



Coconut shell as skin barriers for colorectal cancer survivors with ostomy

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Abstract

Ostomy bag is a pouch highly needed by the ostomate to collect the liquid leaking out of the stoma, seen in skin barrier. This is essential for preventing peristomal skin irritations, known to be one of the most common ostomate complications. The current cost of a standard appliance is relatively expensive, especially for patients with low income. Therefore, it is necessary to create more affordable and less risky alternative tools, e.g., coconut shell, as against those commonly used in Indonesia. This study used quasi-experimental design with basic time series (n=8). Therefore, The Studio Alterazioni Cutanee Stomali (SACS) Instrument was adopted for the analyzing and classifying the degree of peristomal skin irritation. The data collected were then examined by experts, through picture documentations obtained using the Digital single lens reflex (DSLR) camera equipped with zoom lens EF-s18-55 mm, on day 1, day 3 and day 7 after the attachment of coconut shell skin barrier. The result indicated the absence of peristomal skin irritation experience in most of the respondents, while clinical evaluation using SACS Instrument, showed erythema symptoms on the skin area, which suggests irritation. It is possible to adopt coconut shell as a reference alternative tool for ostomate. This tool has the advantage of minimizing the potential risk of peristomal skin irritation, compared to others used in Indonesia, alongside the better cost effectiveness, accessibility, and reusability.

Keywords: Coconut shell, Colorectal cancer, Skin barrier, Ostomy, Survivors

1. Introduction

Peristomal skin complications (PSCs) are one of the common challenges encountered during stoma creation. This is known to appear between 2 weeks to 3 months post-surgery [1,2] and sometimes after 2 years [3]. The most common type of damage causing irritants include erosion, maceration, erythema, and chemical dermatitis [4], and the highest percentage of the PSCs among another stoma formed is ileostomy [5]. These complications often result from the leakage of liquids, including alkaline and digestive enzymes into the ileostoma output, subsequently destructing the epidermis layers and the acid mantle covering of the skin from external factors.

Peristomal skin complications have also been initiated at times when the intestinal ostomy bag is removed, therefore, causing skin exfoliation [6], changes in the function of skin barrier, and subsequently trans-epidermal water loss [7]. These disruptions trigger over hydration, because excessive fluid evaporation is related to skin dryness, and eventually exfoliation, and further instigate discomfort and pain for the ostomate [8]. Therefore, skin surrounding the stoma area has to be clean, dry and prevented from exposure to other objects. Also, the peristomal and other abdominal skin areas ought to be maintained under similar conditions [8]. This consideration is important, in order to protect against possible irritations resulting from ostomy bag leakage.

The approach towards prevention and management of complication is a critical component of stoma care. Furthermore, nurses are expected to play a good role by maintaining the health/condition of the peristomal skin and also provide comfort to the ostomate [4], in order to sustain the quality of life [9]. Some preventive methods include using the proper ostomy bag specified for the abdominal skin type and contour [10]. This is then supported by additional equipments, comprising of adhesive removers, barriers creams, barrier films, filler paste, seals, protective powder, protective paste as well as collars [7], and also through the provision of proper stoma care [11].

In addition, the presence of peristomal skin complications on ostomates is considered a crucial problem, and is known to cause broader implications in the aspect of life [12], and also in health and economics, based on the care cost estimates [13].

The majority of ostomate patients in Indonesia are underprivileged with low income, making it difficult to afford the expensive cost of ostomy bag and the other recommended accessories. Moreover, the weekly cost of a single standard ostomy bag ranges from Rp 50,000-Rp 150,000 (similar to USD 5-15), which is not cost-effective, and this is often provided only one time after the surgery by insurance. Therefore, subsequent provision is the patients responsibility, hence the need for innovations or alternatives, particularly for the intestinal ostomy bag and also the skin barrier with possess similar function and characteristics. These substitutes ought to highlight and ensure efficiency, effectiveness, and affordability, using more accessible and reusable materials, with minimal side effects, and also more comfortable during use. The chemical composition of coconut shell consists of lignin (29.4%), pentosans (27.7%), cellulose (26.6%), moisture (8%), solvent extractives (4.2%), uronic anhydrides (3.5%) and ash (0.6%). Furthermore, the cellulose and lignin components are not immunogenic to skin and are also capable of moisture sorption, needed to maintain dryness and closure. Budipramana (2007) reported on the possible application as an ostomy skin barrier, because of the high tendency to ensure adequate desiccation at all times [14]. Recently, especially in Indonesia, the majority of ostomate patients with low income have adopted the use of plastic bags made from polyethylene as a feces pouch, typically attached using paper double tape. However, some modifications and other alternatives are also applied to achieve cost-effectiveness. Studies on these possible approaches are limited, and the products are expected to be more efficient and effective in terms of cost, accessibility, and complications risk minimization.

