



The effect of different patient education methods on quality of bowel cleanliness in outpatients receiving colonoscopy examination



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ABSTRACT

Aims: To investigate the effectiveness of an educational film intervention on the quality of bowel cleanliness of outpatients receiving colonoscopy examinations and also to understand the related factors affecting bowel cleanliness.

Method: This is a quasi-experimental design. One hundred four patients in the experimental group and 114 patients in the control group are the participants in this study. An 8-minute “Preparation for Bowel Cleanliness” educational film was made based on clinical experience and references to related literature. We adopted a valid Aronchick scale evaluate bowel cleanliness.

Results: The patients in the experimental group had significantly better bowel cleanliness compared to the control group (80.8% vs. 48.2%, $p < .001$). Logistic regression showed that the experimental group, gender, and experience with colonoscopy were potentially important factors that may affect bowel cleanliness.

Conclusions: The “Preparation for Bowel Cleanliness” educational film provides simple and easy-to-follow methods for the preparation of cleaning the colon and related information.

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1. Introduction

Colonoscopy is the most important screening tool for colon cancer, in which the whole mucous surface of the colon and rectum can be viewed directly and in detail for an immediate diagnosis. Immediate treatments (e.g., polyp resection or biopsy) can be implemented if abnormalities are found. Bowel cleanliness quality is especially important in making an accurate diagnosis in colonoscopy. Insufficient cleanliness with residual stools in the colon will affect the doctors' judgment during the examination and make a diagnosis difficult, and also prolong the examination time (Modi et al., 2009; Nguyen & Wieland, 2010) leading to increased pain and discomfort for the patient (Chan, Saravanan, Manikam, Goh, & Mahadeva, 2011), a decreased polyp detection rate (Hong et al., 2012) and affecting cecal intubation failure (Park et al., 2013).

Good bowel cleanliness is therefore a requirement for successful colonoscopy. However, studies have shown that 15% ~ 54% of the patients receiving colonoscopies do not have good bowel cleanliness before the examination (Chan et al., 2011; Modi et al., 2009; Nguyen & Wieland, 2010; Wu et al., 2011). The underlying reason for this is related to the patients not following bowel cleaning instructions (Chan et al., 2011; Modi et al., 2009; Nguyen & Wieland, 2010). Therefore, patient education plays an important role in understanding the importance of bowel cleanliness and in assisting patients to perform bowel cleaning properly.

In clinical practice, interventions using patient education can increase patient compliance when receiving examinations (Wu et al., 2011). Oral explanations combined with educational flyers for a specific test are the most common clinical method of patient education (Folley et al., 2008). However, an oral explanation can be easily affected by the work environment and time constraints, leading to inconsistent delivery of information content. With regards to educational flyers, patients may have varying degrees of comprehension due to educational level and language differences (Calderwood, Lai, Fix, & Jacobson, 2011). Information delivery can be made easier by using multi-media with vivid and clear images to explain the preparation methods and techniques for bowel cleanliness. Multi-

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media patient educational materials not only help patients understand complex and abstract ideas, but also increase patient compliance such as with a bowel cleanliness diet and taking medications. Patient satisfaction with care is thus also increased. Studies using patient educational film interventions for patients receiving colonoscopies often focus on reducing patient anxiety (Bytzer & Lindeberg, 2007; Jjala, French, Foxall, Hardman, & Bedforth, 2010), however few studies have focused on bowel cleanliness. Therefore, the aim of this study was to use an educational film as the intervention method to teach patients the methods and importance of bowel cleanliness, and expected that the patients would be willing to comply with the instructions of diet and medication with a subsequent increase in the effectiveness of bowel cleaning.

2. Methods

2.1. Design and sample

This study used a quasi-experimental design. The research subjects were outpatients who received colonoscopy examinations at a local hospital in southern Taiwan. Data were collected from January to April 2011. After colonoscopy examinations had been arranged by their doctor, the patients were invited to participate in this study, and the details of the study were explained. The participants were grouped into experimental and control groups after agreeing to participate. Patients receiving examinations during the odd weeks of the month were assigned to the experimental group, and those receiving examinations during the even weeks of the month were assigned to the control group. The control group received routine hospital care while the experimental group received both routine care and also watched the "Preparation for Bowel Cleanliness" educational film in a separate room. The researchers provided explanations and clarifications to questions that the participants raised. To avoid the influence of a long duration (more than 2 weeks) between the outpatient appointment and colonoscopy examination, some pictures (an A4 paper) from the film were given to the participants to remind them of the precautions they needed to take when cleaning their bowel at home.

