Comparison of macro lens with normal lens in digital single lens reflex cameras for orthodontic intraoral photographs

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ABSTRACT

Introduction: With the ever-increasing number in adults seeking dental treatment, improvement in esthetics has remained one of the main goals in the treatment objectives. The emphasis has long been on taking study models and radiographs as records, while photographs were often considered as luxury and time consuming. With time, this idea has certainly changed, and photographs were considered important diagnostic records. The aim of the study is to compare the image quality of intraoral photographs taken using the macro lens and normal lens of a particular digital single lens reflex camera.

Materials and Methods: This study includes a questionnaire with 20 image based on multiple choice questions and was distributed among dental undergraduates and postgraduates in the city. The digitized photographs in the questionnaire were assessed based on the quality of photograph, depth of field, reproducibility, brightness, and contrast. The data obtained were then subjected for statistical evaluation. Results: Nearly 64.11% of the total response suggested that both the pictures were taken in a macro lens and a normal lens are similar whereas 24.15% and 11.74% opted for macro lens and normal lens, respectively. Conclusion: Macro lens performs better than normal lens. However, a majority of the study population found no difference between the two photographs taken using normal and macro lens. Macro lens was found to produce more pleasing images in frontal occlusal photographs.

KEY WORDS: Digital single-lens reflex, Intraoral photographs, Macro lens, Nikon, Normal lens, Orthodontic photographs

INTRODUCTION

With the ever-increasing number in adults seeking dental treatment, improvement in esthetics has remained one of the main goals in the treatment objectives. Esthetics is a complicated matter, affected by numerous factors including the subjective judgment of beauty (dependent on the observer’s cultural and psychosocial conditions) and numerous other factors such as the characteristics of the observed scene. People tend to undergo orthodontic treatment due to the desire to look attractive and self-perception of dental appearance. A satisfactory treatment outcome lies in the proper diagnosis and treatment planning for each patient because there are considerable differences between a clinician’s and patient perceptions of dental appearance and need for orthodontic treatment.

The basic orthodontic record taking provides certain diagnostic information that aids a clinician in diagnosing and determining the best possible treatment outcome. The emphasis has long been on taking study models and radiographs as records, while photographs were often considered as luxury and time consuming. With time, this idea has certainly changed, and photographs were considered important diagnostic records.

In the current treatment scenario, a complete set of photographs taken for documentation includes...
extraoral and intraoral photographs, both at the start and end of the treatment and ideal mid-treatment photographs showing the key stages of treatment.[11,12] The ideal characteristics for intra- and extra-oral photography for dentistry and orthodontics, in particular, are a reproducible magnification of the images, good depth of field and consistent, and homogeneous illumination. Ideally, all the above characteristics should be standardized within one series of images, as well as consistent over long periods of time.[13,14] When esthetic treatment to obtain a harmonious smile is performed, clinicians must be careful about imposing his/her own beauty norms on patients.[15]

Single lens reflex (SLR) cameras are more appropriate to take intra- and extra-oral photography which has an added advantage of a viewfinder. In earlier days, in the pre-digital era, cameras were used which had macro lenses attached to the body permanently with a built-in ring flash. Only in the recent times, has the digital SLR (DSLR) cameras become more affordable. Digital photography has the following advantages, namely rapid turn-around, checkable exposure accuracy, no aging of photos, irrelevant to dust and scratches, inexpensive storage, immediate viewing, no film or processing costs, easy duplication, easy retrieval, and highly feasible in the transmission of images around the world.

One of the major disadvantages of using camera with point flash is the shadowing. Several techniques were put forth to eliminate this. Taking photographs from further away might increase the illumination, but will inevitably waste the pixels and focusing will also be problematic. The best way to eliminate this is to use a ring flash.

With an innumerable number of cameras available in the market today, it has left us in a confused situation of which camera to use and what type of lens to use. In this study, we intend to find out if DSLR cameras require a macro lens for orthodontic intraoral photographs.

**MATERIALS AND METHODS**

A sample size of 20 was selected and the subjects were randomly involved in the study. The subjects were informed before the entire study, and an informed consent was obtained. A random sampling methodology was adopted to achieve the sample size. Before the start of the study, ethical approval was obtained from the Scientific Review Board of the University. Every participant was assured that their personal identity was masked during data processing and analysis.

A Nikon D5100 DSLR camera was used to take the photographs. The AF-S DX NIKKOR 18–55 mm f/3.5–5.6G VR lens was compared with the AF-S VR Micro-Nikkor 105 mm f/2.8G IF-ED medium focal length macro lens.

Intraoral pictures (frontal, right, and left lateral views) in occlusion are the photographs considered for evaluation [Figure 1-3]. The procedure was standardized by taking all photographs with a shutter speed of 1/80. The aperture was set at 22 and the ISO at 400. This way, all the photographs obtained were of the same kind. All photographs were taken by a single operator with adequate experience. Operator bias, if any, was eliminated by this means.

