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The use of magnification in general dental practice in Scotland—a survey report

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Abstract

Objectives: This study had two aims, first, to quantify the level of the use of magnification in general dental practice in Scotland and second, to determine the current and potential areas of clinical use of magnification by general dental practitioners.

Methods: A questionnaire was sent to all general dental practitioners in Scotland with a Health Board list number ($n = 1790$). The questionnaire asked the practitioners about their experience of magnification and their opinions on possible areas for clinical use. An information sheet and a prepaid envelope were included with the questionnaire.

Results: One thousand two hundred and eighty (72%) of the dentists replied to the questionnaire. Nine percent of the respondents routinely used magnification. The level of routine use of magnification by practitioners increased with time since qualification. The suggested areas of clinical use of magnification by all the respondents were crown and bridge work, diagnosis and radiography. The routine users of magnification had a more positive view of magnification than non-users.

Conclusions: Routine use of magnification was associated with the length of time the practitioner had been qualified and the attendance at a course at which magnification was discussed. The perceived uses of magnification depended on the experience of the practitioner with magnification. It was considered suitable for all clinical procedures except orthodontics and prosthodontics.

Keywords: Magnification; Dental practice; Diagnosis; Conservative dentistry and endodontics

1. Introduction

Modern dentistry places many stringent demands on the dentist. A necessary attribute for clinical work is a high level of visual acuity, especially for near vision. A common way to achieve better vision is to move closer to the patient, effectively magnifying the area of interest. This has two main drawbacks; firstly, this movement can place the clinician in a compromised posture, which may, over time, cause muscular and orthopaedic problems. Secondly, as the dentist reaches middle age the physiological ageing of the eye causes an inability to focus on near objects; presbyopia [1,2]. One possible method to improve clinical vision is to use magnification.

There are four magnification systems used in dentistry: simple magnifying glasses in spectacle frames, hinged magnifiers that can be attached to either spectacle frames or worn attached to a headband, multiple lens systems commonly referred to as loupes or surgical telescopes and the operating microscope. There are reviews which describe the different types of magnification available in detail [3]. A characteristic of magnification that must be considered prior to its use is that the field of view and depth of focus decrease as the level of magnification increases. Other possible methods of achieving magnification include adaptations of endoscopes [4], colposcopes [5] and surface microscopes [6]. Intra-oral video systems can also produce magnified images; however, in common with some of the adapted systems, they use indirect vision.

The use of magnification in dentistry has been advocated for many years by a few members of the profession [7,8]. There is, however, little quantitative data available about its level of use by general dental practitioners. Burton and Bridgman reported that 18% of New Zealand dentists attending a conference used magnification [2]. Additionally, there are relatively few reports in the literature determining the areas of potential and/or actual use of magnification in clinical practice but numerous reports considering its use in connection with operative techniques [9,10]. Whitehead and Wilson considered restorative decision making with magnification [11], whilst Leknius and Geissberger investigated

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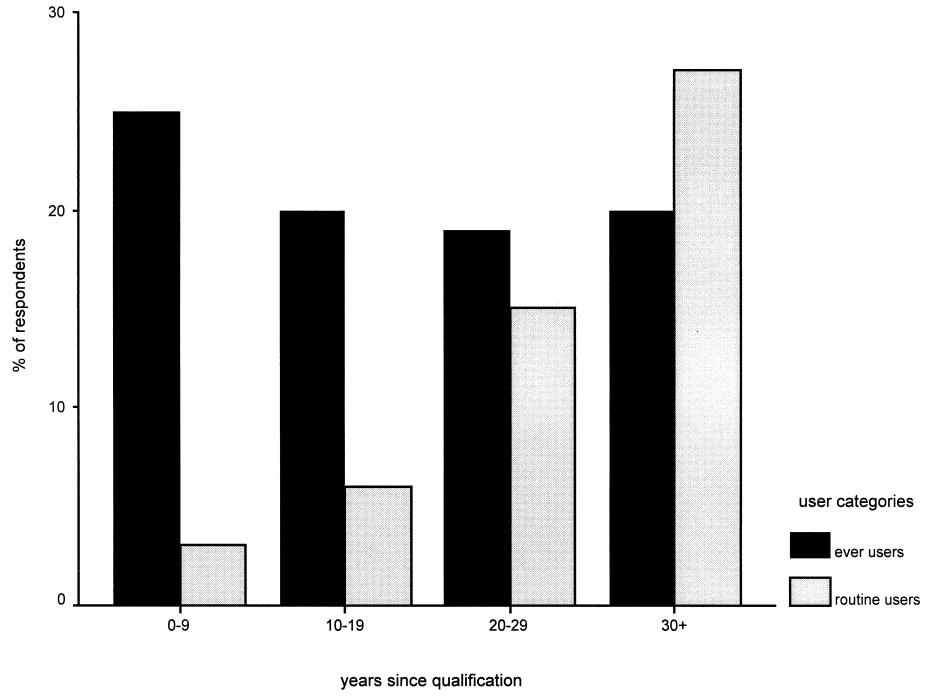

