Original Article

Camera Housing for Intraoperative Photography

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Background: Intraoperative photography features key aspects of surgical procedures. However, out-field personnel are usually requested to take photos with a surgeon-owned camera, without acknowledgement of correct surgeon-needed perspectives. The present study presented a waterproof camera housing case that could be sterilized and host a camera in surgical field. Surgeons take better photos themselves with shorter time spent.

Objective: To capture good intraoperative photos with a camera housed in a sterile case without any complications.

Materials and Methods: Fifty photos from twenty patients were taken. Two photos were taken per one visual aspect, one in-field photo from the surgeon who owned the camera, applied in the sterile camera housing case (Group 1), another photo from out-field personnel (Group 2). Both photos were shot with the same camera (Nikon P310) and the same settings with a fixed point of focus. Photo quality, time consumed for each photo taken and the out-field personnel's satisfaction rate for intraoperative photography were compared. The time consumed for application of the camera into the case was also recorded.

Results: The mean application time until the camera was completely sealed was 36.30±5.25 seconds. Photo quality rate, from two blinded raters, was significantly higher in Group 1 (p-value=0.00). Less time consumed for each photo taken was found in Group 1 (p-value=0.00). Out-field personnel's satisfaction rates were higher when the surgeon took intraoperative photos himself in Group 1 (p-value=0.00). There was no surgical site infectious complication in all patients in the present study.

Conclusion: A sterile camera housing case, adapted from a waterproof case for underwater photography, could be used for intraoperative photography. Then, good intraoperative photos with less time consumed were achieved without any surgical site infections.

Keywords: Camera housing; Intraoperative photography

J Med Assoc Thai 2021;104(Suppl.5): S98-102
Website: http://www.jmatonline.com

Plastic surgery specialty is highly visible and relies on accurate representation of form, as well as function, to diagnose, plan, treat, evaluate, and track patient's surgical outcomes. As the value of images increases over time, photography is not an only useful, documentary, collaborative, didactic, medico-legal, a research tool and even promotional – it is standard of care and a sine qua non for proper practice in plastic surgery[1].

Along with pre- and postoperative documentations, intraoperative imaging may feature key aspects of the surgical procedure[1]. However, intraoperative photography is quite troublesome; the out-field personnel would be requested to take some photos but, at that moment, they might be busy, unavailable, or concentrating on something more important. The surgeon's camera is, again, problematic to them, as there is a variety of camera models; more time must be taken to master all the applications. After all these time-consuming processes, most photos, taken by others with their concern whether they might potentially contaminate the operative field, were not good and satisfied in the surgeon's perspective, in terms of, photo angle, focus and magnification.

This article presents a sterile camera housing case used for intraoperative photography, adapted from a waterproof camera case for underwater imaging. During the procedure, the surgeons could take patient's photos themselves with familiarity of their own cameras, within a shorter time, to achieve the good and satisfying intraoperative images.

Materials and Methods

This study was approved by Human Research Ethics Committee, Faculty of Medicine Ramathibodi Hospital, Thailand (MURA2013/447).

From June to October 2013, we took 50 intraoperative photos of 20 patients. Two photos were taken per a particular body part with two consecutive shots, from the same compact camera (Nikon P310, Nikon Corp., Tokyo, Japan), with a fixed point of focus and same camera settings; one from a single in-field, camera-owner surgeon (SD) with a sterile housing case covering his camera and another from the out-field personnel (circulating nurses, residents, or medical

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How to cite this article:

Dumrongwongsiri S, Chatdokmaiprai C. Camera Housing for Intraoperative Photography. J Med Assoc Thai 2021;104 (Suppl.5): S98-102

doi.org/10.35755/jmedassocthai.2021.S05.00085

students). There were 25 photos by the surgeon (Group 1) and another twenty-five by other personnel (Group 2), from 20 patients (Figure 5 to 8).

We used a waterproof camera case (DiCaPac WP-ONE, DiCaPac, Kang Won Do, South Korea, Figure 1 to 3), designed to fit our camera model, sterilized by 3m™ Steri-Vac™ EO Gas Sterilizer (3m, St. Paul, Minnesota, USA, Figure 4) using ethylene oxide (EO) at 55 degrees Celsius, to house the in-field camera. After the camera was applied in the case, we put them under water to make sure there was no leakage in the system. Afterward, the surgeon (SD) could take in-field photos himself, as he knew which part should be included in the photos, as well as, proper zoom in/out magnification and angle, in completely sterile conditions.

The objective results in this study were the photo quality rated by two blind non-plastic surgeon medical doctor raters, used a rating scale (1 for very poor to 5 for very good), the time consumed for each photo taken and the out-field personnel satisfaction rate of intraoperative photography (1 for unsatisfied to 5 for very satisfied), compared between two groups. We also study the application time of the sterile housing case until the camera was waterproof.

