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Kap survey on role of magnification in dentistry

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Abstract--Background: The use of magnification devices in dentistry, not only enhances the quality of each procedure but in addition reduces the time for each procedure and improves the ergonomics of the practitioner. Various devices such as dental loupes and endoscopes are employed, which differ in their magnification based on the type of procedure conducted. Aim: The present study aims at determining the awareness of the different types, advantages, disadvantages and effects of magnification in dentistry. Materials and method: A self assessable survey consisting of 16 questions were prepared and circulated among 100 dental students and the results were analysed to determine the use and effects of magnification and magnification devices. Results and discussion: On analysing the results, it was found that different dental procedures require the use of different magnification devices and the advantages posed by these devices include reduced procedure time, improved posture and ergonomics of the dentist and enhanced quality and success of treatment regimes. The awareness among dental students was moderate and better knowledge on these aspects can improve the success of treatment procedures employed. Conclusion: The present study concludes that the awareness of the different magnification

devices among dental students was moderate. However, further depth and perspective on the functioning, type of magnification and principle can enhance the quality and success of dental treatments.

Keywords--Magnification, ergonomics, procedures, awareness, innovative technique.

Introduction

Dentistry as a profession requires the use of highly trained and skilled professionals along with advanced technology and instruments which make complex dental procedures relatively simple. One such important aspect is the magnification of minute structures in the oral cavity which helps in improving precision. Magnification in general refers to the process of enhancing the size of an object, both physical and apparent size (1). The development of devices such as dental loupes and surgical operating microscopes have significantly enhanced the success of dental treatments, decreased the time for each procedure and improved the ergonomics of the dental practitioner as well (2). The different magnification devices display positive and negative outcomes to both the dentist and the patient and also help compensate any visual deficiencies present. These devices used for microsurgical procedures produce magnifications such as 2.5x, 4.0x, 6.7x, 10x, 16x, and 24x (3). Factors such as resolving power, type of lens, field depth and range of magnification affects the magnification of each instrument used (4).

The naked eye can aid in vision inside the oral cavity but limits itself to the level of the canal orifice. Continuous strain produced on the human eye can lead to compromised vision at an early age. Enhanced visual acuity assists in removing pulp stones, management of tooth resorption, cleaning of canals, obturation procedures and supervising sclerosed root canals (5). The benefits produced by magnification devices differ with the different branches of dentistry. In prosthodontic fields, the magnification instruments help in easy placement and removal of prosthetics in the oral cavity and prevent any structural damage to abutments placed (6). For various types of oral surgeries, endoscopies are employed. They are known for their minimally invasive property and least complications. Further, endoscopies can provide a wide range view of the affected area. In periodontal procedures, the microscopes used can help in removal of any residual debris which could otherwise facilitate the loss of the epithelial layer (7). The magnification device chosen for dental procedures must ensure maximum comfort during the treatment and this can be obtained by ensuring that the angle of declination is around 35° while the working distance, that is the distance between the dental professional and the patient is 18 inches.

From previous research conducted, it can be noted that magnification of the oral cavity affects the quality of dental procedures and the use of these devices varies with each procedure conducted. Our team has extensive knowledge and research experience that has translated into high quality publications (8–17),(18–21),(22–26) (27). The present study was adopted to determine the importance of

magnification in dental procedures. Further, the awareness of the various devices used, their magnification values, working and efficiency was noted.

Materials and Method

For the present study, a self-assessable survey consisting of 16 questions including demographic data was prepared and circulated through a google forms link among 100 dental students of varying age groups. The responses provided by the students were collected, analysed, diagrammatically represented and analysed to determine the comprehension levels and understanding on the importance of magnification in dentistry. The statistical test performed was the student's unpaired 'T' test and the statistical software employed was the SPSS version 22.0.