Fig. 1. Level of use of magnification by different time qualified groups.

its effect on the performance of fixed prosthodontic procedures [12]. The first aim of this study was to determine the level of use of magnification in general dental practice in Scotland and to consider a number of factors relating to its use. The second aim was to determine the current and potential areas of clinical use of magnification reported by general dental practitioners.

2. Materials and methods

A self-completion questionnaire was sent to all general dental practitioners registered to undertake National Health Service treatment in Scotland, ($n = 1790$). The questionnaires were sent between November 1995 and February 1996. A letter of explanation was included with the questionnaire which clearly stated that the study was interested in 'dental loupes, headbands and clip on lenses' and not 'magnifying glasses or prescription glasses'. The questionnaire was divided into three sections. In section one the level of use of magnification was ascertained and categorised as 'never', 'routinely' or 'ever'. 'Ever' was included to allow for dentists who had used magnification in the past or had experienced it even for a short time. The dentists were also asked if they had attended any courses or meetings on magnification and the form in which these courses were taken: undergraduate, postgraduate or manufacturers' demonstrations. In section two the dentists were asked "Do you think magnification would be useful for"; diagnosis, routine conservation, crown and bridge work, endodontics, prosthetics, surgical treatment, periodontal treatment, reading radiographs and orthodontics. Section three asked the dentists whether they wore glasses or not and also what position they held in the practice. The data from the questionnaires was entered into a spreadsheet and analysed using SPSS for Windows (SPSS inc). Data was summarised into frequency tables and the significance of any association between a number of factors and the use of magnification was tested using chi-square tests.

3. Results

One thousand two hundred and eighty questionnaires were returned – a 72% response rate. Twenty-three were incorrectly filled out and were unable to be used for analysis. Totals may not add up to one thousand two hundred and eighty or one hundred percent because of internal non-responses.

3.1. Reported levels of use

The overall level of use was as follows: 9% ($n = 117$) of dentists routinely used magnification, 19% ($n = 242$) had 'ever' used it and 71% ($n = 886$) had never used it.

3.1.1. Time since qualification

Although the age of each dentist was not included in the questionnaire their year of graduation, obtained from the Dentists' Register for 1996, was used as a surrogate. There was a significant difference ($p < 0.05$,

