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Dental Magnification

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Mini Review

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ABSTRACT

Magnification is the amplification of the real image of an object that allows a better visual acuity for the professional. It was considered a support applied in the health area, its use grew, gained significance in the dentistry field and promoted the improvement of operative techniques for a safer and more accurate procedure. Magnifying glasses and clinical microscopes stand out the most among the devices used for this purpose. The present work aims to review the literature, in a narrative way, about the magnification technologies used in aesthetic dentistry, showing its benefits and limitations.

INTRODUCTION

In the search for aesthetic excellence, the result of restorative treatment, made an important evolution in the aesthetic dentistry, in the development of new materials, techniques, and technology. Optical science, particularly of magnification, has contributed with magnifying glasses, operative microscopes (OM) and intraoral cameras, for a more controlled optimization of quality intervention, providing greater ergonomic and visual rest to the professionals, as well as in the manipulation of instruments in places previously inaccessible to human vision [1,2].

For many years, magnifying glasses were the only means available for the dental surgeon to expand in the operative field. However, this equipment had limitations such as limited magnification and depth of focus; in addition, the weight caused visual fatigue when used for a long period of time [3]. Currently, digital OM has allowed better visibility of the oral cavity by having magnification lenses with high magnification and field illumination; it offers freedom and ergonomics to the operator, allowing precise clinical diagnoses, and assistance in surgical procedures [4].

Understanding the technological evolution of magnification in the aesthetic dentistry field will help the professional come to a decision to implement or not the use of these devices in their clinical practice, as well as to decide which type would bring better results to their work. The present work aims to review the literature, in a narrative way, about the magnification technologies used in aesthetic dentistry, showing its benefits and limitations.

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LITERATURE AND DISCUSSION

The visualization and illumination of the operative field during restorative clinical procedures have been a challenge for professionals. In 1876, the German physician Saemmish introduced visual enlargement using binocular loupes [3]. These portable magnification systems are the most commonly used in aesthetic dentistry.

The use of magnifying glasses reduces the number of clinical errors by 50%, helping to detect early carious lesions, crown margin defects, evaluation of possible micro leakage around restorations, root fractures and direct visualization of root canals. They also help to distinguish natural dental surfaces from dental restorations [5-7]. These loupes also reduce the natural inclination of the operator's head, which allows less pressure on the neck and back muscles [5,8].

The magnifying glasses should be adjusted for each user; adjusting it is as important as its optical properties since the convergence of the eyes can cause muscle pain or fatigue when practiced for a prolonged time [9].

All magnifiers are made of converging lenses, placed side by side and angled to focus on an object, providing an increase of two to eight times. There are three types of magnifying glasses: simple, composite and prismatic [1,8,9]. Galileans magnifying glasses are recommended, it has a magnification of 2.5 times; this low magnification is a compromise between visual acuity and ergonomics, for a relatively large field of a focal range are beneficial. For larger magnifications, Keplerianos loupe systems (synonymous: prismatic), which offer greater magnification due to its sophisticated optical system [9,10].

It is known that contrast sensitivity and visual adjustment decreases with increasing age due to presbyopia. Dentists 40 years of age and older can compensate for their deficiencies in presbyopia at a 2.5-fold magnification and achieve visual acuity that is compared to younger people without any visual impairment [11].

Although these magnification systems can improve the visual acuity of the operator, it can present limitations such as set weight, image distortion, color change, small depth of focus, limited magnification and field, illumination dependent on reflectors, and can also cause visual and muscular fatigue when used for long periods of time. Muscular fatigue is due to the fact that the focus is given by the head movement of the professional, approaching and moving away from the object to be visualized; besides, the focal distance does not provide an ergonomically correct position for the operator's work [9,12]. Another limitation of the magnifying glasses is that infection control can be difficult since some of them do not tolerate disinfectants [5].

In terms of high-cost investment, OM promotes an upgrading in operative techniques with qualified and improved visual acuity, enabling safer and more accurate procedures [3,13].

OM has been used in the health area since the beginning of the 20th century, but it was introduced in dentistry in the 1980s [13]. Its use was first presented in 1977 by Baumann, a medical specialist of microsurgery of the ear, then, a dental surgeon questioned the reasons why the dentistry class could not utilize this technology; Because of the established use in medicine, he argued that under the microscope, the structures of the oral cavity would be seen more clearly. In 1992, was the first publication of the use of OM presented by Gary Carr, introducing it to Endodontic and thus promoting a great advance in the specialty [3].

OM is made up of three parts: optical head, lighting, and stationery. A tilted binocular and a 200 mm lens, which are part of the head, are used in dentistry. To enable increases from 3 to 30 times, a drum selector is used, which can be an electronic or manual zoom. Accessories such as mini video cameras and photo cameras can be attached to the optical head through a light splitter, making it easier to work with legal documentation or clinical cases, helping the professional in the education and motivating their patients through this efficient form of visual communication [1,4,13].

