although loupes are widely used, their major disadvantage is that the eyes converge to view an image (Keplerian optics), which can result in eye strain, fatigue, and even vision changes with the prolonged use of poorly fitted loupes.[23] Another barrier was the belief that the devices add no value to treatment and add more cost to the dentist, a finding similar to previous reports.[21,24]

Age group, gender, subspecialty, status and years of practice did not influence the level of awareness of the different types of magnification systems as well as their usage. A previous study had reported no gender difference in usage of magnification devices.[20] Also, being a specialty group with trainers and trainees, one expects a similar knowledge base of the respondents. Residents are most likely to mirror consultants' behaviour, hence it is not surprising that the status of the respondents did not influence utilization of magnification devices. The various subspecialities are usually housed under one department that is Restorative Dentistry in most hospitals[30] hence access to magnification devices will be similar and this may be a reason for subspeciality not influencing awareness or usage.

The limitation of this study is that it only reflects the views of a subsection of Nigerian dentists, further research is needed to include private practitioners.

CONCLUSION

The awareness of magnification was high; however, with average utilization, while cost and availability were the major barriers to routine utilization of magnification devices in Restorative practice amongst the respondents.

RECOMMENDATION

This study recommends the early introduction of the use of magnification devices in Dental schools, as well as the increased advocacy on the importance of the use of magnification in Restorative practice. These coupled with the availability of pocket-friendly magnification devices which will no doubt, encourage the routine use of magnification amongst Nigerian restorative dentists.

Source of support
Nil

Conflict of interest
None Declared

REFERENCES

1. Carcia AR. The value of the dental operating microscope in restorative dentistry: Axiomatic or absurd? available from https://www.oralhealthgroup.com/features/the-value-of-the-dental-operating-microscope-in-restorative-dentistry-axiomatic-or-absurd/ Accessed 10th May, 2024
2. Petromilli P, Wajngarten D, Garcia NS. Expanding the operating field in endodontics: from magnification loupes to microscope. Dent Oral Biol Craniofac Res. 2018; 1:1-4.
3. Feix LM, Boijink D, Ferreira R, Wagner MH, Barletta FB. Operating microscope in Endodontics: Visual magnification and luminosity. Rev Sul-Bras Odontol. 2010; 1: 340-348
4. Carr GB, Murgel CA. The use of the operating microscope in endodontics. Dent Clin North Am 2010; 54: 191-214. doi: 10.1016/j.cden.2010.01.002
5. Perrin P, Neuhaus KW, Lussi A. The impact of loupes and microscopes on vision in endodontics. Int Endod J. 2014; 47: 425-429.
6. Mamoun JS. The maxillary molar endodontic access opening: A microscope-based approach. Eur J Dent. 2016; 10: 439-446.
7. Del Fabbro M, Taschieri S, Lodi G, Banfi G, Weinstein RL. Magnification devices for endodontic therapy. Cochrane Database Syst Rev 2015; 12: CD005969.
8. Narula K, Kundabala M, Shetty N, Shenoy R. Evaluation of tooth preparations for class II cavities using magnification loupes among dental interns and final year BDS Students in preclinical laboratory. J Conserv Dent. 2015;18:284-287
9. Penmeta GS, Mari LP, Praveen G, Dwarakanath CD, Suresh S. Awareness, attitude and prevalence of usage of magnification devices among dental practitioners in the state of Andra Pradesh- A questionnaire-based study. J Indian Soc Periodontol. 2017; 21:398-402.
10. Hoerler SB, Branson BG, High AM, Mitchell TV. Effects of dental magnification lenses on indirect vision: a pilot study. J Dent Hyg. 2012; 86: 323-330

11. Bowers DJ, Glickman GN, Solomon ES, He J. Magnification's effect on endodontic fine motor skills. J Endod 2010; 36: 1135-1138.
12. Khayat BG. The use of magnification in endodontic therapy: the operating microscope. Pract Periodontics Aesthet Dent. 1998; 10: 137-144.
13. Taschieri S, Del Fabbro M, Weinstein T, Rosen E, Tsesis I. Magnification in modern endodontic practice. Refuat Hapeh Vehashinayim 2010; 27: 18-22.
14. Rashmi H, Vivek H. Magnification-enhanced contemporary dentistry getting started. J Interdiscipl Dent 2016; 6:91-100.
15. Alhazzazi TY, Alzebiani NA, Alotaibi SK, et al. Awareness and attitude toward using dental magnification among dental students and residents at King Abdulaziz University, Faculty of Dentistry. BMC Oral Health. 2016; 17:21. doi:10.1186/s12903-016-0254-4.
16. Technology: the buzz in the dental office. Dental product report survey 2005:42-45.
17. Buhrley LJ, Barrows MJ, BeGole EA, Wenckus CS. Effect of magnification on locating the MB2 canal in maxillary molars. J Endod. 2002; 28: 324-327.
18. Ibhawoh LO, Enabulele JE. Evaluation of the quality of class II cavities with and without dental loupes. Nig J Med Dent Educ. 2021; 3: 35-40
19. Makwani DA, Patel MC, Bhatt RK, Patel C, Patel F. Awareness and attitude of using magnification while working on pediatric dental patients by postgraduates and pedodontists of Ahmedabad city. J Coastal Life Med. 2023; 2:562-567.
20. Basunbul IG. The use of magnifying loupes among dental professionals. J Contemp Dent Pract. 2018; 19:1532-1538.
21. Aboalshamat K, Daoud O, Mahmoud LA, Attal S, Alshehri R, Othman D, Alzahrani R. Practices and attitudes of dental loupes and their relationship to musculoskeletal disorders among dental practitioners. Int J Dent. 2020:8828709. doi: 10.1155/2020/8828709. PMID: 32802059; PMCID: PMC7414349
22. AAE Special committee to develop a microscope position paper. AAE position statement. Use of microscopes and other magnification techniques. J Endod. 2012; 38:1153-1155.
23. Pieptu D, Luchian S. Loupes-only microsurgery. Microsurg. 2003;23:181-188
24. Alrebdi A, Alkhudhair M, Alqifari F. Dental faculty and students' awareness and attitude towards the use of dental magnification tolls: A cross-sectional study at College of dentistry, Qassim University. J Pharma Neg Results. 2022; 13:2799-2804.
25. Panda KD, Penmetsa GS, Radha RK, Jaswitha V. Attitude, knowledge and overall perception towards working under magnification among undergraduate and postgraduate students of a dental institution in Andhra Pradesh- A questionnaire-based study. Int J Periodont Implantol. 2019; 4:88-91.
26. Gogiya RJ, Chandak MG, Modi RR, Bhutda P, Kela S, Chandak RM. Magnification in dentistry: A review. Int J Appl Dent Sci. 2018; 4:83-85.
27. Auswin MK, Ramesh S. Knowledge, attitude and practice survey on the use of dental operating microscope in endodontics: A cross-sectional survey. J Adv Pharm Edu Res. 2017; 7:320-322.
28. Low JF, Dom TNM, Baharin SA. Magnification in endodontics; A review of its application and acceptance among dental practitioners. Eur J Dent 2018; 12:610-616.
29. Wajngarten D, Botta AC, Garcia PPNS. Magnification loupes in dentistry: A qualitative study of dental students' perspective. Eur J Dent Educ 2021; 25:305-309.
30. Arigbede AO. Need for immediate restructuring of restorative dentistry curriculum and practice in Nigeria. Nig J Clin Pract. 2011; 14:118-120.