2. Materials and methods

2.1 Study design and setting

This was a quasi-experimental research with basic time series design. In addition, consecutive sampling was applied in sample determination, based on the inclusion criteria of >21 d - 6 months post-surgery, and age range of >18 years. Conversely, the exclusion criterion include the nonappearance of sign and symptom related to peristomal skin irritation, and also the absence of any records on other chronic diseases. A total number of 8 respondents were then selected.

2.2 Measurements

The initial data was obtained using the SLR Canon EOS 60D camera, with zoom lens EF-s18-55 mm, and also through the benefitting assessment instrument of "SACS" (The Studio Alterazioni Cutanee Stomali/Study on Peristomal Skin Lesions). This has previously been tested for content validity in numerous countries, and an index of 0.94 was obtained [15]. Furthermore, the application in assessment and classification of peristomal skin lesion is divided into two steps: (1) measure the level of severity (L1-L5; L1 Hyperemic Lesion, L2 Erosive Lesion, L3 Ulcerative Lesion, L4 Ulcerative Lesion and L5 Proliferative Lesion), and (2) ascertain the topographical location, following the peristomal quadrant (TI-TV). The SACS Instrument was selected based on simplicity, clarity and relevance to the study needs.

2.3 Data Collection

This research was conducted from February-June, 2013 at Dr. Moh Hoesin Hospital of Palembang, South Sumatera, Indonesia. The data obtained from observation were then compiled through The SACSTM Instrument, documented using digital camera, and subsequently analyzed by expert to identify indications of peristomal skin complications. Prior to research admission, the participants had to be clarified for the absence of stoma and peristomal complications. Therefore, patients with skin irritations according to the assessment, were excluded. The experts include 2 Enterostomal Therapy Nurses (ETN) employed for the validation and measurement of data, using the SACS Instrument .

The participants were also enlightened on the methodology of using, attaching, and cleaning the coconut shell skin barrier, and it was also possible to ask any further questions for better clarification during difficulties. Therefore, daily visits were conducted to observe and ensure the use of coconut shell. In addition, each patient was provided with 6 sets of coconut shell skin barriers, alongside plastic bag, ostomy belt and glue gun. The subjects as well as other family members were also taught the technique used to prepare the coconut shell skin barriers. This enabled the respondents to change and replace used materials, and the old ones were then cleaned and sun-dried for at least 7 h. Furthermore, they were also trained on how to replace the skin barriers in cases of broken plastic bags.

The treatment instruments used in the research include coconut shell, ostomy belt and the measure for stoma size. In addition, the coconut shell was characterized by an outer circular shape, measuring 8-10 cm in diameter, and a hole (the inner diameter) was made at the center, adjusted to fit and not to tighten the stoma (with excess of 2-3 mm). The shell was then sun-dried for 7 h or heated in an oven at a temperature of 1300 °C for 20 min. This process was conducted to reduce the water mass, and permit an increase in absorption level, up to 15-20 g/20 h after attachment to the peristomal area (15). Therefore, the plastic ostomy bag and coconut shell skin barriers were tightened using a portable and washable ostomy belt, constructed using cotton, and layered with thick soft sponge.

Prior to the coconut shell attachment, the stoma size was measured using the measuring guide, and then prepared to fit the diameters of 35, 44, 50, 60 and 70 mm (or else, the respondent's stoma is adjusted).