The operative microscope has the characteristic of positioning the eyes parallel to the object, allowing greater visual rest. The head of some commercial models allows adjustment between the operator's pupils, with inclination of up to 90є, with distance between the focus and object of 25 cm [13], allowing the dental surgeon to work in a correct posture, maintaining a correct distance from the patient, which improves bio-safety [12].

Lighting is promoted by one or two halogen lamps guided by an optical fiber. Orange or yellow filters are added to prevent the polymerization of composites and/or resin cement by the light of the apparatus. The luminous intensity of eighty thousand lux allows it to be regulated by a shutter [1]. The coaxial illumination is parallel to the line of sight and allows the operator to observe an operating field without shadows. Since the light is parallel, the eyes remain at rest, as if observing infinity; it is for this reason that prolonged intervention can be performed, without ocular fatigue [3], even though the high power is far away from the light power of the best dental reflector [14].

The MO present in the market goes from an articulated arm attached to the office wall, then from wheels supported on the floor, to those fixed on the ceiling [1], it became a simple instrument, totally adaptable to the dental office.

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Learning to use OM is a matter of time and persistence as it requires initial training and should be employed first in simple procedures such as diagnosis and clinical examinations until the skill is attained. It is recommended to start working on extracting teeth, adjusting the focal length, adjusting the binoculars (one at a time) and adapting the focus of vision. Only afterward it should be applied in the clinical

Working with large magnification can be difficult and requires learning dedication because any movement of the patient can take the field focus, which would increase working time. The lack of proper professional training and assisting staff can also result in an increase in working time. In addition, it is worth noting that with the use of OM, one can identify more details and imperfections not observed with the naked eye, which requires the professional to take an extended time to perform a more accurate procedure [12] and for these reasons, many professionals give up on its use [3]. However, the operative time of procedures performed with and without the use of OM has already been analyzed during in-vitro studies, and with no significant difference was statistically observed [12].

Dentists usually resign themselves to working in an uncomfortable position, squatting or bending for a good visibility. However, with OM it is possible to maintain good posture and appropriate vision orientation [3]. Neck and back pain is a constant complaint in the daily work of the dental surgeon. Visual fatigue, difficulty in obtaining a direct vision of the area to work on and the limitation of the field reflected in the mirror impair the quality of the procedure. The operative microscope allows the professional to work with a correct posture, while at the same time it is possible to visualize the field of work by increasing the binoculars or in an LCD monitor attached to the equipment that increases the image by up to 150 times [4].

In aesthetic dentistry, great importance has been given to the accuracy of the preparation and restoration of margins, color, shape, application of adhesive systems, insertion of composite resins and surface polishing quality of finished restoration [14]. Through magnification, it is possible to see the fragile limits responsible for the failure or success of the restorative procedure. Most of the time, dentist works by replacing restorations, which may be aesthetic or not, due to the incidence of recurrent carious lesions, to superficial pigmentation that affects the aesthetic quality of the restoration, or to persistent postoperative sensitivity. Distinguishing the limit between tooth and restoration, analyzing the procedure and defining the structure under the magnification and high amount of light raises the quality of the work reducing the unnecessary wear of healthy dental tissue [1,9,14].

Restorative procedures require low, medium or high magnification; therefore, great advantages in the use of microscopes were initiated in relation to the magnifiers, since several increases can be performed at the same time without interrupting the clinical procedure. When important dental borders at the time of making the restorations are not seen, it is easy to understand that the clinical failure will be imminent, since success has not been achieved from the time when the restoration was performed. So there is no immediate restorative success, and this certainly shortens the clinical longevity of the restoration. If restorations fail, we need to rethink and analyze what we probably saw or didn't see during the restorative procedure [6].

Despite all the technological improvements, there is no restorative material, currently available, that replaces, under equal conditions, the natural dental structure. Thus, the concern with the preservation of the healthy dental structures has led to the implementation of less invasive restorative procedures, which requires a more careful and meticulous work [7].

The use of magnification to perform restorative procedures, whether through magnifying glasses or microscopes, allows the aesthetic dental practice to work with higher quality and accuracy, consequently, greater clinical longevity. However, the use of larger increases for better focus enables more precision to diagnose, perform extremely meticulous and detailed procedures whether in preparation, removal of pathological or carious dental tissue, in the removal of restorative material, also in detection of initial carious lesion or cracks [8,14,15].

CONCLUSION

1. The use of magnification systems (magnifying glasses, intraoral cameras, and OM) represents a very significant technological advance in restorative practice.
2. The use of magnification allows greater technical resolution; real obedience to judicious work protocols; greater visual acuity; better communication with the patient and the OM, also a better ergonomic positioning.
3. The limitations presented by some systems may not overcome the possibility of performing a restorative treatment of excellence with higher success rates.

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