Digital photography in endodontics

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Abstract

The current article presents itself as an experimental study on non-biological material, as it will describe, explain and interpret photographic documentation in endodontic practice using the dental microscope.

The purpose of the descriptive research is to develop an updated protocol with practical applicability, easy to use in endodontic treatments and retreatments, on a series of clinical cases.

The material taken in the study is represented by the complementary examinations (digital photographs) of a number of patients undergoing endodontic treatment/retreatment in a dental office where endodontic treatments are carried out under the direct view of the dental microscope.

Keywords: endodontics, dental photodraphy, digital, microscope

INTRODUCTION

Digital photography is an additional method used in case documentation, diagnosis and treatment planning. This technique is based on the use of semi-professional Single Lens Reflex (SLR) digital cameras, which allow the attachment of an auxiliary flash or removable Through the Lens (TTL) lenses (1).

The word dental photography or photography in the context of dental medicine refers to the set of photographic techniques and frames that can be applied in various fields of dental medicine, both in clinical practice and in the fields of research or medical events. Clinical dental photography represents the most effective way of visual communication between doctor and patient, between doctor and dental technician, as well as in the interdisciplinary context. This offers the possibility of self-assessment and control, allowing the highlighting of clinical manifestations (2).

Technological advances in digital photography have had a significant impact on the concept of photography as a powerful means of expression and communication, offering a wide range of perception, interpretation and execution. Photography and dentistry are two interconnected fields, revealing dental and oral cavity defects that would otherwise be overlooked (3).

Post-treatment photos are equally important for critically evaluating treatment results, encouraging professionals to improve their performance. Magnifying the image allows for details that might be overlooked, helping specialists identify potential errors and decide on appropriate solutions. These images can also be used to demonstrate correct procedures, thus representing a valuable tool in the pursuit of excellence in the practice of dental medicine (5).

In terms of benefits, digital technology has changed dentists' perspective on data collection, academics and treatment aspects. Intraoral cameras are available to capture the image of a tooth or oral lesions from different angles in just a few seconds. Therefore, it is recommended to take a complete set of intraoral and extraoral photographs for each patient before and after treatment, together with video recordings of the procedures performed (4).

Aim and objectives

The scientific objectives to be solved within the scientific research are: standardization of an updated work protocol in endodontic practice; familiarizing doctors with digital photographic documentation in endodontic practice; the importance of endodontic doctors' ergonomics in specialized practice, (in cases where modern means of magnification (the dental microscope) are used/helped; listing the advantages of digital photography in endodontic practice: the meaning of documentation and more effective communication between doctor and patient, for self-evaluation to the doctor/tracking the evolution of the treatment, promotion and marketing, medico-legal document); listing the disadvantages of digital photography in endodontic practice: creating, during treatment, additional times for photography.

MATERIAL AND METHODS

The actual experiment will include the photographic documentation of a series of clinical cases of endodontic treatments and retreatments, explaining the conditions, frameworks and norms from which a digital photograph is executed.

The material taken in the study is represented by the complementary examinations (digital photographs) of a number of patients undergoing endodontic treatment/retreatment.

The material taken into account consisted of a series of patients: 93 in number, of which 46 were clinically healthy, 17 had periodontal problems, 19 had heart and respiratory conditions and 11 wore orthodontic appliances.

The experimental study was made up of 58 patients from western Romania, Timișoara, who came to our clinic.

The criteria for the inclusion of patients in the study being the following: clinically healthy, aged between 25-40 years, non-smokers, periodontally healthy, without edentulous teeth

The exclusion criteria of the patients taken into account were: patients with cardiac and respiratory diseases, had periodontal diseases, wearers of orthodontic appliances.

The material used in this research includes a Sony A6000 digital camera and a CJ Optic dental optical microscope.

The CJ Optik dental optical microscope is equipped with the Flexion Advanced system, offering a complete and comprehensive solution that includes a wide range of accessories. This system, available at an economical price, features an integrated, fanless LED source, ensuring pure and bright light for optimal working and shooting conditions. The microscope also features a 5-step apochromatic magnifier (0.4x/0.6x/1x/1.6x/2.5x), ensuring accurate and detailed magnification.

The CJ Optik dental optical microscope has a 30-degree tilt beam splitter and retrograde photo port, offering optimal ergonomics and nearly symmetrical balance. It also features an HD camera adapter compatible with all major manufacturers. The focal lengths and optics have been designed to be perfectly compatible with the most advanced photo-video cameras on the market.

The microscope's VarioFocus system offers a working distance between 210 and 470 mm, and its plano-apochromatic optics ensure superior image quality. The microscope is equipped with an integrated and removable lens protector, providing additional protection and facilitating cleaning and maintenance.

The binocular tube of the microscope can be tilted between 0 and 200 degrees, providing a large range of vertical flexibility for comfortable user positioning.

With the uniquely designed MonoBall coupling, the user can make smooth and easy repositioning at any angle without having to unscrew or re-screw the fastening systems.

The CJ Optik dental optical microscope has an integrated orange filter, which is useful when working with composites. Thanks to the best optical coatings and optimal alignment, the light transmission between the user and the camera is efficient and provides a clear and detailed image.

The microscope rotation plate allows the user to maintain an upright and ergonomic working position while the microscope is angled to the left or right.

Ergonomically placed control handles provide immediate access to all functions, enabling quick inter-procedural changes.