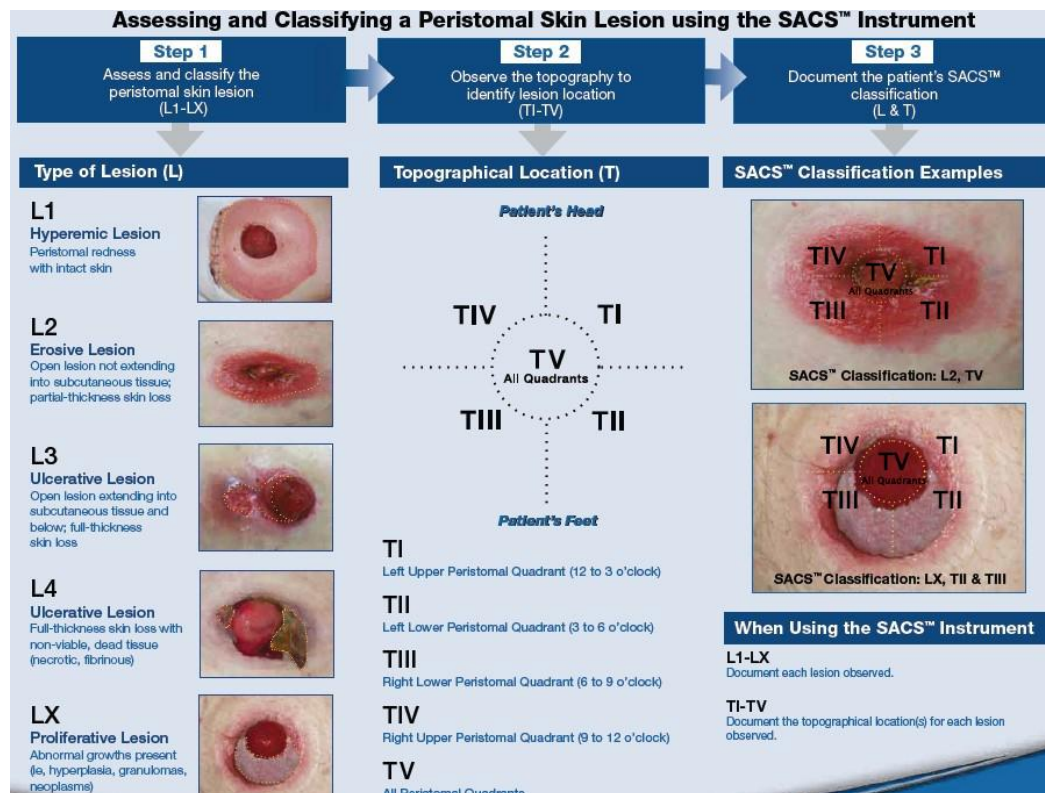


Figure 1 The SACS instrument for assessing peristomal skin irritation.

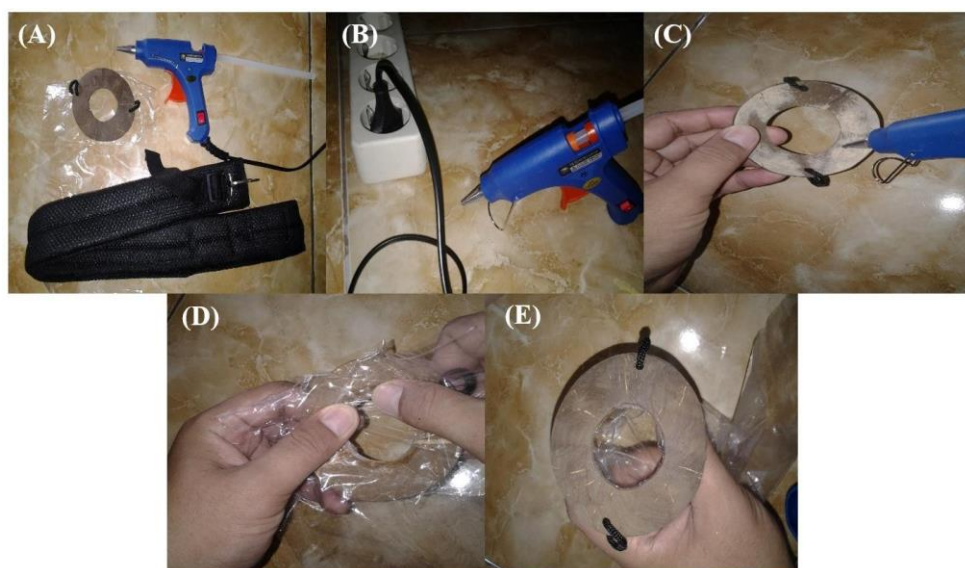


Figure 2 Preparing the coconut shell skin barriers to use. (A) Preparation, (B) Turn on the glue gun, (C) Spread the glue gun around the inner circle, (D) Patch with plastic and (E) Tear the plastic following the inner circle.