Statistical analyses were conducted using SPSS version 18.0 (SPSS Inc., Chicago, Illinois, USA). All experimental data was expressed as mean±SD. We used the paired t-test for nonparametric variable (time) and the Wilcoxon signed rank test for categorical variables (quality and satisfaction rates). Values of $p<0.05$ were considered statistically significant.

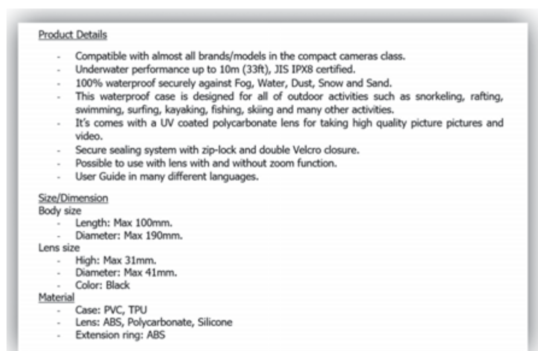
Results

The mean application time (Table 1), until the camera was sealed, was 36.30±5.25 seconds. The mean time consumed for each photo taken in group 1 (with housing case) was 22.59±3.39 seconds, statistically significantly less compared to 45.84±3.75 seconds in group 2 (without housing case), p-value=0.00.

The mean quality rate (Table 1), by two blind raters, in group 1 was 4.30±0.47 from five-rating scale compared to 2.90±0.85 in group 2. The quality rate was significantly better in Group 1, p-value=0.00.

The out-field personnel satisfaction with surgeon's intraoperative photography (Table 1), was 4.65±0.49 when the surgeon took intraoperative photos himself with the sterile housing case (Group 1), compared to 2.30±1.03

Figure 1. DiCaPac WP-one underwater camera case.



Product Details

- Compatible with almost all brands/models in the compact cameras class.
- Underwater performance up to 10m (33ft), JIS IPX8 certified.
- 100% waterproof securely against Fog, Water, Dust, Snow and Sand.
- This waterproof case is designed for all of outdoor activities such as snorkeling, rafting, swimming, surfing, kayaking, fishing, skiing and many other activities.
- It's comes with a UV coated polycarbonate lens for taking high quality picture pictures and video.
- Secure sealing system with zip-lock and double Velcro closure.
- Possible to use with lens with and without zoom function.
- User Guide in many different languages.

Size/Dimension
Body size
- Length: Max 100mm.
- Diameter: Max 190mm.

Lens size
- High: Max 31mm.
- Diameter: Max 41mm.
- Color: Black

Material
- Case: PVC, TPU
- Lens: ABS, Polycarbonate, Silicone
- Extension ring: ABS

Figure 2. The product details, size/dimension, and material of DiCaPac WP-one case.

Figure 3. After the camera case was applied for intraoperative photography A) without the lens cover, B) With lens cover, C) Posterior view with lens cover.

Figure 4. 3m™ Steri-Vac™ EO Gas Sterilizer (www.3m.com).

Figure 5. A left thigh in a patient, as a donor site for anterolateral thigh flap, after the flap was harvested. Left, a photo from the in-field camera with sterile case. Right, a photo from the same body part by out-field personnel, with swab, assistant surgeon's foot and a chair wheel included.

Figure 6. After the flap was inset. Left, a photo from infield surgeon with sterile camera housing case. Entire face and neck incisions can be seen with a better comparison of the flap's skin color with surrounding normal facial skin. Right, a photo from out-field personnel.

Figure 7. A patient with left-sided alveolar cleft in his maxilla underwent alveolar bone graft. This photo was from the in-field surgeon using a sterile camera case.

when they had to use the surgeon's camera to take photos from the out-field (Group 2). The out-field personnel satisfaction rate was statistically higher in group 1, p-value=0.00.

Discussion

The first principle of photography as a medical record is to document the pre- and postoperative condition of the patient, serving as an accompaniment and function analogous to radiography, CT scans, nuclear imaging, or magnetic resonance imaging. Preoperatively, the record is a guide in the evaluation of the anatomy and demonstrating aspects of physiologic function for tissues like the nose, eyes, mouth, and hands. Postoperatively, images record changes for patient teaching, self-evaluation for retrospective review and assessment of results vis-a-vis planned outcome[1]. Systematic image collection and evaluation improve the surgeon's awareness. Reviewing photographs with a patient may transform the preoperative planning from an interaction tilted one way from the doctor to the patient. Instead, the effort may be collaborative and consultative, an interaction between the doctor and the patient. The image serves to refresh the memory of the surgeon. In addition, it is critical for patients to understand excesses and deficiencies of tissue, issues of symmetry[2]. Patient teaching requires proper photographic representation, which may facilitate or hinder surgical planning, influence choices in surgical approaches, affect risks of complications, and enhance patient satisfaction.

