

Original Article

EFFECT OF USING IMAGE STANDARDIZATION DEVICE FOR DENTAL PHOTOGRAPHY STANDARDIZATION IN COMPARISON TO INDIVIDUALIZED PHOTOGRAPHY: IN VIVO STUDY

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Abstract

Aim: This randomized clinical trial aimed to evaluate the effect of Image Standardization Device (ISD) on standardization of clinical images from the same entry point (patient right 45°). Other studies discussed standardization from a different point of view regarding the standardized patient head position and fixed camera/patient distance using various devices slightly resembles the ISD used in this study.

Subjects and methods: The methodology of the current study included a total of twenty patients, photographed with ISD taking duplicate photographs and using individualized photography as a control group via conventional Tripod from the same photography point at 45° from the patient's right side to study the effect of the image standardization device in photograph standardization over conventional imaging methods. The Intervention used in this study was bleaching that was done before taking the same photographs once again from the same projections to reproduce the same images using both methods. The assessment was done by measuring in millimeters the horizontal and vertical measurements of the canine in each patient by using a ruler tool on digital software and comparing them with the reference standard which was the canine's real measurements.

Results: The results of this study showed no statistically significant decrease in the ISD group regarding the mean canine horizontal measurement while there was a statistically significant increase in the same measurement in the Tripod group after the treatment. Meanwhile, both groups showed a statistically non-significant difference in mean canine vertical measurements after treatment. On the other hand, there was no statistically significant difference between both groups in mean canine horizontal and vertical measurements before and after bleaching. In the terms of change, both groups showed a statistically significant difference in mean canine horizontal and vertical measurements, as the ISD group showed lower change than the Tripod group.

Conclusion: This study concluded that ISD is capable of producing perfectly standardized images each time they're taken by the device from the same position and entry point with minimal effort and time consumption, while the Tripod resulted in standard but yet not perfect photographs.

Keywords: replication, pictures, documentation

I. INTRODUCTION

Photography in modern dentistry is fundamental in Examination, diagnosis, and treatment planning. During the treatment phase it is essential in measuring progress and monitoring the treatment outcomes.

Photography in dentistry has several applications including but not limited to case documentation for legal purposes, diagnosis and treatment planning, patient education and communication, forensics, communication and consultation between specialists, laboratory communication, marketing and advertising.

II. REVIEW OF LITERATURE

There have been several attempts for image standardization in modern dentistry in order to replicate position, distance, orientation and quality of images produced for accurate assessment.

According to Weinla'nder et al., 2009., in order to obtain standardized and reproducible data in oral photography, three primary requirements must be met: standardized and reproducible patient positioning, standardized and reproducible camera positioning, and standardized as well as reproducible mirror positioning for data collection mostly in premolar and molar regions. The patient is seated, and his head is placed in a head holder. A chin rest supports the chin. In order to establish these relations, a novel apparatus for standardized intraoral photography has been developed namely the circumferential rail guide.

The study by Han et al., 2010, demonstrates that it is vital to establish the standard head position in standardized clinical photography because it is impossible to reliably identify landmarks with the head in a resting posture, particularly when considering the lateral perspective. In this work, the standard head posture was established using a cephalostat.

Ahmed et al., 2020, attempted to replicate photography setup through setting two flashes

positioned 45° in front of the patient with a flash ratio of 1: 2 and a third flash to illuminate the background, which is normally neutral sky blue or grey, a conventional clinical portrait set-up and made it reproducible by fixing their positions and relation to each other and to the tripod position.

III. MATERIALS

Tripod: for standardizing the camera position. It consists of three movable poles which were fixed on the floor at certain marks for re-positioning, with a standing base for camera fixation. The camera was then placed at 42 cm far from the patients at 45 degrees. The Tripod poles were fixed on pre-determined marks on the floor in a position similar in height, distance, and entry point at 45 degree on patient right side to camera position on the Image Standardization Device (ISD)

Professional camera : The model used in this study was Canon EOS 5D Mark II, with a macro lens.

Image Standardization device (ISD): A device used to stabilize patient position to the camera and standardize their relation. The standardization is acquired by fixing the patient's head in a certain reproducible position. It also reproduces the camera's distance, position, and orientation to capture different views and angles.

Image standardization device is composed of following components:

Head rest, to keep the patient's head rested on the dental chair and it carries the whole body of the device.

Semi adjustable nose piece, guided by the glabella of the nose.

Semi adjustable earpieces with horizontal and vertical adjustable scaled rods to replicate the patient's head position using a pointer to the inside of the patient's auditory meatus.

Chin rest that stabilizes the patient's head orientation, it also holds an extended camera arm that is free to move in a 180 degrees movement to produce 5 different positions (0, 45, 90, 135, 180 degrees).