Result

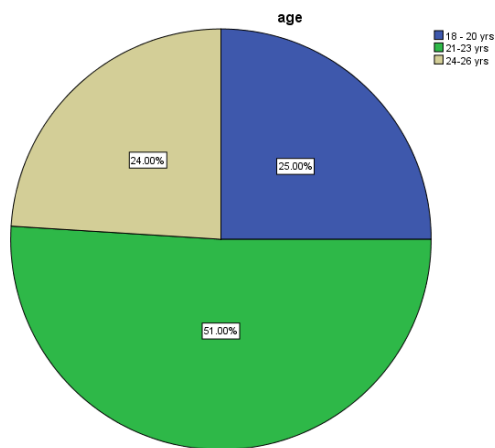


Figure 1: Pie chart showing percentage distribution of responses on the age group of participants. 25% were of the age group 18-20 years (blue), 51%- 21-23 years (green) and 24%- 24-26 years (brown)

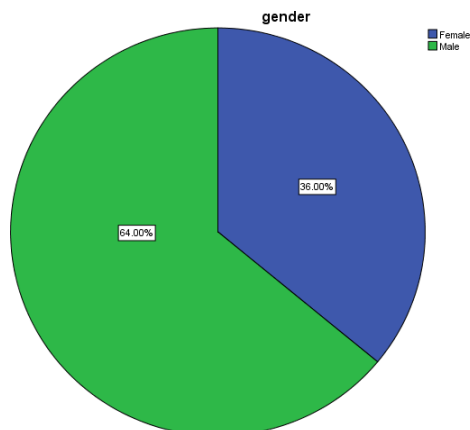


Figure 2: Pie chart showing percentage distribution of gender of participants. 53% were females (blue) and 47% were males (green)

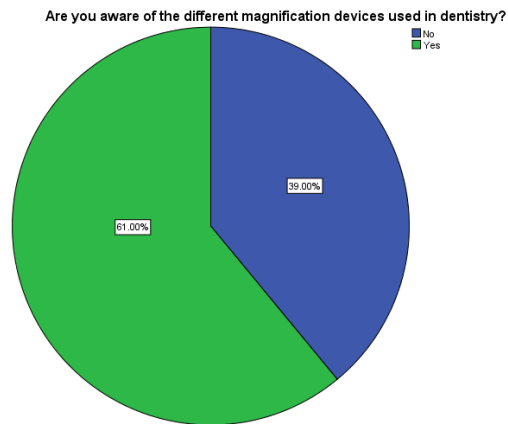


Figure 3: Pie chart showing percentage distribution of responses on awareness of the different magnification devices used in dentistry. About 61% being aware (green) and 39%- unaware (blue). Higher number of participants had responded that they were aware of the various dental magnification devices (61%).

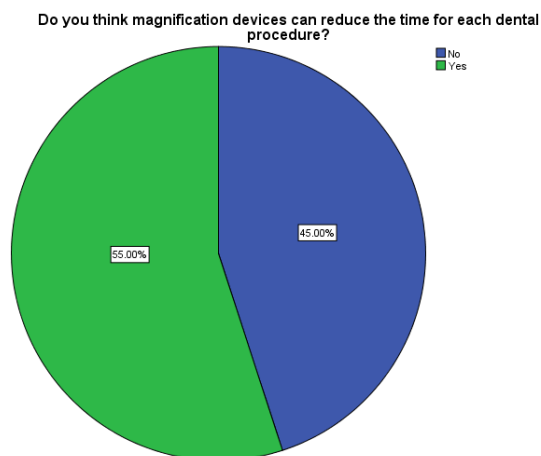


Figure 4: Pie chart showing percentage distribution of responses on whether magnification devices can reduce the time for each dental procedure. About 55% responded to yes (green) and 45%- no (blue). Higher number of participants had responded that magnification devices reduce the time for each procedure (55%).