The fiberscope used in this study was standard equipment (Olympus CF-Q260AL). The three doctors participating in this study were all board certified gastroenterologists, all certified to perform endoscopy examinations, and all had performed more than 1000 examinations. The nurses providing routine patient education, doctors and technicians performing the colonoscopy examinations in this study were all blinded to the subjects' group. The participants were asked not to discuss whether or not they had watched the educational film during their colonoscopy examination. To avoid results being confounded by different medications, we used sodium phosphate as the medication for bowel cleaning in this study.

The inclusion criteria were outpatients receiving colonoscopy who were aged 20 years and older and had clear consciousness and no vision or hearing impairments. The exclusion criteria were receiving a painless colonoscopy, inpatients, patients not using sodium phosphate as the bowel cleaning medication, and patients who could not comply.

A total of 297 patients were scheduled for colonoscopy examinations during the research period. Three patients could not participate, 23 received painless colonoscopies (sedation and anesthesia), 18 were inpatients, 5 did not use sodium phosphate as the laxative, 28 canceled their appointment on the day of examination (10 were in the control group), and 4 patients could not participate due to mental or vision problems. In total, 218 subjects were included with 104 patients assigned to the experimental group and 114 to the control group.

2.2. Instruments

An 8-minute "Preparation for Bowel Cleanliness" educational film was made based on clinical experience and references to related

literature, in addition to suggestions from gastrointestinal and clinical nursing specialists. The primary aim was to make abstract and difficult-to-understand bowel cleaning concepts clear through the use of imagery so that the patients could truly understand the importance of a low-residue diet and taking laxatives, and, therefore, to comply with the bowel cleaning instructions willingly. The contents of the film included information on the following: the digestive process from food intake in the oral cavity to stool formation and discharge from the anus; accurate intake methods and types of low-residue and clear liquid diets; explanations for the purpose and importance of water supplementation; and principles and timing for taking laxatives. Images of clean and dirty bowels were presented, and the effects of different degrees of cleanliness on the examination results were explained so that the patients would voluntarily comply with the diet and medication suggestions. Chinese captions and Mandarin/Taiwanese language dubbing were used for the film in post-production. After completion of the film, it was carefully examined by clinical nursing specialists. The content was then modified according to expert opinions until it was deemed suitable for the requirements of the study. After completing the modifications, 10 patients receiving their first colonoscopy were recruited to test the clarity of the contents of the film. Nine patients indicated that the content was easier to understand than traditional patient education flyers. They also indicated that they were more willing to follow the instructions to ensure bowel cleanliness after they understood the effect of bowel cleanliness on examination results.

Bowel cleanliness is mainly evaluated in terms of residual stools in the bowel and the influence on the clarity provided by the video light source of the fiberscope. In this study, we adopted a valid Aronchick scale (Aronchick, Lipshutz, Wright, Dufwayne, & Bergman, 2000) to evaluate bowel cleanliness, which is used widely clinically (Aronchick et al., 2000; Hong et al., 2012; Tajika et al., 2013). In this scale, four scores are used to indicate the degree of bowel cleanliness. A score of 1 indicates excellent quality: no stools or only watery stools that can be suctioned to clearly show the bowel mucous. A score of 2 indicates good quality: some solid stools or watery stools but most can be suctioned to clean the bowel for a reliable examination. A score of 3 indicates fair quality: the examination can be completed, but the reliability of the results is questionable due to stools remaining after suctioning. A score of 4 indicates poor quality: excess remaining stools leading to an incomplete examination. In short, higher scores indicate a lower degree of bowel cleanliness. The final assessment of bowel preparation was divided into two categories, clean and not clean (Calderwood et al., 2011; Park et al., 2013; Tajika et al., 2013).

2.3. Ethical consideration

This study was approved by the institutional review board of our hospital (approval number 99-IRB-004). Data collection started after approval had been given. All participants in the study were given a manual explaining the purposes of the study. The participants were informed that their participation in this study was voluntary, and that their information would not be given to any other party to protect their privacy. They were also informed of their right to withdraw during the study period. All of the participants signed informed consent.