Maintenance of proper images which are consistently and systematically be evaluated can only improve awareness of surgical choices and outcomes. Building a digital database and engaging in periodic data mining is a core component of self-improvement in clinical care. Information density in images is an order of magnitude greater than the written word[1]. The increased use of imaging would improve learning and documentation.

Figure 8. A photo of a patient's left leg before skin grafted. This photo was from out-field personnel. A trash bin was included in this photo.

Intraoperative imaging may feature key aspects of the surgical procedures[1] and findings, which can be reviewed with patients for what we are going to do or what we have done for them. Medical students, residents, including other medical personnel such as nurses, could do medical study using intraoperative photos or, even, videos. Nevertheless, intraoperative photography is quite troublesome, unlike pre- or postoperative photography which is usually taken by the surgeons themselves. The out-field personnel, attending to something more critical most of the time, with different skills in photography, is asked to take the photos with an unfamiliar surgeon's camera. There is a wide variety of camera models in the market with different usage guides; so, learning to use each surgeon's cameras is problematic, dissatisfying, and time-consuming. The photos taken from each personnel have a vary widely in quality; most are not good enough in terms of point of view, magnification, and angle. There might be some unnecessary objects or artifacts included in a photo that would diminish the image quality.

In 2001, Galdino et al[3] recommended some key principles in plastic surgery photography. Some of their principles were using the same camera, the same shutter speed and aperture. Along with these principles, this study presented efficient intraoperative photography using a sterile camera housing case, adapted from a waterproof case for underwater photography. As the objective results (time, quality, and satisfaction), it was significantly better if the surgeon could take intraoperative patient's photos himself. It consumed less time for each photo taken; despite the little time spent for the application of camera case (mean, 36.3 seconds), it saved about 23 seconds per photo compared to the other personnel's shot. The photo quality (Figure 5 to 8) was better, and more sophisticated, to be a precious mine of database for the surgeon as good photos could be presented and reflected the surgeon's hard work. The last objective parameter, the out-field personnel's satisfaction, showed they

Table 1. The overall objective results, housing application time, time consumed for each photo taken, photo quality and satisfaction of the out-field personnel

	Range		Mean	SD	p-value
	Min	Max			
Application time in Group 1 only (second)	28.10	45.40	36.30	5.25	
Time per photo (sec)					0.00
Group 1	18.4	30.2	22.59	3.39	
Group 2	39.8	52.6	45.84	3.75	
Quality					0.00
Group 1	4	5	4.30	0.47	
Group 2	2	4	2.90	0.85	
Satisfaction					0.00
Group 1	4	5	4.65	0.49	
Group 2	1	4	2.30	1.03	

were more satisfied with the reasons mentioned above.

The waterproof case (Figure 1 to 3)[4] used in this article was made mainly from polyvinylchloride (PVC), thermoplastic polyurethane (TPU), polycarbonate and silicone, with its melting point around 100 to 260 degrees Celsius. So, we could use the 3m™ Steri-Vac™ EO Gas Sterilizer (Figure 4)[5] with 55 degrees Celsius, ethylene oxide gas (EO) without any degradation on these material bases. The case was waterproof after sealing a zip lock and double layers of Velcro as we had tested by putting the system (camera and case) under water without any leakage.

We heartily emphasized the usefulness of sterile camera housing case for intraoperative photography as; the uppermost of all, there were no surgical infection complications in all patients in this study.

Conclusion

A sterile camera housing case, adapted from a waterproof case for underwater photography, could be used for intraoperative photography. Then, good intraoperative photos with less time consumed were achieved without any surgical site infections.

What is already known in this topic?

Overtime, intraoperative photography becomes more and more important for patient education, surgical training, and medico-legal issue. Good quality photos, from the surgeon perspective, are needed to fulfill these objectives.

What this study adds?

Intraoperative photos could be taken by the surgical team with the camera housing equipment under sterile condition.

Acknowledgements

The authors would like to thank Wijittra Matang, BSc, BPH for data collection and statistical assistance.

Potential conflicts of interest

The authors declare no conflict of interest.

References

1. Kinny BM. Photography in plastic surgery. In: Neligan PC, editor. Plastic surgery. 3rd ed. London: Elsevier Saunders; 2013. p. 104-23.
2. Chavez AE, Dagum P, Koch RJ, Newman JP. Legal issues of computer imaging in plastic surgery: a primer. Plast Reconstr Surg 1997;100:1601-8.
3. Galdino GM, Vogel JE, Vander Kolk CA. Standardizing digital photography: it's not all in the eye of the beholder. Plast Reconstr Surg 2001;108:1334-44.
4. Waterproof case. DicaPac-wp-one (Internet). 2021 (cited 2021 Sep 22). Available from: https://www.digital2home.com/product/housing-dicapac-wp-one/.
5. 3M™ Steri-Vac™ Sterilizer, 1 Door GS8-1D (Internet). 2021(cited 2021 Sep 22). Available from: https://www.3m.com/3M/en_US/p/d/v000212700/.