The photographs obtained were then sorted, and no further processing was done apart from color corrections by changing the brightness and contrast. An online survey was created with each question carrying three options [Figure 4]. The respondents were asked to choose the best out of the two photographs. A third option that both the images were similar was also included. The images were randomly uploaded and it was separately noted down to derive the results. All the responses were collected and subjected to statistical evaluation.

The data were statistically analyzed using Statistical Package for the Social Sciences (SPSS) for Windows software. Descriptive statistics using percentage and mean were done.
RESULTS

A total of 63 responses were obtained for this study [Figure 5], who were the dental undergraduates and postgraduates. 64.11% of the total response suggested that both the pictures taken in a macro lens and a normal lens are similar whereas 24.15% and 11.74% opted for macro lens and normal lens, respectively [Figure 6].

Comparing the likeliness of photographs within the intraoral photos taken, most of the responders said both the images were similar.

In the intraoral frontal photograph, 58.35% of respondents have said that both the images are similar and 39.6% opted for macro lens photograph and only 8.35% opted for the normal lens photograph. In case of both the right and left lateral intraoral images, though only 11% and 2.8% opted for normal lens photos, a majority of people said that both were similar. They were 70.83% and 65.26% for the right lateral and left lateral intraoral images, respectively. The remaining 16.6% and 31.9% chose photos taken in the macro lens [Figure 7].

DISCUSSION

The findings of this study indicate that the experts might find the images taken using a macro lens more appealing compared to a normal lens. Images taken using normal lens also had consistent results. However, most respondents have ranked that both the images taken using a normal lens and macro lens are similar. When comparing individually between the frontal, right lateral, and left lateral images, macro lens was found to produce more pleasing results in frontal occlusal photographs compared to the right and left lateral images.

Image quality might be affected not only by the sensor size but also by its technology, resolution, pixel depth, and several other factors. Even the size of a sensor might be both advantageous and limiting at the same time: Smaller sensors record fewer details, whereas the peripheral image might be distorted in broader sensors. Moreover, it is possible to standardize the photographs taken using a particular camera. The shutter speed, focal length, and ISO are the three key elements in obtaining a picture of the required quality.

Focal length or aperture of a camera controls the amount of light entering the lens. A fully opened aperture is denoted by the smallest (f/stop) number and a smaller aperture is denoted by the larger (f/stop) number. The choice of aperture affects the depth of field of a photograph. In very simple terms, the depth...
of field refers to the amount of the image that is sharp. If you use a wide aperture, the depth of field will be shallow. That is only a part of the image is sharp and the rest will be out of focus or blurred. The depth of field is deep when a narrow aperture is used. That is, when the depth of field is deep, all of the photograph from foreground to background is sharp.

The amount of light entering the image sensor is proportional to the shutter speed. That is, the shutter speed or exposure is the amount of time that the camera sensor is exposed to the light. When the exposure is set high or low, the images obtained could be overexposed or underexposed accordingly. If the photo has turned out too dark (underexposed), the exposure might be increased by one or two to make it brighter. Conversely, if the image is overexposed, it might be decreased by a stop or two.

The ISO refers to how sensitive the digital sensor in your camera is to light. The digital sensor is less sensitive to light if the ISO is low. Setting a higher ISO number increases the sensitivity of your camera sensor to light. The higher the ISO used, the more digital noise will be present in the image. The image quality is affected by the appearance of grains in the image due to the higher ISO.

Ring flash is considered the universal flash system for general macrophotography.[16,17] The ring flash tube surrounds the lens, resulting in a circular-shaped shadow zone surrounding the subject. The light completely surrounds the optical axis and is generally slightly in front of the lens so that it eliminates all shadows. The specular or mirror-type reflection created by this type of flash tends to eliminate shadows in the image. The advantage of this flash system is that objects in the oral cavity can be evenly illuminated without shadows. This system furnishes either a single ring flash tube or individual sector flash tubes.

Although the main goal of dental imaging has been documentation, as the population has been relying increasingly on digital file sharing, dental practice might depend more and more on the quality of digital images. One of the concerns of patients or dentists might be the beauty of the images, regardless of the technical qualities of the image. Patients might mostly seek esthetic improvement, and other clinicians might judge one’s work primarily based on esthetic factors. Therefore, more appealing digital dental images might be considered a clinical advantage.

The previous study by Seyed et al. compared the digital camera sensors and smile esthetics. According to the results of their study, image quality affected the perception of smile beauty and a full-frame sensor produced consistently better results over half-frame and compact sensors.[18]

The quality of photographs taken by orthodontists, professional photographers, and orthodontic auxiliaries was compared in a study conducted by Jonathan et al. according to the result of that study, orthodontists produced significantly more good-quality intraoral photographs.[19]

The current study like any other had few limitations. The sample size could have been higher and the respondents could have been made more specific pertaining the orthodontic fraternities. Within the limitations of the study, further conclusions were drawn.

CONCLUSION

Macro lens performs better than a normal lens. However, a majority of the study population found no difference between the two photographs taken using a normal and macro lens. Macro lens were found to produce more pleasing images in frontal occlusal photographs.

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