2.4. Data collection

After the participants checked in on the day of the examination, they completed a questionnaire to provide information about their age, marital status, educational level, reason for taking the examination, history of abdominal surgeries, and prior examination experience. Examination results were recorded using the doctor's report on bowel cleanliness.

2.5. Statistical analysis

All statistical analyses were performed using SPSS version 17.0 for Windows (SPSS Inc., Chicago, IL, USA). Descriptive statistics included frequency count, percentage, mean and standard deviation to describe basic information. Inferential statistics included the chi-square test, independent t-test, and logistic regression analysis. A *p* value less than .05 was considered to be statistically significant.

3. Results

The study period was from January to April 2011. A total of 218 patients participated in this study, and the age range of participants were from 22 to 91 years old. There were 104 subjects in the experimental group (47.7%) with a mean age of 59.1 ± 12.4 years, and 114 subjects in the control group (52.3%) with a mean age of 59.2 ± 13.1 years. There were no significant differences in age, gender, educational level, marital status, prior experience of examination, bowel habits, histories of abdominal surgeries and symptoms between the two groups (Table 1).

3.1. The influence of the educational film intervention on bowel cleanliness

The results showed that bowel cleanliness was significantly better ($p < .001$) for the experimental group compared to the control group (80.8% vs. 48.2%). This indicates that the film effectively promoted the bowel cleanliness of the patients (Table 2).

3.2. Factors affecting bowel cleanliness

Table 2 shows that bowel cleanliness was significantly better in the females than in the males ($p = .025$). In addition, a prior experience of a colonoscopy was significantly correlated with bowel cleanliness ($p = .028$), in that patients without a prior colonoscopy experience had better bowel cleanliness than those with prior experience. There was a borderline statistical significance for the correlation between the color of the last discharged stool and bowel cleanliness ($p = .047$). There were no statistically significant correlations between bowel cleanliness and other factors such as age, body mass index, waist circumference, waist-to-hip ratio, educational level, average family monthly income, marital status, stool habit and history of abdominal surgeries (Table 2).

Further analysis with logistic regression was conducted to identify the important factors affecting bowel cleanliness. The results showed that intervention group, gender and prior examination experience were better prediction variables. Bowel cleanliness was better for the experimental group than for the control group (OR = 4.533, 95% CI = 2.426–8.470), and better in the females than in the males (OR = 2.025, 95% CI = 1.100–3.730). In addition, bowel cleanliness was better in the patients without prior colonoscopy experience than in those with prior experience (OR = 1.948, 95% CI = 1.062–3.573) (Table 3).

4. Discussion

The primary aim of this study was to investigate the effects of a bowel cleanliness educational film intervention on the bowel cleanliness of patients receiving a colonoscopy. There were no significant differences in the basic characteristics of the two groups of subjects, thereby enhancing the validity of comparisons between the two groups.

The results showed that bowel cleanliness was better in the experimental group than in the control group, indicating that the film effectively promoted bowel cleanliness. This finding is in contrast to prior studies due to the different study design (Bytzer & Lindeberg,

Table 1

Basic information of the experimental and control groups ($N = 218$).

Variable	Experimental group	Control group	<i>p</i> value
	($N = 104$)	($N = 114$)	
	<i>n</i> (%) / Mean (SD)	<i>n</i> (%) / Mean (SD)	
Age	59.13 (12.36)	59.16 (13.05)	.995
Gender			.525
Male	53 (51)	63 (55.3)	
Female	51 (49)	51 (44.7)	
Body mass index	23.57 (3.72)	24.22 (3.40)	.176
Waist circumference	83.6 (11.0)	85.1 (9.8)	.279
Hip circumference	95.1 (8.2)	96.0 (6.8)	.373
Waist to hip ratio (Waist/Hip circumference)	0.9 (0.7)	0.9 (0.7)	.372
Educational level			.220
Less than elementary	32 (30.8)	27 (23.7)	
Junior/Senior high school	34 (32.7)	50 (43.9)	
More than college	38 (36.5)	37 (32.5)	
Marital status			.562
Single	9 (8.7)	6 (5.4)	
Married or cohabitating	84 (80.8)	96 (85.7)	
Divorced or other	11 (10.6)	10 (8.9)	
Average monthly family income			.432
≤ 40000 NT dollars	61 (59.2)	69 (64.5)	
≥ 40001 NT dollars	42 (40.8)	38 (35.5)	
Smoking status			.866
No smoking	92 (88.5)	100 (87.7)	
Smoking	12 (11.5)	14 (12.3)	
Drinking			.504
No drinking	90 (86.6)	102 (89.5)	
Drinking	14 (13.5)	12 (10.5)	
Exercise habit			.797
1. No	29 (27.9)	30 (26.3)	
2. 1 ~ 2 times/week	27 (26.0)	34 (29.8)	
3. 3 ~ 5 times/week	19 (18.3)	16 (14.0)	
4. Everyday	29 (27.9)	34 (29.8)	
Bowel habit			.058
Normal	91 (87.5)	108 (94.7)	
Constipation	13 (12.5)	6 (5.3)	
Prior colonoscopy experience			.423
None	54 (51.9)	53 (46.5)	
Yes	50 (48.1)	61 (53.5)	
History of abdominal surgeries			.732
None	68 (65.4)	72 (63.2)	
Yes	36 (34.6)	42 (36.8)	
Symptom			.293
None	41 (39.4)	53 (46.5)	
Yes	63 (60.6)	61 (53.5)	