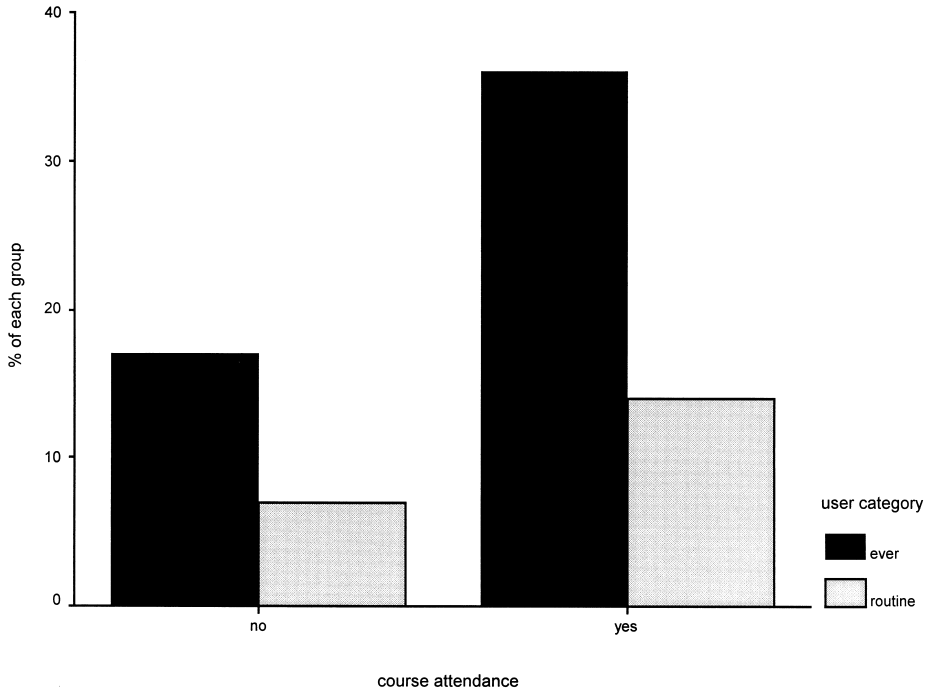

Fig. 2. Level of use of magnification related to course attendance (all respondents).

Mantel–Haenszel test) between different time-qualified groups with respect to the level of routine use of magnification, except for the two groups 0–9 and 10–19 years qualified (Fig. 1). Only 3% of practitioners with less than 10 years' experience used magnification compared to 27% of practitioners with more than 30 years' experience. The proportion of practitioners who had ever used magnification did not alter significantly with years since qualification. There was, however, a non-significant trend for more practitioners with less than ten years' experience to have "ever"

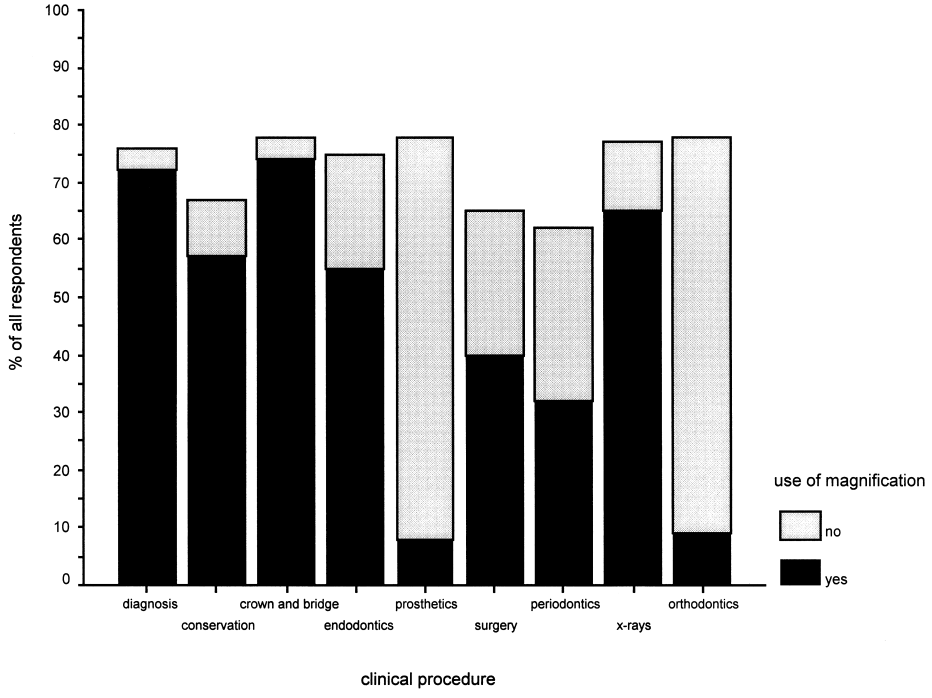

Fig. 3. Opinions on the use of magnification for a variety of clinical procedures (all respondents). Magnification is perceived as being useful for five of the procedures by more than half the sample.