2.4 Data Analysis

The analysis result benefitted the frequency distribution approach, and the outcomes were categorized as occurrence and non-occurrence of peristomal skin irritation. Therefore, observation were conducted on day 1, 3 and 7 after attaching the coconut shell skin barrier by collecting pictures of the affected area. These were subsequently sent to the experts (2 ETN) for validation, and examination on the possibility to experience complication, both before and during the research, using the SACS Instrument.

3. Results

3.1 The characteristic of the demography

The results show some respondent characteristics, where the individuals had an average age of 44 (SD: 13.59), including 5 women. Furthermore, all participants had stoma colostomy with elective surgery, 7 people had normal BMI, and most were undergoing chemotherapy (7 respondents) and radiotherapy (1 respondent).

Table 1 The characteristic of the demography of respondents.

Variabel	Mean	Median	SD	Min-Max	95% CI
Age	44	44,5	13,59	21-62	32,64 – 55,36
Characteristics				f	%
Sex		Male		3	37.5
		Female		5	62.5
BMI=Body Mass Index		< 18,5		1	12.5
		Normal 18,5-22,9		7	87.5
Type of stoma		Colostomy		8	100
Type of surgery		Elective		8	100
Therapy		Chemotherapy		7	12.5
		Radiotherapy		1	87.5

3.2 Peristomal Skin Irritation

The results showed the absence of peristomal skin irritation in most patients, while 2 respondents experienced mild erythema.

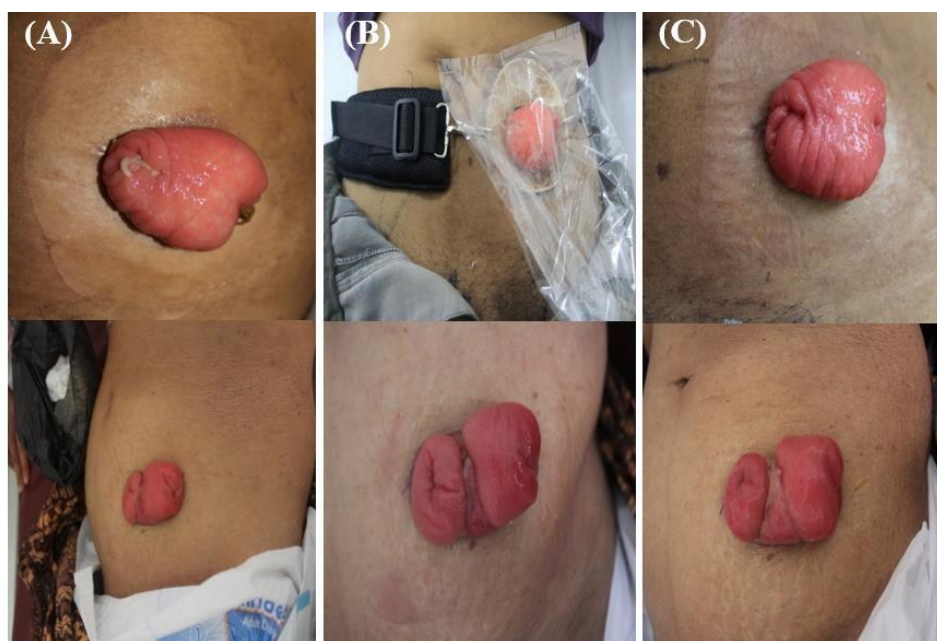


Figure 3 1st, 3rd and 7th days observation of peristomal skin irritation. (A) 1st day (no irritation), (B) 3rd day (no irritation) and (C) 7th day (no irritation).

Table 2 Observation of peristomal skin irritations at 1st, 3rd, and 7th day.

Coconut shell as skin barriers	Day					
	1 st		3 rd		7 th	
	frequency	%	frequency	%	frequency	%
Not Irritations	8	100	6	75	6	75
Irritations	0	0	2	25	-	-

4. Discussion

Colorectal cancer patients with stoma have a 2.6-3 times greater risk of experiencing peristomal complications [3,10]. This is an incident faced by up to 80% sufferer with ostomy. In addition, irritant contact dermatitis was recognized as the the most significant form (15.5%), often caused by exposure to chemical irritation from feces and another supplementary components of the bag [16].