Note: The chi-square (χ^2) test was used for categorical data. The independent t-test was used for continuous variables. Significance level $\alpha = .05$ (two tailed test). NT = New Taiwan.

2007; Calderwood et al., 2011; Modi et al., 2009). A study by Bytzer and Lindeberg (2007) also used an educational film in an intervention study. However, the film they used was only 5 minutes long, so there was no way to introduce bowel cleaning preparation methods to the patients in detail. Also, their study focused on patient satisfaction and examination anxiety. Due to these differences with our study, their results did not show a significant difference resulting from the intervention. Modi et al. (2009) used an educational method that involved answering patient's questions to clarify any misconceptions that they may have had about bowel cleaning, and to explain the correct methods of cleaning to the patients. This method, however, could not properly explain the abstract concept of clean or unclean bowels to the patients, nor affect cognition with regards to the importance of bowel cleanliness, leading to reduced compliance. A study by Calderwood et al. (2011) used pictures to compare images of clean and unclean bowels. However, English was used to explain the pictures even though 77% of their study participants did not use English as their first language. The language barrier therefore casts doubts on the suitability of their research tool. In the current intervention study, there was a significant difference in bowel cleanliness after the intervention. The primary reason for this is not

Table 2
Factors affecting bowel cleanliness (N = 218).

Variables	Clean, n (%)	Not clean, n (%)	p value
Group			<.001
Experimental group	84 (80.8)	20 (19.2)	
Control group	55 (48.2)	59 (51.8)	
Gender			.025
Male	66 (56.9)	50 (43.1)	
Female	73 (71.6)	29 (28.4)	
Age (years)			.349
1. <40	11 (68.8)	5 (31.3)	
2. 41 ~ 60	58 (58.6)	41 (41.4)	
3. >61	70 (68.0)	33 (32.0)	
Body mass index (kg/m ²)			.595
1. <18.50	5 (83.3)	1 (16.7)	
2. 18.51 ~ 24.99	87 (63.5)	50 (36.5)	
3. >25.00	47 (62.7)	28 (37.3)	
Waist circumference			.823
Normal	77 (63.1)	45 (36.9)	
Abnormal	62 (64.6)	34 (35.1)	
Waist-to-hip ratio			.729
Normal	84 (63.2)	49 (36.8)	
Abnormal	55 (65.5)	29 (34.5)	
Educational level			.213
1. Less than elementary	43 (72.9)	16 (27.1)	
2. Junior/Senior high school	52 (61.9)	32 (38.1)	
3. More than college	44 (58.7)	31 (41.3)	
Income			.922
Less than 40000 NT dollars	82 (63.1)	48 (36.9)	
More than 40001 NT dollars	51 (63.8)	29 (36.3)	
Marital status			.160
1. Single	12 (80.0)	3 (20.0)	
2. Married or cohabitating	110 (61.1)	70 (38.9)	
3. Divorced or others	16 (76.2)	5 (23.8)	
Stool habits			.149
Normal	124 (62.3)	75 (37.7)	
Constipation	15 (78.9)	4 (21.1)	
Prior colonoscopy experience			.028
None	76 (71.0)	31 (29.0)	
Yes	63 (56.8)	48 (43.2)	
History of abdominal surgeries			.983
None	89 (63.6)	51 (36.4)	
Yes	50 (64.1)	28 (35.9)	
Color of last discharged stool			0.47
Clear or light yellow	133 (65.5)	70 (34.5)	
Yellow or with manure	6 (40.0)	9 (60.0)	