The CJ Optik dental optical microscope benefits from the integration of HDMI, USB, camera AC/DC power, power cable and monitor cables into its arm, providing efficient cable management and superior ergonomics.

The long and stable suspension arm is identical for all wall, ceiling or floor mounting systems.

The Sony A6000 digital camera used in the research offers the advantage of a larger sensor, which translates into high-quality images. The camera's APS-C sensor is 1.6 times larger than that of 4/3 sensors and 13 times larger than that of 1/2.3 sensors, helping to achieve a remarkable level of quality in every image.

The A6000's BIONZ X™ image processor ensures fast data processing, accurately capturing textures, reducing blurred details and eliminating visual noise in certain areas,

resulting in clear, high-fidelity images. These features benefit both still images and video clips recorded with the camera.

The A6000's ultra-fast autofocus makes it one of the most versatile interchangeable lens cameras around. With a focus speed of just 0.06 seconds, you can capture perfect images in any situation, from family events to sporting events or natural landscapes.

The A6000 camera can shoot at a rate of 11 frames per second, allowing you to capture desired moments or expressions with precision and speed.

Full HD 1080 recording at 60p or 24p ensures cinematic quality motion capture in your videos.

The A6000 camera benefits from features such as Auto Eye Focus and Auto Focus Hold, which make it easy to get sharp, well-focused images.

Compared to DSLR cameras, the A6000 is smaller and lighter, offering superior portability and maneuverability. With advanced features and manual control, the A6000 makes no compromises in terms of creativity and photographic performance.

The A6000's Tru-Finder™ OLED electronic viewfinder allows you to plan and preview images. Exposure control ensures proper compensation of brightly lit or dimly lit scenes, and focus zoom allows details to be magnified for more accurate assessment. The display mode presents useful information such as histograms.

RESULTS

In all photographs, the most important features in the stages of photographic documentation are, first of all, the achievement of a professional sanitation by removing tartar, staining and food debris in order to achieve a correct treatment plan and improve the visibility of the remaining hard tissues.

Then, the intraoral focus will always be on the remaining tooth tissue left by the coronal destruction.

Framing will also be achieved by exposing hard tissues and fixed gingiva.

The position of the patient must be horizontal on the dental chair, to facilitate the direct visibility of the microscope, positioned at an angle of 90 degrees with the patient's horizontal.

The magnification of the microscope in the current endodontic photographic documentation was 7.5.

DISCUSSIONS

Therefore, according to the article "Endodontics and the aging patient", written by M Johnstone, P Parashos, the initial digital photograph in the form of preoperative retroalveolar radiographs and the postoperative radiograph in the form of control retroalveolar radiographs are imperative in the realization of a photographic protocol in endodontics (6).

Also, the authors of the article "Endodontic treatment of maxillary lateral incisors with anatomical variations" Moon-Hwan Lee, Jung-Hong Ha, Myoung-Uk Jin, Young-Kyung Kim, Sung-Kyo Kim strongly support taking an intraoral photograph of the access cavity.

Other authors, Hiroshi Kato and Takashi Kamio, find according to the article "Diagnosis and Endodontic Management of Fused Mandibular Second Molar and Paramolar with Concrescent Supernumerary Tooth Using Cone-beam CT and 3-D Printing Technology: A Case Report", that a successful treatment endodontic cannot be done without intraoral photography in the oral cavity with the respective lesion (7).

As in the study "Guided endodontic treatment of multiple teeth with dentin dysplasia: a case report" written by the authors Ralf Krug, Julian Volland, Sebastian Reich et al, in order

to achieve a correct photographic protocol in endodontic practice, digital photography must not be missing in the stage of instrumentation and preparation of the tooth as well as in the stage of definitive obturation of the root canals.

CONCLUSIONS

In conclusion, according to what was presented and documented above, an updated digital protocol in endodontic practice would look according to the scheme below:

Initial digital photograph through an initial x-ray of the studied case (Figure 1); Initial digital photograph of the tooth in the oral cavity with the respective lesion (Figure 2); Digital photograph of the tooth in the stage of making the access road; Digital photography in the stage of instrumentation and preparation of the tooth; Digital photography in the obturation stage of the root canals (Figure 3); Digital photograph in the stage of making the definitive coronal restoration (Figure 4); Final digital photograph of the tooth in the oral cavity after endodontic treatment and adhesive coronal restoration; Final digital photograph by a case control retroalveolar radiograph.

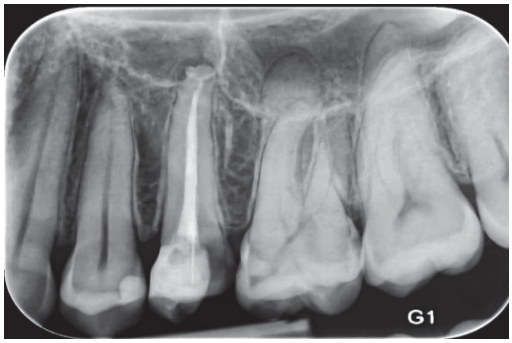

Figure 1. Initial digital photograph through an initial x-ray

Figure 2. Initial digital photograph of the tooth in the oral cavity with the respective lesion

Figure 3. Digital photography in the obturation stage of the root canals

Figure 4. Digital photograph in the stage of making the definitive coronal restoration

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