A good peristomal skin condition is shown from the appearance, which is expected to be unaffected by the ostomy bag and also intact without any redness [17]. The results show the presenc of erythema in 2 respondents during the use of coconut shell skin barrier, measured by the experts, using the SACS Instrument. Following the study ethics, both patients were excluded from the research and subjected to the appropriate treatment. These participants experienced the irritation in L1 (hyperemia lesions: peristomal redness with intact skin), although the erythema remained mild through the study period. Furthermore, peristomal skin irritation is reduced by substituting the pouch with standard ostomy appliances suggested by the experts, maintaining cleanliness in the area, and some respondents applied warm water and 0.9% NaCl solution. This remedy is in accordance with the statement of Seungmi et al., (2011), where cleaning involved the use of warm water [18], non- perfumed soap [19], mild baby soap, and , followed by drying, especially when there are adhesive leftovers in the affected area [20].

The coconut shells skin barrier were replaced in the morning and evening, after bathing. This process was performed on an average of 3 times a day, with a standard deviation of 6.4, and remnant is then washed again and sun-dried. Budipramana (2007) reported on the relatively high absorption ability of the coconut shells, at 34.44 mg/cm² within the first hour. However, this value decreases over time, up to the 20th hour, as the maximum limit is attained. Furthermore, the drying process takes about ± 7 h under direct sunlight without clouds, while an oven set at 130 °C attains the original condition of the shell within 20 min. Also, a maximum time frame of 9-12 h was recommended for daily use.

A total of 2 participants (have had stoma >9 weeks) experienced peristomal skin irritations, and the skin type as well as sensitivity were identified as an influencing factor. Moreover, the coconut shell expected to serve as an alternative instrument to the standard artificial stoma bag, based on the adjustments to achieve low risk, despite the possibility of allergies complications. Standard skin barrier is categorized as effective and good for use, although some influencing factors include: being manufactured by stoma equipment factories, possibility of irritation risk, allergy reaction to the flange material, the ability to cause contact dermatitis and restriction when sweating [21]. Budipramana (2007) reported on the relative effectiveness as a barrier for perileustoma skin damage level, compared to the plastic material [14], hence the possible efficiency in less risky colostomy procedure. This phenomenon is due to the shells' main component, including cellulose, hemicellulose and lignin. These are carbohydrate varieties known to demonstrate resistance towards digestive enzyme hydrolysis, and are also not immunogenic to the skin. In addition, the three constituents are insoluble fibers characterized by the capacity to form bonds with water, and subsequently generate absorption power in the material. These compositions also restrain the digestive system proteolytic enzymes, hence facilitating the use of coconut shell as a skin barrier.

The results show some respondents undergoing chemotherapy and radiotherapy cycles, which possibly impacts on the condition of patients with ostomy. Nagano et al., (2019) reported on the need for chemotherapy patients to obtain peristomal moisture-associated skin damage (MASD) [22] because of the ability to increase skin irritation risk. This is due to the possible inhibition of cell division, resulting from the decline in skin barrier function, hence the consequent failure in cell regeneration. In addition, radiotherapy is a local approach towards cancer management, while chemotherapy is more systemic, leading to some disorders, e.g., dry skin. This condition is also influenced by other factors, including: low humidity environment, poor fluid intake, age and the use of irritants (antiseptic soap). Based on the analysis, chemotherapy patients with stomas demonstrate greater risk of experiencing skin irritation, because of the cancer remedy inhibits cell division, and also reduces the skin barrier / barrier function. In addition, the fluid used tends to remain in the body for 4-6 h post-administration This is subsequently ejected in the stool, and potentially cause peristomal skin irritation.

The coconut shell skin barrier used was convex in shape, which according to [23] is used by 16% of ostomate, while ¼ of ileostomates was reported by Redmond, Cowin & Parker (2009) [24]. The aim of using a convex pattern was to accentuate the stoma, prevent leakage, and serve as a safe tool without exerting intense pressure [25]. Furthermore, the material is expected to confer pressure around the stoma, in order to prevent leakage, and

then the convex surface reaches into the bottom of the stoma to facilitate accentuation. The flexible characteristics enable it to fit and attach properly during movements [26]. Stipulating the following features of convex ostomy bag products: comfortable to use, long lasting, prevent leakage and irritation, and also save time as well as cost. Furthermore, some similarities in functions were recognized between the coconut shell skin barrier and the convex ostomy bag, however, despite the respective differences in convex curve, which cause varied reaction towards the ostomates. Furthermore, the participants expressed displeasure with the strong pressure provided on the body direction, which prompts painful sensations while sleeping and moving. In agreement, Hoeflok & Purnell (2017) also reported effects related to comfort, resulting from pressure or stiffness in movement during used [27]. However, Carllson et al., (2016) reflected on the possible superiority of convex ostomy bag, using a stoma height of ≤ 5 mm [28].