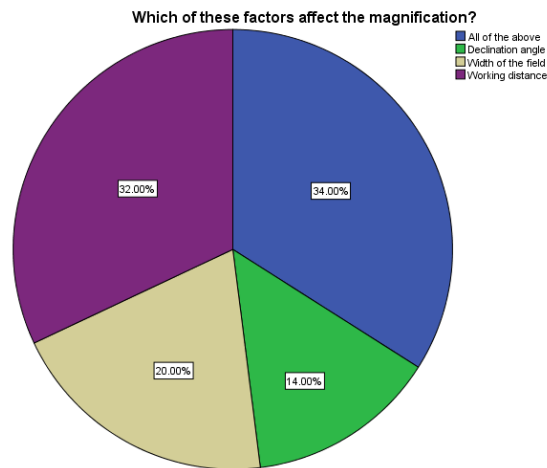


Figure 5: Pie chart showing percentage distribution of responses on awareness of factors affecting magnification. About 32% responded to working distance (purple), 20%- width of the field (brown) and 14%- declination angle (green), 34%- all of the above (blue). Higher number of participants had responded that all these reasons affected magnification (34%).

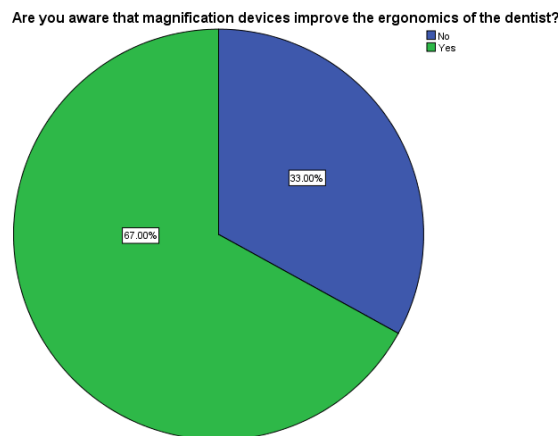


Figure 6: Pie chart showing percentage distribution of responses on whether magnification devices can improve ergonomics of the dentist. About 67% responded to yes (green) and 33%- no (blue). Higher number of participants had responded that magnification devices improve ergonomics (67%).

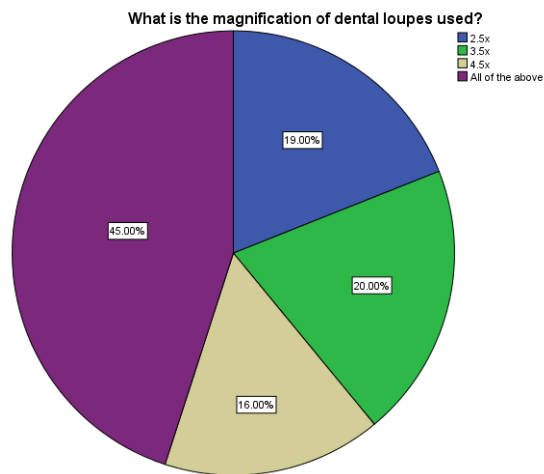


Figure 7: Pie chart showing percentage distribution of responses on awareness of magnification of dental loupes. About 20% responded to 3.5x (green), 19%- 2.5x (blue) and 16%- 4.5x (brown), 45%- all of the above (purple). Higher number of participants had responded that all these reasons affected magnification (34%).

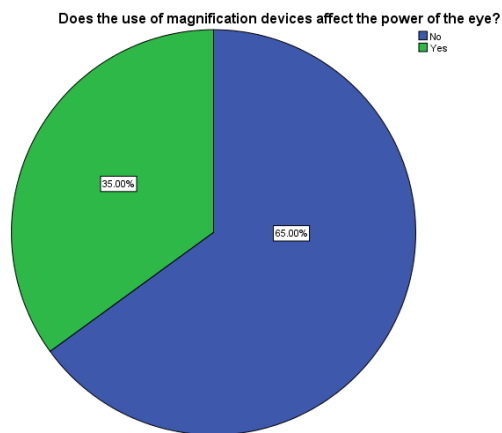


Figure 8: Pie chart showing percentage distribution of responses on whether magnification devices can affect eye power. About 35% responded to yes (green) and 65%- no (blue). Higher number of participants had responded that magnification devices do not affect eye power (65%).