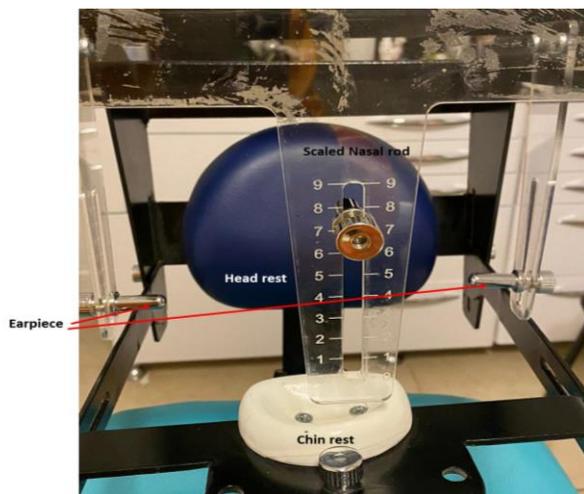


Figure (1): Frontal view of ISD

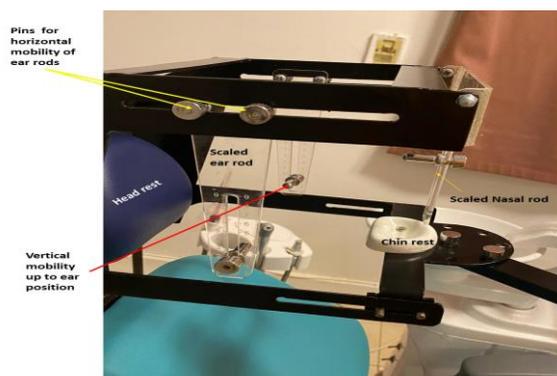


Figure (2): lateral view of ISD

Study Design

The randomized clinical study utilized duplicate photographs taken using the image standardization device (ISD) Control photographs were taken at 45O angle from the patient's right side using individualized photography using a tripod and also by using the image standardization device (ISD) from the same distance and photography point.

Intervention then was done by taking the same photographs one more time from the exact same projections to reproduce the same photographs using

both methods after bleaching treatment was performed. The final second set of photographs were used for assessment by measuring horizontal as well as vertical measurements on the canine tooth for each patient and comparing them with the reference standard that was the canines' real measurements. Measurements were measured in millimeters by using a ruler tool on the digital software.

Data was fed to the computer and analyzed using IBM SPSS software package version 20.0. (Armonk, NY: IBM Corp). The Kolmogorov-Smirnov test was used to verify the normality of distribution Quantitative data were described using range (minimum and maximum), mean, standard deviation and median. Significance of the obtained results was judged at the 5% level.

The used tests were:

- Student t-test: For normally distributed quantitative variables, to compare between two studied groups.
- Paired t-test: For normally distributed quantitative variables, to compare between two periods.

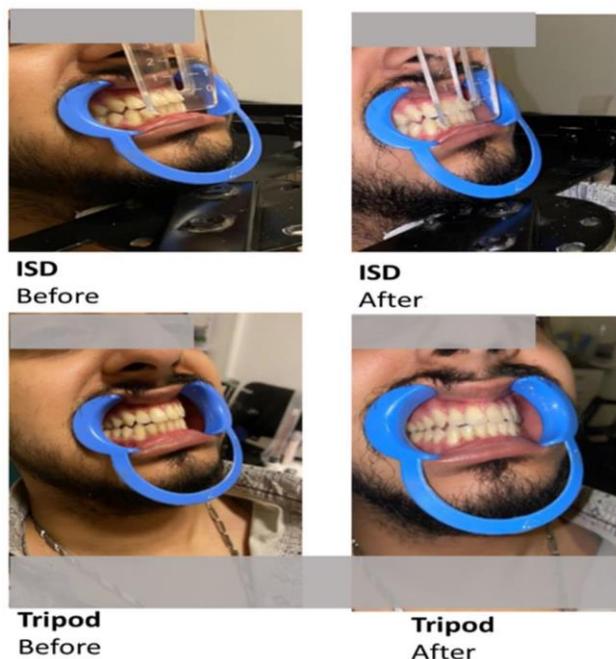


Figure (3): two sets of images taken using ISD and tripod

IV. RESULTS

a. Horizontal measurement

Comparison between the different time periods in each group according to canine horizontal measurement in millimeters: The different time periods in each group according to canine horizontal measurement in millimeters in ISD group showed a statistically non-significant decrease in mean canine horizontal measurement (mm) measurements after treatment. While the tripod group showed a statistically significant increase in mean canine horizontal measurement (mm) measurements after treatment.

b. Vertical Measurements

Comparison between the different time periods in each group according to canine vertical measurement in millimeters: Both groups showed a statistically non-significant difference in mean Canine vertical measurement (mm) measurements using the ISD in comparison to significant difference in both groups using the tripod.

