**TITLE: ADVANCES IN MAGNIFICATION**

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**ABSTRACT**

The oral operating field is a great challenge for dentists to work on, while maintaining proper 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 as 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 the quality of optics was made in the year 1960 by an English physician named Hopkins, who made significant advancements in the field of medicine. Hopkins developed a series of rod lenses that improvised the endoscope's field of view, focal length and magnification, 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 carries out two methods of documentation[7]. A S video camera head is used in the EVS system and the documentation is usually achieved by recording video onto tape or can be 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

The Surgical Operating Microscope was first introduced to otolaryngology around 1950, then later in the 1960s it was used in Neurosurgery, and it came into use in endodontics in the early 1990s[11]. Mostly the microscopes can be configured to magnifications of 40X and beyond but due to the limitations in depth of field and field of view, it becomes impractical to use it beyond this magnification. Fractures, POEs, and canal isthmuses can be readily visualized and treated[12].

**CONCLUSION**

With the introduction of Dental Operating Microscopes and Loupes, many areas of dentistry have adopted them for better patient outcomes. Endodontics has made advancements to enhance the visualization of the surgical field for even the basic procedures like root canal treatment. In this effort, an aided advantage to the operator for better visualization with the use of various magnification devices like surgical microscopes, endoscopes, and magnifying loupes have been added. These are also associated with benefits for the patient in terms of improvement of clinical and radiographic outcomes.

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