

## The effect of gel foam mattress use during total hip replacement surgeries on the development of pressure ulcers in the recovery unit: a quasi-experimental study

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### Abstract

**Objective:** This study was conducted on patients undergoing total hip replacements in order to examine the effect of the use of a gel foam mattress during surgery on preventing the development of pressure ulcers.

**Material and Method:** A quasi-experimental design, with a pretest-posttest control group, was used for this study, which was carried out in the Orthopedics and Traumatology Clinic of the Adnan Menderes University Research and Treatment Hospital between July 2015 with 80 patients who were to undergo total hip replacement surgery (40 in the experimental group and 40 in the control group who were to undergo total hip replacement surgery and April 2016).

**Results:** According to the research results, 30% of the patients in the experimental group and 60% of the patients in the experimental group developed pressure ulcers in the recovery unit ( $p=0.013$ ). It was further observed, according to the results of Braden Pressure Ulcer Risk Assessment Scale (BPURAS), that the type of pressure ulcers in the patients who developed them was stage 1 and located in the gluteal region.

**Conclusion:** Our results have been shown that the development of pressure ulcers in patients from both the experimental group and the control group in the recovery unit was related to age, operating time (min), anesthesia type, while height, weight, gender, diagnosis, temperature of operating theater. However, movement restrictions before surgery have not an impact on the development of pressure ulcers.

**Keywords:** pressure ulcer, total hip replacement, nursing care

### Introduction

Total hip arthroplasty is a major surgery that is performed as a result of pain caused by avascular necrosis, ankylosing spondylitis, and proximal femoral fractures. During this operation, the risk of pressure ulcers developing is high due to the long period of time patients remain on the operating table (1). For patients who are at risk of developing pressure ulcers, the American Nurses Association recommends the use of a support surface that provides a balanced distribution of body weight on the operating table during surgery (2, 3, 4). As the use of gel positioners is one of the methods that can be used to prevent this risk, it is important to conduct research on the effectiveness of gel positioners in preventing the risk of pressure ulcers from developing after lengthy surgical procedures, such as total hip arthroplasties.

The Minnesota Hospital Association (2013) recommends that evaluations on the development of pressure ulcers in the operating theater be conducted by focusing on the following factors: operations that last longer than two hours (such as cardiac, vascular, trauma and transplantation surgeries), patients who have a body mass index of less than 19 or greater than 40, patients who are confined to bed or wheelchair or otherwise unable to change position, patients who previously experienced pressure ulcers, and patients who develop a skin rash.

The development of pressure ulcers in the operating theater is often caused by improper positioning, incomplete support, insufficient protection, the wrong use of positioning tools, or prolonged bodily pressure placed on patients when they are on the operating table for a long time (5).



The incidence of pressure ulcers in patients who have had surgery varies between 4 and 38% (6, 7). According to research in Turkey, the frequency of pressure ulcers developing in patients who have had surgery is 54.8%, while the overall rate of pressure ulcers is 7.8% (8). The occurrence of pressure ulcers in hospital may cause prolonged hospitalization and patient care and higher treatment and care costs, and lead to increased mortality (8, 9, 10, 11).

There are various studies in the literature on the use of gel positioners during major operations. It has been shown that using gel positioners is more effective than using other support surfaces (12, 13, 14). However, further research is still needed on the use of gel foam mattresses and other support surfaces used to prevent the development of pressure ulcers from occurring after undergoing surgical procedures in operating theaters. The aim of this research was thus to investigate the effect of gel mattresses during total hip replacement surgery on the prevention of pressure ulcer development.

## Materials and Methods

This study was conducted using a quasi-experimental design and included a pretest-posttest control group. The research was carried out on patients undergoing total hip replacement surgery by an orthopedic surgeon in the Orthopedic Trauma Operating Room of the Orthopedics and Traumatology Clinic of the Adnan Menderes University Research and Treatment Hospital in Aydın, Turkey between July 2015 and April 2016.