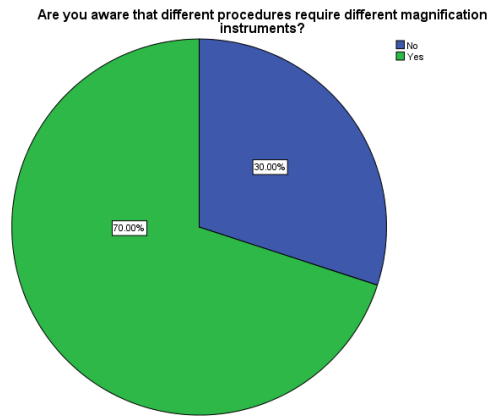


Figure 9: Pie chart showing percentage distribution of responses on whether different procedures require different magnification devices. About 70% responded to yes (green) and 30%- no (blue). Higher number of participants had responded that different procedures require different magnification devices (70%).

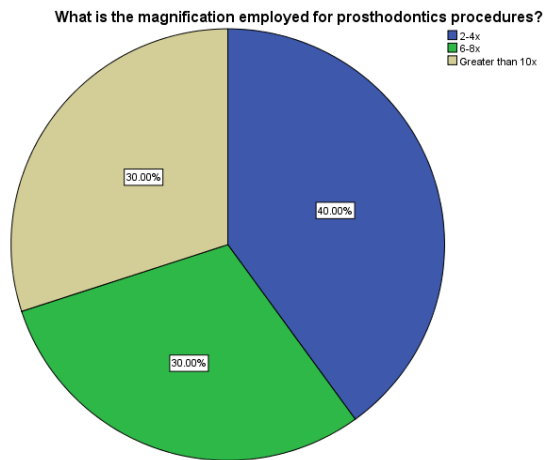


Figure 10: Pie chart showing percentage distribution of responses on awareness of magnification employed for prosthodontic procedures. About 40% responded to 2-4x (blue), 30%- 6-8x (green) and 30%-greater than 10x (brown). Higher number of participants had responded to 2-4x (40%).

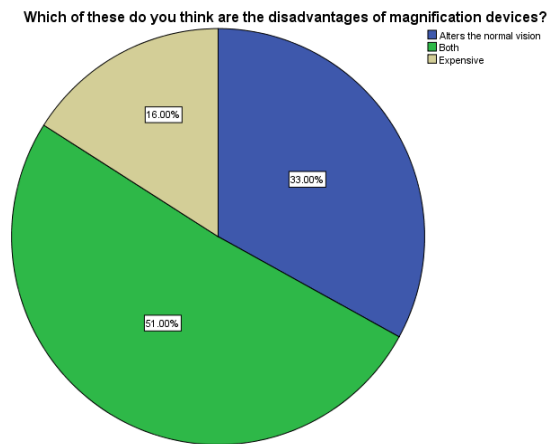


Figure 11: Pie chart showing percentage distribution of responses on awareness of disadvantages of magnification devices. About 33% responded to altered normal vision (blue), 16%- expensive (brown) and 51%-both (green). Higher number of participants had responded to both the disadvantages (51%).

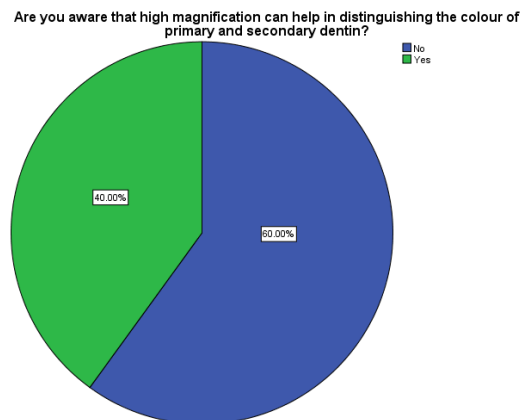


Figure 12: Pie chart showing percentage distribution of responses on awareness of whether high magnification can distinguish the colour of primary and secondary dentin. About 60% responded to no (blue) and 40%- yes (green). Higher number of participants had responded that they were aware of the stated fact (70%).