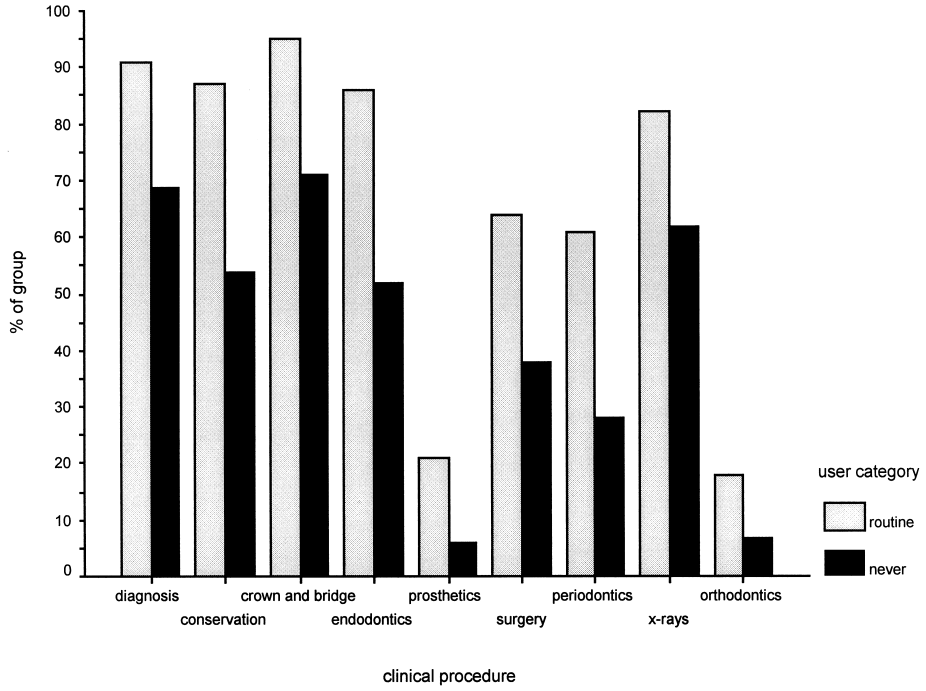

Fig. 4. Difference in positive views between 'routine' users and non-users of magnification.

used magnification compared to the other groups (Fig. 1). All further comparisons used the following groups 0–19, 20–29 and 30+ years qualified.

3.1.2. Course or meeting attendance

The attendance at a course or meeting where magnification was discussed had a highly significant association with the level of use of magnification ($p < 0.01$). The level of use was more than double in both 'ever' and 'routine' categories for practitioners who had attended such a course when compared to practitioners who had not (Fig 2).

3.1.3. Spectacle wearing

The wearing of spectacles had a significant ($p < 0.01$) association with an increase in the routine use of magnification. To investigate this further, the type of spectacles worn was considered with respect to the level of use of magnification. The three classes chosen were: non-wearers, distance wearers and reading/bifocal wearers. There was no significant difference between non-wearers and distance spectacle wearers but significant differences between non-users and reading glass wearers ($p < 0.01$) with reading glass wearers more likely to use magnification. However, when the time since qualification was taken into account the differences between the different classes of spectacle wearer decreased but were still statistically significant at the $p < 0.01$ level.

3.1.4. Job position

Job position was split into two groups: (1) principal/partner and (2) associate/assistant. There was a significant ($p < 0.01$) difference in the routine use of magnification between principals/partners and associates/assistants within the sample as a whole with a greater proportion of principals/partners using magnification.

3.2. Areas of use

The dentists were asked whether they thought magnification would be useful for the various clinical procedures previously detailed. The respondents could reply 'yes', 'no' or 'maybe'. The percentage of positive and negative replies from all the respondents are shown in Fig. 3. The procedures fall into three distinct groupings; where magnification was viewed positively by most respondents (diagnosis, conservation, crown and bridge work, endodontics and radiography), where only one-third of the respondents viewed it positively (surgical work and periodontology) and where it appears to be viewed of benefit by less than 10% of the respondents (prosthetics and orthodontics).