### Participants

The study sample included a total of 80 patients, 40 of whom were placed in the experimental group and 40 in the control group. This study sample was derived from a patient population of 112, which included those who were older than 45 and who had a body mass index of between 18 and 40. It was originally determined that 45 patients, whose operations had already been scheduled, would be placed in the control group and 67 in the experimental group (Figure 1). Informed consent forms to participate in the study were obtained from all patients constituting the population. To determine the sample for the study, the minimum number of individuals to investigate was calculated using the G-Power program, based on the criteria specified by Defloor et al. (2000). The following results were obtained: domain size=0.637, margin of error ( $\alpha$ )=0.05, and power ( $1-\beta$ ) = 0.80. Owing to the fact that this research was a master thesis and that gel positioners were purchased at a late date, the control group's data were collected some time before the experimental group's, and the groups were not able to be randomized.

### Data Collection Tools

For the total hip replacement operations performed on the experimental group patients, gel positioners (183x51 cm in size) were placed onto a standard operating table. The American brand, ACTION gel positioners, which have optimal sensibility and are designed to reduce friction, were used. The gel positioner features a base supported with gel

layers and filled with viscous foam, and it has concave corners and sides.

Standard operating tables without gel positioners were used for the control group patients. The standard operating table features a polyurethane molded cushion atop a stable, compact bed.

Research data were collected using the Braden Pressure Ulcer Risk Assessment Scale (BPURAS) and the Pressure Areas Risk Assessment Form (PARAF). Age, gender, height before surgery, weight, diagnosis, duration of hospitalization before surgery, nutrition and mobility before surgery, period of not eating before surgery, fecal or urinary incontinence, dehydration or edema, laboratory tests, and medication taken for chronic diseases were determined by a question form prepared by the researchers after examining the literature(15, 16, 17, 18).

The BPURAS has six sub-dimensions: detection of stimulus, humidity, activity, motion, nutrition, and friction and irritation. The sum of the sub-dimension scores is the total score, which ranges between 6 and 23. A total score of 12 points or below is evaluated as high-risk, 13-14 points as moderate risk, and 15-16 points as low-risk. In people older than 75, a score of have 15-18 indicates to low risk (19).

Body pressure areas in the lateral, supine, and sitting positions were identified with PARAF. Assessments of pressure areas according to body position were made and then marked on the form (20).

To confirm content coverage and face validity of the questionnaire, expert opinions of 8 faculty members working in the field of Surgical Nursing were taken, and the structure of the questionnaire was rearranged in line with their suggestions. In addition, to improve the intelligibility and applicability of the questionnaire, a pilot study of the questionnaire was conducted with 10 patients who had total hip prosthesis to identify questions that were difficult to understand. Based on the results of this pilot study, the questions identified to be confusing were edited to improve their comprehension. The PARAF form was filled out through face-to-face interviews conducted with the participants.

### Study Design and Data Collection Procedures

The research had to begin with the selection of patients for the control group, as there was an unexpected delay in the purchase of gel mattresses. This delay prevented randomized selection of experimental and control group patients.

For the operations performed on the experimental group patients, gel positioners were placed on standard operating tables for the entire duration of the surgery. Once the operation was completed, the patients were transferred to a recovery unit, where they were placed in a supine position. The body areas – according to the location (right-left lateral) of the area operated on – touching the operating table were then examined for pressure ulcers by observation and palpation. In cases of any signs of pressure ulcers in the pressure areas, the areas where these signs were seen were marked on the PARAF. If any pressure

ulcers had in fact developed, where and what stage they were at were indicated on both the BPURAS and the PARAF (19).

Body pressure areas in the lateral, supine and sitting positions were identified with PARAF. Assessments of pressure areas according to body position were made and marked on the form (20).

### Ethical Considerations

Permission to conduct the research was obtained from the Aydın Adnan Menderes University Research and Treatment Hospital in August 2015. The research protocol was approved by the Ethics Committee for Clinical Research and Counseling of the Adnan Menderes University Medical Faculty. Prior to the study, information about the study, including the freedom to withdraw from the study at any time, was given to all participating patients, and their verbal and written consent to participate in the study was received.

### Statistical Analyses

Research data were analyzed via the SPSS (Statistical Package for Social Sciences) program for Windows 18 SPSS (Inc., Chicago, IL, USA). Descriptive statistics, the Mann Whitney U test, Chi Square test, Kruskal-Wallis test, and Wilcoxon test were used to evaluate the research data. Normal distribution of variables was tested with the Kolmogorov-Smirnov test. The significance level of the results was set at the  $p < 0.05$  level, with a 95% confidence interval. The dependent variables of the research were the recovery unit and the development of pressure ulcers after surgery, while the independent variable was the gel positioner (15, 16, 17, 18).