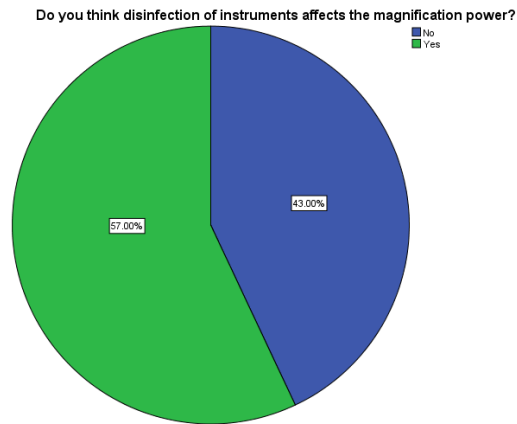


Figure 13: Pie chart showing percentage distribution of responses on awareness of whether disinfection of instruments affects the magnetic power. About 57% responded to yes (green) and 43% - yes (blue). Higher number of participants had responded that they were aware that magnification power is affected by disinfection of the devices (57%).

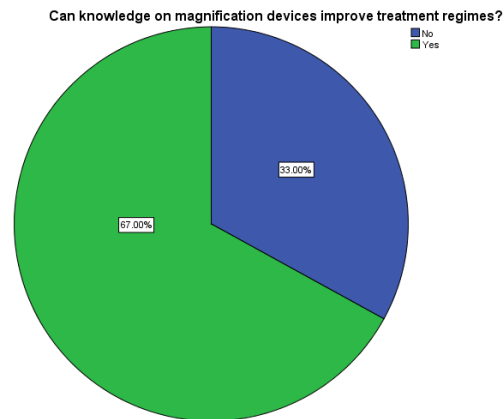


Figure 14: Pie chart showing percentage distribution of responses on awareness of whether knowledge on magnification can affect treatment regimes. About 67% responded to yes (green) and 33% - yes (blue). Higher number of participants had responded that they were aware that knowledge on magnification affects treatment modalities (67%).

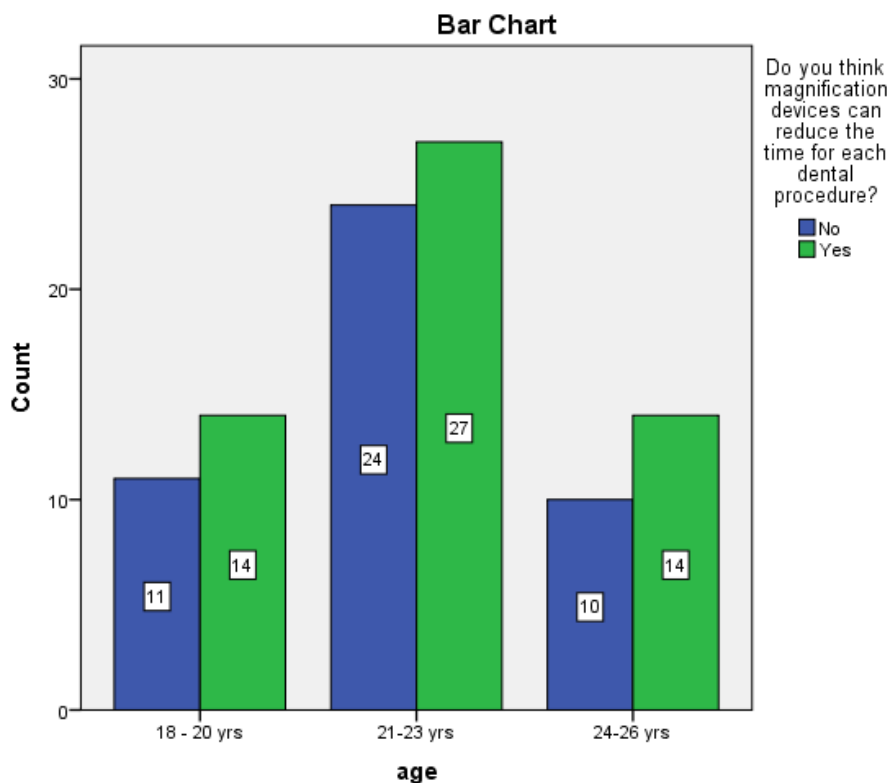


Figure 15: Bar graph showing association between age and awareness on whether magnification devices can decrease the time for each dental procedure. X-axis represents age and y-axis represents the number of participants responded. Green colour represents yes while blue colour represents no. The use of magnification instruments decreases the procedure time was the most responded option and it was highest among dental practitioners of the age group 21-23 years. Chi square test showing $p = 0.902$ ($p > 0.05$ indicating statistically insignificant).