The opinions of the three different categories of user; 'routine', 'ever' and 'never' were compared in relation to the use of magnification for the clinical procedures described above. The differences, all significant ($p < 0.01$), in the 'yes' replies between the 'routine' and 'never' users of magnification are depicted in Fig. 4 . The 'routine' users of magnification replied 'maybe' less frequently than the other two groups. The opinions of the 'ever' users on the use of magnification lay between those of the 'routine' users and 'never' users in all procedures.

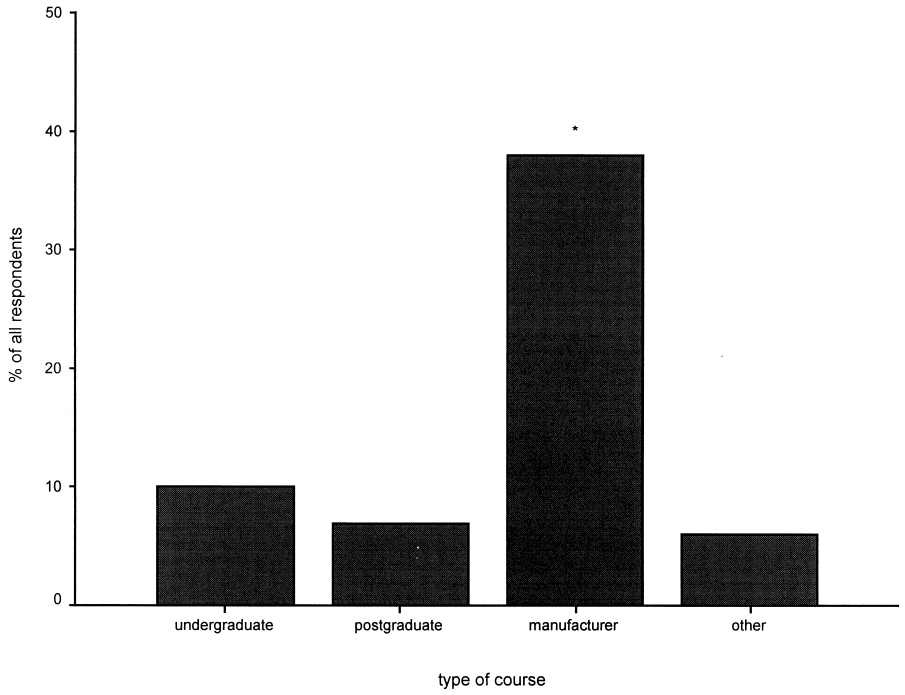

Fig. 5. Sources of information on magnification. '*' = The level of attendance at a manufacturers meeting is significantly higher ($p < 0.01$) than any of the other courses.

4. Discussion

4.1. Level of use

Little previous work has been published on the level of use of magnification by dentists. The overall level of routine use of magnification was found to be more than might have been anticipated, especially as the study clearly excluded magnifying glasses or prescription lenses. The reported level of use of magnification was higher than presently reported in New Zealand and can be accounted for by differences in the age distributions between the two studies. Other factors may also be involved including national differences, the lack of differentiation between the 'routine' and 'ever' use of magnification and the fact that the sample in New Zealand was attending a conference and did not consist solely of general dental practitioners. Over 95% of dental practitioners in Scotland are registered to undertake NHS dentistry, therefore this study achieved a nationally representative sample.

A significant association was found between the use of magnification and time since qualification, i.e. use increased with the time since qualification. The higher level of 'routine' use by the longer time qualified practitioners is most likely to be due to the physiological ageing of the eye and the need for visual correction for close-up work. There is no obvious reason why the level of 'ever' use of magnification decreases as the time since qualification increases. Possible explanations are: if the older practitioner tries magnification, (s)he is more likely to then use it routinely and secondly course attendance in the 'ever' users also tends to decrease with time since qualification.

The attendance at a course or meeting at which magnification was discussed was also strongly associated with the use of magnification. This is in line with the concept that the major obstacle to the adoption of a technique is insufficient knowledge [13]. The questionnaire did not ask whether the course had hands-on experience or what the primary topic of the course was. It did ask the type of course or meeting from which their knowledge of magnification came. The most common source was manufacturers' demonstrations (Fig. 5) . In considering science transfer and innovation in general dental practice, it would be relevant to determine if those who do use magnification were given an opportunity to try out magnification as this may be another factor influencing its adoption.