### Strengths and Limitations

The fact that only volunteer patients were involved in the study and that the research was conducted at only one hospital, within a specific period of time, were the primary limitations of this study. Secondly, as another limitation, data were restricted to being collected within the period of time set for the master's thesis.

Lastly, some of the experimental patients in the study were hesitant to participate, as they expressed concern over the cost of using gel positioners and were worried that the gel foam mattress could be harmful for them.

### Results

The socio-demographic and surgical characteristics of the patients in the study are given in Tables 1 and 2, respectively. Patients in the experimental and control groups were determined to have similar characteristics.

In 30% of the patients in the experimental group and in 60% of the patients in the control group, pressure ulcers developed in the recovery unit. Patients in the experimental and control groups who developed pressure ulcers had Stage I pressure ulcers in the gluteal region (Table 3).

According to the results of the study, there was a significant difference in the BPURAS mean scores of all subdimensions in the preoperative and postoperative periods. More specifically, the mean postoperative BPURAS scores were observed to have decreased for both the control and experimental groups (Table 4).

When the results were examined, a statistically significant difference was found in the average ages of patients who had developed and those who had not developed pressure ulcers ( $p = 0.002$ ). The average age of the patients who developed pressure ulcers in the recovery unit was higher than that of the patients who did not develop pressure ulcers (Table 5).

Furthermore, the results of the study showed that there was a statistically significant difference in pressure ulcer development based on operating time, type of anesthesia, and presence or absence of a rash ( $p = 0.026$ ). Patients with a longer operating time were determined to have a higher rate of developing pressure ulcers. Patients who received epidural anesthesia were observed to have developed pressure ulcers 58.3% more of the time in the recovery unit. Other categorical variables used in the study were not found to be statistically significant ( $p > 0.05$ ) (Table 5).

**Table 1. Descriptive Characteristics of Patients in the Control and Experimental Groups**

Characteristics	Experimental (n=40)	Control (n=40)	p
Age/Range	65.5/48.75-69	62/49.25-68.75	-0.535/0.593
BMI(Body Mass Index), n (%)			
18.5-24.9 kg/m <sup>2</sup>	5 (12.5)	12 (30)	3.660/0.160
25-29.9 kg/m <sup>2</sup>	25 (62.5)	20 (50)	
30-39.9.kg/m <sup>2</sup>	10 (25)	8 (20)	
Gender, n (%)			
Female	18 (45)	21 (52.5)	
Male	22 (55)	19 (47.5)	0.655
Have Chronic Disease, n (%)	11 (27.5)	7 (17.5)	0.645/0.422
Have Anemia, n (%)	11 (27.5)	7 (17.5)	0.000/1.000
Smoking Cigarettes, n (%)	1(2.5)	5(12.5)	0.3230.201

**Table 2.** Characteristics of Control and Experimental Group Patients in Surgical Period

Characteristics	Experimental (n=40)		Control (n=40)		p
	X±SD	Range	X±SD	Range	
Preoperative Hospitalization Duration (days)	1	1-2	1	1-7	-2.037/0.042
Operating Time (min)	150	140-170	170	150-189	-2.895/0.004
Average Temperature of Operating Theater (°C)	19.2	18.6-19.75	19.3	18.4-19.8	-0.270/0.787
Operating Humidity (%)	65	65-75.5	67.5	65-71.5	-0.991/0.322
Type of Anesthesia					
Spinal, n (%)	14(35)		5(12.5)		
Epidural and Spinal, n (%)	24(60)		27(67.5)		<b>0.018</b>
General	2(5)		8(20)		