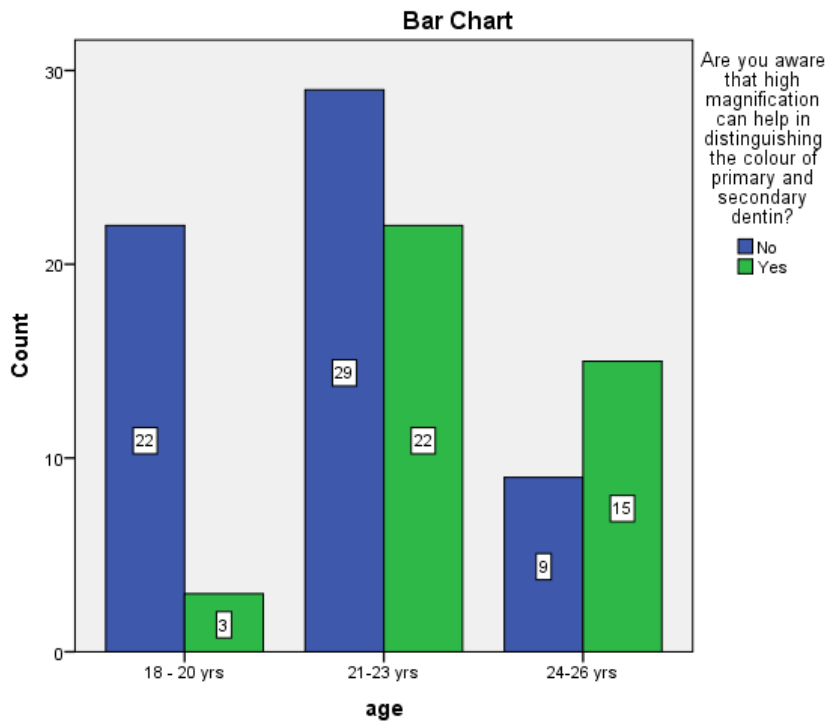


Figure16: Bar graph showing association between age and awareness on whether high magnification can distinguish primary and secondary dentin by colour. X-axis represents age and y-axis represents the number of participants responded. Green colour represents yes while blue colour represents no. The use of high power magnification can not distinguish the colour of primary and secondary dentin was the most responded option and it was highest among dental practitioners of the age group 21-23 years. Chi square test showing $p=0.001$ ($p<0.05$ indicating statistically significant).