Coconut shell skin barrier requires the use of a belt to hold and apply pressure. This practice was reported by Cronin (2005) as safer and more useful [23], although it is important to provide information regarding the compulsory use of elastic belts, which is not tight enough to leave marks on the stomach surface [25]. Furthermore, the belt adjustment process is ascertained by the possibility of freely placing one hand between the belt and the skin. Also, holes are created in each tip of both shell sides, as a place for attachment, to achieve a firm hold and prevent movement. However, too much pressure is applied on the stoma and stomach areas when the arrangement is too tight, subsequently causing pain and itch.

The hole diameter is created with similar dimensions as the stoma of the respondent. This was in the form of a circle, with sizes ranging from 30 mm up to 60 mm, and is also expected to not cause strangulation. William, et al. (2010) reported on the tendency for overly larger sizes of skin barrier to trigger skin irritation, while the smaller ones prompt the incidence of stoma constriction, and necrosis ensues sometimes [4]. Therefore, the ideal size is estimated at 2-3 mm larger than the stoma of respective patients, using similar shapes, usually circular or oval [38]. The skin barrier size was expected to not exceed 1/8 inch of the stoma. Meanwhile, the diameter used by respondents were enlarged by about ± 2 mm to avoid stoma strangulation, by ensuring the product is not too tight. However, the gradual reduction in stoma size, was followed by adjustments in the hole dimension.

Despite the good absorption capacity of the coconut shell, observations show the presence of dry and hard surface. Therefore, respondent with sensitive and dry skin are confronted with an increase in the risk factor of irritation, due to possible friction and reactions. In addition, the shell pH was identified as another contributing factor, as a decline in water content elevates wood acidity. The pH of human skin is in medium base category, spanning from 4.2 to 5.6, hence interactions possibly lead to acid-base neutralization reactions, consequently forming salt and water. Therefore, the increase in the alkalinity or basicity of materials in contact with skin leads to greater difficulties in the neutralization process. Despite the water composition of 8%, and limited knowledge on the coconut shell pH, the possible reaction with skin is unknown. In addition, the drawbacks reported during use include the poor flexibility and the challenges faced while adjusting to the stoma condition.

Based on the result, coconut shell skin barrier demonstrated characteristics needed for possible application by ostomate. This is observed from the aspects of effectiveness, efficiency, cost, and risk minimization against peristomal skin complication, compared to other alternative instruments used in Indonesia, despite the numerous trigger factors. However, preventive actions are perhaps conducted by ensuring the use of good and appropriate stoma appliances and treatment.

5. Conclusion

This study shows the possibility of using coconut shell as skin barrier for ostomate, featuring a minimum risk of peristomal skin irritation, affordable price, comfort during use, and also high accessibility. However, some considerable factors include the dissimilar curve shape, stiffness and inability to follow the body movements during activities. This product is recommended as a cost-effective skin barrier alternative with relatively lower risk comparing to other ostomy appliances. The nurses awareness towards the patients' condition is increased, subsequently instigating the development of better comfort during the use. Also, it is necessary to have a review with stakeholders, clinicians, NGOs (Non-Government Organizations) and survivors, focused on the possible application. This ought to be conducted during hospital or home treatments, by providing information regarding the use of alternative ostomy bag, with similar effectiveness. The results recommend future researches to evaluate the coconut shell thickness considered to be effective in the achievement of maximum water absorption. Also, it is important to determine the number of times the saturation point is possibly reached, as well as the most efficient degree of convexity.

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7. Ethical considerations

The study was approved by the institutional review board, Faculty of Nursing, University of Indonesia (approval No. 52/H2.F12.D/HKP.02.04/2013), and the government hospital of dr. Moh. Hoesin, Palembang, South Sumatera, with approval No. Lb.02.03/II.1.3/001/2013. Furthermore, all respondents were well-informed of the study objectives and implementation process, and participation was based on personal free will, and under the premise of guaranteed confidentiality. This was followed by signing an informed consent form to certify involvement, and the researcher took full responsibility of respondents' recovery in cases of peristomal complications.

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