V. DISCUSSION

Dental practice compared to any other health profession, has benefited from the trends and developments in digital photography. A well-designed dental photography procedure could make a substantial contribution to the field of dentistry. Digital records can be applied for numerous objectives, such as therapy evaluation, patient records, patient counselling, medicolegal applications, patient counselling, and marketing. Consequently, a proper dental photography protocol can be of great service to a dental practice. Obtaining high-quality, reliable clinical pictures is simple with the proper equipment and skilled personnel. A thorough understanding of all the potential faults in extra- as well as intra-oral clinical photography can raise the likelihood of producing high-quality photographs. (Abhilasha et al., 2016)

Meanwhile, it is essential to avoid positioning errors; both the doctor and the patient must be positioned correctly and in a standardized manner in order to create consistent images. All occlusion features must be visible, and regions of interest must not be concealed by hair, clothing, saliva, or impression material. Therefore, retractors were utilized to increase the field of view and permit uninterrupted focusing on it (Abhilasha et al., 2016). When there is a height difference between the patient and the physician, positioning issues may also arise, and it may be impossible to obtain a uniform background since the images may appear to be taken from above or below the patient (McKeown et al., 2005). By understanding the origin and effect of such errors, difficulties may be handled with far more professionalism (Schaaf et al., 2006).

Standardized protocols of documentation include equipment, settings, angles, distance, backdrops, and editing. In the current study, tripods were used and compared to ISD to ensure that the camera was exactly at eye level to ensure verification of reproducible positions. This also ensures that there aren't any subtle angular changes in the way the dentist holds the camera, which can easily spoil any composition without the dentist even noticing it (Davda and Pasquali, 2020). Moreover, According to Paiva et al., 2019, who examined the standardization of face pictures (front, left profile, right profile, and submental oblique view) of patients with cleft palate and lip, departures from standardization can lead to erroneous conclusions. In order to acquire reproducible and high-quality photos, it is vital to standardize lighting, equipment, and patient placement.

Due to the difficulty to continuously retain the head during photography, distortions may appear in the captured image. When the head is somewhat lifted (10% above FH), the forehead and nose can appear shorter; a straight nose can appear to have an inclination of the nasal bone; and also, the chin, even when little, can appear somewhat protruding. The upper and lower lips may appear longer, while the

upper lip's vermilion can appear smaller. Such a protruding posture of the jaw gives the appearance of mandibular prognathism when the head is tilted backward; a similar distortion in the opposite direction might occur when the head is slightly depressed.

As a result, the nose may appear longer, the top and lower lips may appear shorter, and indeed the upper lip vermilion may become more prominent. Because of the fact that the width of the nose is a horizontal measure, it is less susceptible to distortion caused by vertical head movement.

As a result, the width of the nose varies relatively little depending on the position of the head. With the head tilted forward, this position of the lower jaw (mandible) emphasizes the dominant retrognathic appearance of the profile in the lateral view. The movement of the head in the frontal shot also impairs symmetry, creating the impression of facial asymmetry.

The camera should preferably be positioned on a stand so that all images are taken from the same distance. When the line from the central lens to the eyes is perpendicular to the horizontal plane and also the lens is centered between both eyes, the camera is situated in its ideal position (Tripathi et al., 2011).

In a different study by Casaglia et al, the principal investigator was responsible for capturing all photos of the trial, to minimize variations between individuals. However, based on a survey of Angle Society of Europe members, 60% of orthodontists took their own clinical images, 35% allocated the task to an auxiliary, as well as 5% hired professional clinical photographers, and the majority of the photographs taken by all three groups were deemed to be of high quality (Casaglia et al., 2016). Although the obtained photographs were of high quality, it is never guaranteed to avoid discrepancies and image distortions in dimensions when using a freehand photography method without using a proper positioning device.

This study was conducted to limit the deviation that takes place while capturing dental photographs without using a method or a device to standardize the captured photos to ensure reproducibility and avoid actual dimension discrepancies, which can be compared over a period of time. Images that follow these standards will be useful for accurately diagnosing, documenting, and monitoring our cases. They will be a valuable resource for education and research and will also be useful as a part of the library of images for future references. Thus, comparable images are considered a fundamental requirement of any clinical photo-documentation.

VI. CONCLUSION

The ISD is proven to be a reliable device in image standardization in regards to size variance. In order to further improve image standardization using the ISD, light fixation is advised be added to the device as with measurable light intensities in order to be able to standardize light sources and help assess color and shade variations as well.

Conflict of interest:

No conflict of interest.

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Ethics:

This study protocol was approved by the ethical committee of the faculty of dentistry- Cairo university on: 27May2015, approval number:15-7-21.

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