**Table 3.** Diagnosis of Pressure Ulcer in Post-Operative Recovery Unit

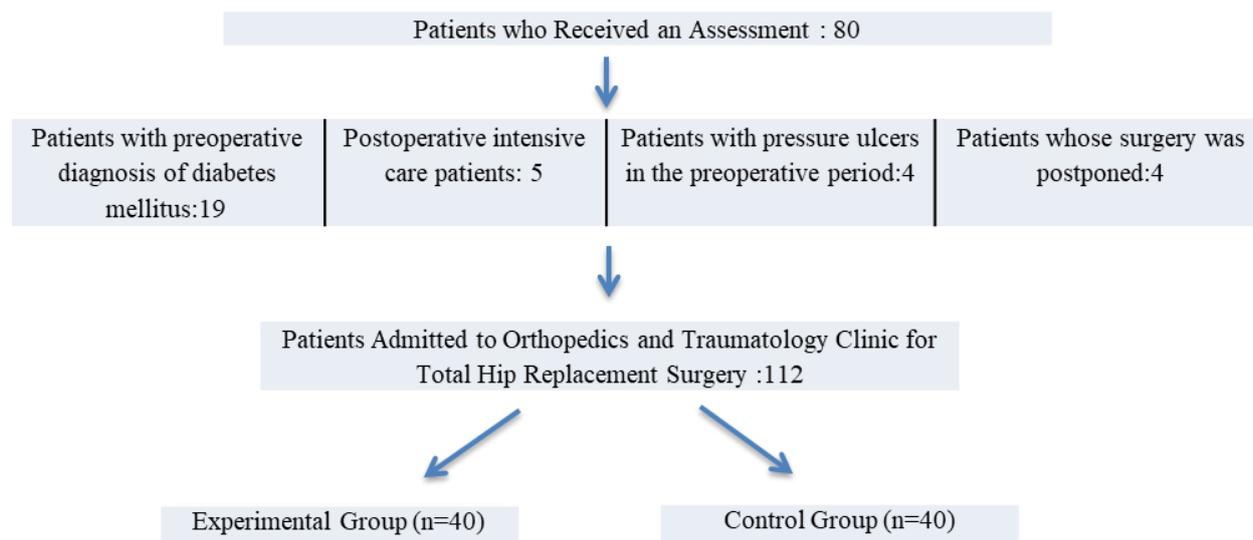
Diagnosis of Pressure Ulcer in Post-Operative Recovery Unit	Experimental (n=40)	Control (n=40)	p
Positive, n (%)	12 (30)	24 (60)	6.111/ 0.013
Negative, n (%)	28 (70)	16 (40)	

**Table 4.** Comparison of BPURAS Scores Obtained by Patients in the Experimental and Control Groups in Pre-Operative and Post-Operative Periods

	BPURAS Preoperative Mean Score (X±SS)	BPURAS Postoperative Mean Scores (X±SS)	p
Control Group (n=40)	20 ±19.425	18±17.825	-4.573 < <b>0.001</b>
Experimental Group (n=40)	20 ± 19.400	18±17.925	-3.807 < <b>0.001</b>

**Table 5.** Relationship between Socio-demographic data and Surgical Period Characteristics of Patients who Developed Pressure Ulcers in the Experimental and Control Groups

Sociodemographic Characteristics	Patients Who Developed Pressure Ulcers in the Recovery Unit (n=36)		p
Average Age, n (range)	67 (59.25-73)		-3.060/0.002
Height(cm), n (range)	161.5 (157-170)		-1.367/0.172
Weight(kg), n (range)	73.5 (67-85.75)		-0.504/0.614
Gender			
Female, n (%)	21 (58.3)		1.759/ 0.185
Male, n (%)	15 (41.7)		
Preoperative Hospitalization Duration (days), n (range)	67.5 (65-75.75)		-0.864/0.387
Operating Time (min), n (range)	170 (150-192.75)		-2.603/0.009
Average Temperature of Operating Theater (°C), n (range)	19 (18.4-19.6)		-1.358/0.174
Operating Humidity (%), n (range)	67.5 (65-75.75)		-0.864/0.387
Restriction of Movement Before Surgery, n (%)	Positive	18 (50)	0.147/ 0.702
	Negative	18 (50)	
Type of Anesthesia, n (%)	Spinal	6 (16.7)	9.866/0.007
	Epidural+Spinal	21 (58.3)	
	General	9 (25)	
Smoking Cigarettes, n (%)	1 (2.8)		0.168/0.215
Have Chronic Disease, n (%)	8 (22.2)		0.000/1.000
Anemia, n(%)	10 (27.8)		4.944/0.026
Body Mass Index (BMI), n (%)	18.5-24.9 kg/m <sup>2</sup>	12(30)	-0.523/ 0.601
	25-29.9 kg/m <sup>2</sup>	20(50)	
	30-39.9 kg/m <sup>2</sup>	8(20)	