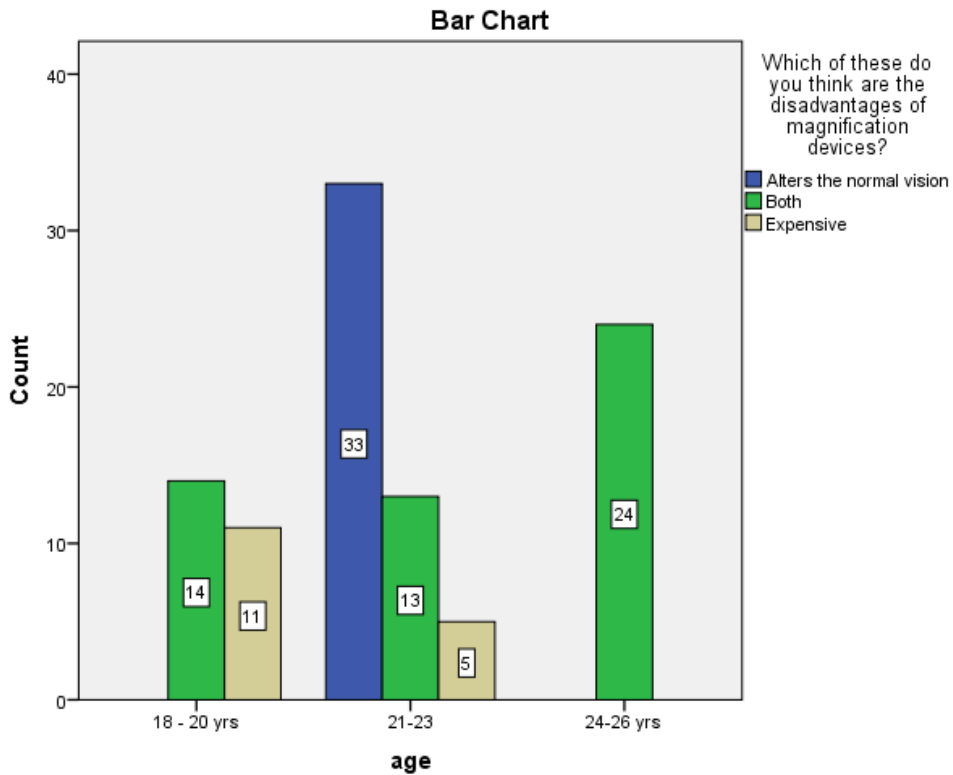


Figure 17: Bar graph showing association between age and awareness on the disadvantages of dental magnification devices. X-axis represents age and y-axis represents the number of participants responded. Blue colour represents alteration in normal vision, brown colour represents expensive and green colour represents both the disadvantages. Alteration in normal vision was the most responded option and it was highest among dental practitioners of the age group 21-23 years. Chi square test showing $p = 0.000$ ($p < 0.05$ indicating statistically significant).

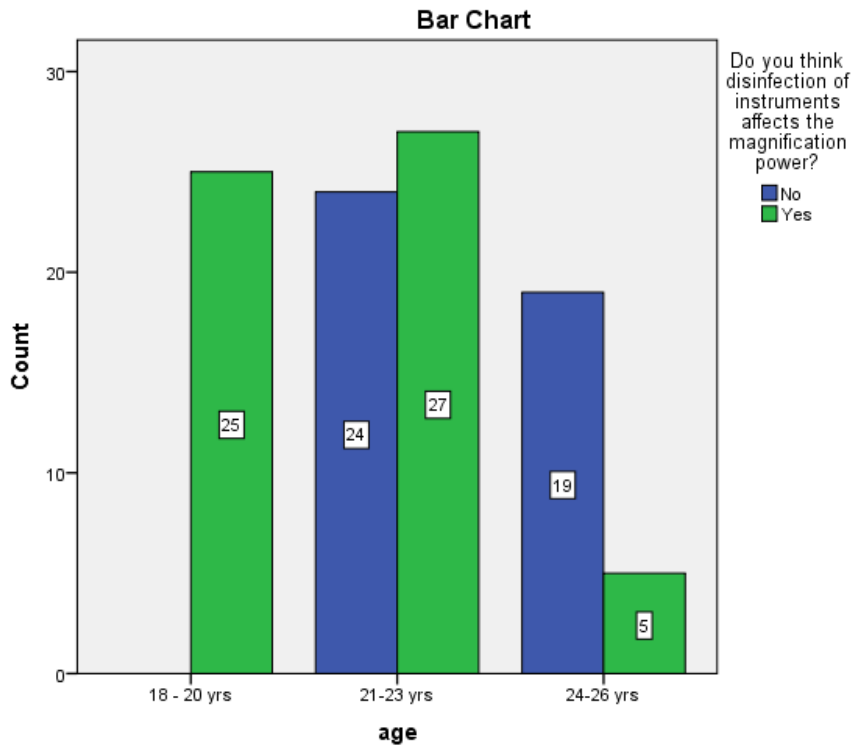


Figure 18: Bar graph showing association between age and awareness on whether disinfection affects the magnification of devices. X-axis represents age and y-axis represents the number of participants responded. Green colour represents yes while blue colour represents no. Disinfection can potentially alter the magnification of devices was the most responded option and it was highest among dental practitioners of the age group 21-23 years. Chi square test showing $p= 0.000$ ($p<0.05$ indicating statistically significant).

