**TITLE: ADVANCES IN MAGNIFICATION**

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**ABSTRACT**

The oral operating field is a challenge for dentists to work on while maintaining musculoskeletal health. In recent years many studies have been executed to improve visualization of the operating field and the use of magnification systems has been recommended for providing additional benefits. Magnification in general is considered one of the great revolutions in science, and specifically in dentistry.

**INTRODUCTION**

The art of dentistry is based on precision. The microscope and other forms of magnification fill that need, especially for accomplishing endodontic procedures.

-J Esthet Restor Dent

Both microscopes and loupes have been widely adopted by dentists. Magnification can be divided into low-magnification (2x-8x), mid-magnification (8x-16x), and high-magnification (16x- 25x). Microscopes render adjustable magnification (magnification range 4x-25x), on the other hand, most loupes provide fixed magnification (magnification range 2.5x-6x).

**RECENT ADVANCES**

ENDOSCOPES

Primitive tube-like tools were employed for endoscopy by early endoscopists like Hippocrates circa 377 BC[1]. A breakthrough in optical quality was made in 1960 by an English physician named Hopkins, who made significant advancements in the field of medicine. Hopkins developed a series of rod lenses that improved the endoscope's field of view, magnification, and focal length, resulting in a clearer image[2]. With the development of the dental endoscope, the field of endoscopy has grown further. In 1979 there was for the first time mention in the literature of the use of rod-lens endoscopes in endodontics was seen[3]. As it is based on contemporary microendoscope technology, the Modular endoscope system (Sialotechnology Ltd., Ashkelon, Israel) is employed in small channel organs (salivary gland ductal system, tear duct system)[4].

ORASCOPE

The recently introduced flexible fiberoptic orascope, which has a 15mm-long working part and a.8mm-diameter working tip, is advised for intracanal viewing. The use of a flexible orascope or a rigid rod-lens endoscope in the oral cavity is referred to as orascopy[5]. The use of orascopy for visibility during traditional and surgical endodontic therapy is known as orascopic endodontics[6].

An endoscope and an orascope are different in that:

• Fiber optics are used to create orascopes.

• Glass rods make up an endoscope.

ENDODONTIC VISUALIZATION SYSTEM

The recently introduced Endodontic Visualization System (EVS) (JEDMED Instrument Company, St Louis, MO, USA) incorporates both endoscopy and orascopy into one unit. The EVS system allows for two methods of documentation[7]. The camera head used in the EVS system is an S-video camera and, as such, documentation is usually accomplished by recording streaming video onto tape or digitized to DVD[8].

DENTAL LOUPES

The most common type of magnification utilized in apical surgery has been dental loupes. With lenses positioned side by side and slanted inward (convergent optics) to concentrate on an object, loupes are effectively two monocular microscopes[9].Sometimes magnifying telescopes are referred to as "loupes."

Binocular magnifying loupes come in three different categories:

(1) a single-lens, diopter-corrected loupe,

(2) a surgical telescope with a two-lens system in the Galilean configuration,

(3) a surgical telescope with a Keplarian system setup (a prism ceiling that bends light's path)[10].

OPERATING MICROSCOPE

Surgical Operating Microscopewas used first introduced to otolaryngology around 1950, then to neurosurgery in the 1960s, and to endodontics in the early 1990s[11]. Most microscopes can be configured to magnifications up to 40X and beyond but limitations in depth of field and field of view make it impractical. Fractures, POEs, and canal isthmuses can be readily visualized and treated accordingly[12].

**CONCLUSION**

The introduction of microsurgical principles in dentistry, many areas of dentistry have adopted them for better patient outcomes. Endodontics has developed new techniques for root canal treatment, to enhance the visualization of the surgical field. In this effort various magnification devices like surgical microscopes, endoscopes, and magnifying loupes have added advantage to the operator for better visualization. These are also associated with benefits for the patient in terms of improvement of clinical and radiographic outcomes.

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