**Figure 1.** Flow Diagram of the Patients

## Discussion

This research, which was conducted to examine the effect that the use of gel foam mattresses has on the development of pressure ulcers during hip replacement surgery, concluded that the use of gel foam mattresses decreases the risk of pressure ulcers after operations. This conclusion is important insofar as it shows that the development of post-surgical pressure ulcers, which extends the period of hospitalization and care required, increases the cost of treatment and care, and also increases mortality, is a problem that can be mitigated through the use of gel positioners.

The factors responsible for increasing the risk of patients developing pressure ulcers following surgery should be examined in detail and precautions should be taken to address them (14, 21).

There are studies in the literature that have focused on the use of gel pads to prevent pressure ulcers in the preoperative and postoperative period (2, 3, -13, 14, 21). However, only a limited number of studies have been conducted on the use of gel positioners during operations and its effect on pressure ulcer development.

According to the study results, a statistically significant relationship exists between patients who developed pressure ulcers in the recovery unit and patients who had anemia ( $p=0.026$ ). Among the patients who contracted a skin rash in the recovery unit, 28% developed anemia. In the results reported by Jerusum et al. (1996) in their study evaluating patients who had cardiac surgery, using BPURAS, anemia and the inability to change position after the surgery were related to the development of pressure ulcers. A similar study by Totur (2006), which also used BPURAS, reported that 100% of the experimental group patients and 20% of the control group patients who developed pressure ulcers had anemia (22, 23).

When the relationship between the factor of operating time and incidences of pressure ulcers for patients in the control and experimental groups was analyzed, it was observed that the average operating time for patients with pressure ulcers was 170 (150-192.75) min, while the average operating time for patients who did not develop pressure ulcers was 150 (140-170) min (Table 5). In the study conducted by Hoshowsky and Schramm (1994), it was reported that patients whose surgical operation duration was between 150-240 min developed tissue damage. Schultz et al. (2005), in their study on patients undergoing surgical procedures, the prevalence of pressure ulcers was determined to be 26.6%. Furthermore, Chalian and Kagan (2001) indicated in their study, which involved 39 patients who were separated into an experimental and control group, that the patients who developed pressure ulcers had longer operating times; the study by Schoonhoven et al. (2002) involving patients who were undergoing surgery indicated that as operating time extended, the risk of developing pressure ulcers increased; and finally, Karadağ and Gümüşkaya (2005) reported in their study that patients with an operating time of 180 min or longer had a higher risk of developing pressure ulcers than that of patients with an operating time of between 120-180 min (7, 24, 25, 26, 27). From these results, including those found in the present study, it can be concluded that as operating time extends, the risk of developing pressure ulcers becomes greater, owing to the prolonged period of time patients are unable to change their position and the higher amount of time their body parts are exposed to pressure.

The results of the present study found that 60% of the control group patients and 30% of the experimental group patients developed pressure ulcers in the recovery unit. This suggests that the gel positioner-supported operating tables, as compared to standard operating tables, resulted in the reduced number of pressure ulcers seen in the experimental group patients. A number of studies in the literature support

this finding, in suggesting that the use of support surfaces in the operating theater decreases the risk of developing pressure ulcers (28, 29, 30, 31, 32).

## Conclusion

The results of the present research showed that pressure ulcers developed less often in the experimental group, and that compared to the standard operating table, the gel positioner-supported operating tables were more effective in decreasing pressure ulcer development. It is recommended that further studies, similar to that of the present, be performed with larger sample groups in order for the results to be generalizable.

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**Author's Contributions:** Planning the research: **BS, RC**; collecting data: **BS**; analyzing data: Can Türkiş; preparing the research report: **BS, RC**.

**Ethical issues:** All Authors declare, Originality and ethical approval of research. Responsibilities of research, responsibilities against local ethics commission are under the Authors responsibilities.

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