Discussion

The results obtained from the survey were analysed and it was found that the majority of the students were aware of the different magnification devices used in dentistry. Most of the students felt that the time for dental procedures can be reduced by magnification devices and the ergonomics of the dental professional could also be enhanced. Among the students who attempted the survey, 25% of the participants belonged to the age group 18-20 years, 51% were of the age group 21-23 years while 24% fell under the age group 24-26 years (Figure.1). The percentage of females who attended the questionnaire was 53% while the percentage of males included was 47% (Figure.2).

On enquiring about the magnification devices, only 61% of the students were aware of the different devices used while 39% had comparatively less knowledge on the different devices used (Figure.3). 55% of the students were aware that magnification devices could reduce the time for each dental procedure while 45% believed otherwise (Figure.4). 14% of the population chose declination angle, 32%

chose working distance, 20% responded to width of the field while 34% responded to all of these factors when asked about the factors which affect the magnification of devices used (Figure.5). The results obtained are in accordance with the results proposed by Massimo which state that failure to meet the requirements of these factors can lead to decreased magnification of the devices used (28). To test the awareness on relation between magnification devices and ergonomics, the students were questioned on the same. 67% believed that ergonomics of the dental professional can be improved with the use of magnification devices while 33% objected to this statement (Figure.6). The practice of using dental loupes can improve the posture and ergonomics of the dental professional (29). The magnification of dental loupes used during procedures was enquired and 2.5x, 3.5x, 4.5x and all three magnifications were proposed as options. 19% of the participants chose 2.5x, 20% responded to 3.5x, 16% chose 4.5x while 45% chose all three magnifications (Figure.7). The article proposed by Gautami Subhadra states that around 91% of the dental professionals were aware about the different magnifications of loupes available which is contraindicated to the present findings (30).

35% of the dental students responded that that power of the human eye is affected by the prolonged use of magnification devices while 65% did not agree to this statement (Figure.8). The statement 'different procedures require different magnifications' was accepted by 70% of the students and rejected by 30% of them (Figure.9). For prosthodontic procedures, 2-4x is the ideal magnification was proposed by 40% of the students. 30% chose 6-8x and the remaining 30% responded to greater than 10x (Figure.10). The ideal magnification for prosthodontic procedures ranges between 24x while magnifications greater than 4x produce less visual enhancement (31). For deciphering the disadvantages of magnification devices in dentistry, 16% felt they were expensive, 33% believed that they alter the normal vision and 51% felt that both of these were the disadvantages of magnification devices (Figure.11). The article proposed by Jennifer Thomas agrees with the present study and in addition states that visual dependency, infection control and limited depth of vision were the other disadvantages of magnification devices in dentistry (32). 40% of the students were aware the colour of primary and secondary dentin could be distinguished by magnification devices at high power while 60% did not possess knowledge on the same (Figure.12). The results obtained from previous studies support this finding (33). According to 57% of the population, disinfection of instruments could potentially affect the magnification power and for 43% of the population this statement was incorrect (Figure.13). The article proposed by Dario Melilli states that disinfection not only affects magnification but also increases the quality of the image produced (34). 67% agreed that knowledge on magnification devices could improve treatment regimes while 33% believed otherwise (Figure.14).

On comparing the overall results obtained with the association graphs plotted, it was found that dental students belonging to the age group 21-24 years possessed the highest knowledge on the types, uses, advantages, working and disadvantages of various dental magnification devices. Similar results were obtained by a study put forth by Turki Alhazazzi which states that the accuracy and quality of work was enhanced by the use of magnification devices and the awareness of the same was considerably high among dental practitioners (35).

The present study uncovers the importance of magnification devices used in the field of dentistry and its various applications. Although the awareness on the different devices was moderate among the dental students, there was a need to spread knowledge on the various magnification powers and their relation to the various treatment modalities employed. The results of the present study are enhanced by facts laid out by previous studies. Yet, the present study posed certain limitations such as limited sample size, restriction to a small age group of dental students and a regional population.

Conclusion

The present study concludes that the awareness of the different magnification devices among dental students was moderate. However, further depth and perspective on the functioning, type of magnification and principle can enhance the quality and success of dental treatments.

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Conflict of Interest

The author declares that there was no conflict of interest in the present study.

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