Both spectacle wearing and being a principal or partner were associated with a higher level of routine use of magnification. However, when taking into account the skewed nature of the sub-groups with respect to time since qualification it was obvious that the association was primarily with age.

The sex of the clinician was a factor associated with the use of magnification. Only 3% of women claim to use magnification routinely ($n = 12$), compared to 12% of their male colleagues ($n = 105$, $p < 0.01$ level).

The level of 'ever' use appeared to be relatively high. This study did not investigate the reasons why the level of use was limited to 'ever'. One possible reason for this is the period of adaptation required to use magnification. With

other demands, such as financial and temporal ones, the practitioner may not persevere with magnification until comfortable with its use. Other reasons, which could limit the length of time for which magnification is used, are free trial offers from manufacturers, limited use at courses and access to magnification as undergraduates.

When asked for comments, the most common fear expressed by practitioners was the possibility that the use of magnification would adversely affect their eyesight ($n = 34$). From the literature there appears to be no evidence that this occurs [14]. Since magnification improves visual acuity it would seem reasonable to assume that its use would improve those clinical skills which rely to a large extent on visual acuity. Incorrectly fitted magnification aids can cause unnecessary eye strain and therefore, professional assistance when wearing magnification for the first time should be sought.

4.2. Areas of use

The clinical procedures where magnification is recommended by more than 60% of the "routine" users are crown and bridge work, diagnosis, routine conservation, endodontics, reading radiographs, surgical treatment and periodontal treatment. In only three areas do more than 60% of non-users suggest it would be useful: crown and bridge work, diagnosis and reading radiographs. It is interesting to note that the areas suggested by the 'routine' users but not the 'never' users; routine conservation, endodontics, surgical work and periodontal treatment make up a large proportion of the general dental practitioners' clinical work. The differences provide an indication that the potential uses of magnification are not well recognised. The benefits, if any, of using magnification have not been defined for many clinical procedures and the results from this study give an indication of areas where it may be indicated.

5. Conclusion

In Scotland, magnification was found to be used by few dentists less than 20 years qualified but by over a quarter of dentists who have been qualified for more than 30 years. Routine users find magnification useful for a larger range of clinical procedures than that suggested by non-users.

References

[1] Atchison D. Accommodation and presbyopia. Ophthalmic and Physiological Optics 1995;15:255–272.
[2] Burton J, Bridgman G. Presbyopia and the dentist: the effect of ageing on clinical vision. International Dental Journal 1990;40:303–312.
[3] Millar BJ. Focus on loupes. British Dental Journal 1998;185:504–508.
[4] Longbottom C, Pitts N. An initial comparison between endoscopic and conventional methods of caries diagnosis. Quintessence International 1990;21:531–540.
[5] L'Estrange P, Bevenius J, Williams L. Intra-oral application of microcolpohysteroscope. Oral Surgery, Oral Medicine and Oral Pathology 1989;67:282–285.
[6] Walsh C, L'Estrange P, Seymour G. High magnification in situ viewing of wound healing in oral mucosa. Australian Dental Journal 1996;41:75–91.
[7] Fiolek D. Magnification (letter). Journal of the Canadian Dental Association 1992;58:351.
[8] Caplan S. Magnification in dentistry. Journal of Esthetic Dentistry 1990;2:17–21.
[9] Sheets CG. The magic of magnification. Dentistry Today 1998;December:60–67.
[10] Tibbetts LS, Shanalec D. Periodontal microsurgery. The Dental Clinics of North America 1998;42:339–359.
[11] Whitehead SA, Wilson NHF. Restorative decision-making behaviour with magnification. Quintessence International 1992;23:667–671.
[12] Leknius C, Geissberger M. The effect of magnification on the performance of fixed prosthodontic procedures. Journal of the Californian Dental Association 1995;23:66–70.
[13] Sarll D. An investigation into some effects of the organisational structure of the dental profession on the ability of General Dental Practitioners to respond to change. MSc Thesis, University of Manchester, 1980.
[14] Winn B. Letter. Dental Practice 1998;36:5.