Note: The chi-square (χ^2) test was used, significance level $\alpha = .05$ (two-tailed test). NT = New Taiwan.

only because the film compared how differing degrees of bowel cleanliness affect examination results, but also because it provided simple and easy-to-follow methods to facilitate patient compliance. In this study, the content from the film to make an educational flyer, which helped the patients to remember the bowel cleaning methods in the event of a long duration between making an appointment and the examination. Providing such fliers can help promote bowel cleanliness. Nguyen and Wieland (2010) found that patients requiring language interpretation had poorer bowel cleanliness. Therefore, issues relating to language can be reduced if a patient's mother tongue is used. The film used in this study used both Mandarin and Taiwanese, encompassing the languages used by the major ethnic

Table 3
Analysis of important factors affecting bowel cleanliness.

Variables	B	OR	95% CI	p value
Group (control group)	1.511	4.533	2.426 ~ 8.470	<.001
Gender (Male)	.706	2.025	1.100 ~ 3.730	.024
Prior colonoscopy experience (Yes)	.667	1.948	1.062 ~ 3.573	.031
Constant	-.742	.476		.115

Note: 1. Logistic regression was used for analysis. Reference group is listed in ().
2. Factors entered into the regression analysis: group, gender, prior colonoscopy experience, color of last discharged stool.

groups in Taiwan. Therefore, deviations in message delivery were reduced effectively. In addition, the researchers communicated with the patients after they had finished watching the film. The researchers clarified and explained any questions that the participants may have had to ensure even greater clarity in message delivery. Other studies have demonstrated increased bowel cleanliness with patient navigation systems. However, this equipment is expensive, and specialized personnel are required to provide the service, thereby incurring even higher costs (Christie et al., 2008). In this study we used a film broadcast in the outpatient clinic, which is not only cost effective, but also reduces the work load of nursing staff in the clinic.

This study found that gender and prior examination experience were important factors affecting bowel cleanliness. Bowel cleanliness was higher in the women than in the men, the findings are similar to the other study (Fatima, Johnson, & Rex, 2010), although in contrast to other studies (Nguyen & Wieland, 2010; Wu et al., 2011). This may be attributed to higher compliance with the instructions to prepare for the examination in women. In the current study, patients without prior colonoscopy examination experience had better bowel cleanliness than those with prior experience. Further analysis showed that there were 47 patients (87%) in the experimental group without prior experience who had good bowel cleanliness, which is significantly higher than the 29 patients (54.7%) in the control group. The first reason was because the patients without prior examination experience could keep more attention to learning bowel cleanliness methods, and they were more willing to follow suggestions of bowel preparation for the examination, leading to improved bowel cleanliness. The other might be due to variations in the three physician assessments, which the future research could be further explored.

Many studies have shown that age can affect bowel cleanliness, although the results have not been consistent (Modi et al., 2009; Nguyen & Wieland, 2010; Wu et al., 2011). According to a study by Modi et al. (2009), better bowel cleanliness was found in patients younger than 55 years old. Similarly, Nguyen and Wieland (2010) also found poorer bowel cleanliness with increased age. However, Wu et al. (2011) reported that younger patients had worse bowel cleanliness. In the current study, no significant correlation between age and bowel cleanliness was found, similar to the findings of Fatima et al. (2010). Therefore, further research and analysis are needed to investigate the effect of age on bowel cleanliness. In addition, there are inconsistent results with regards to the effect of obesity on bowel cleanliness. In the current study, non-significant relationships of waist circumference, waist-to-hip ratio, and body mass index with bowel cleanliness were noted. This finding was in agreement with a previous study (Nguyen & Wieland, 2010), although in contrast to a study by Wu et al. (2011) which showed worse bowel cleanliness with increased body mass index and waist circumference. Another study from Fatima's group also found better bowel cleanliness in patients with a body mass index of less than 30 kg/m² (Fatima et al., 2010).

4.1. Study limitations

It is important to acknowledge the weaknesses of the present study. The nature of educational film intervention made unblinded assessment difficult in the current study. In addition, the pamphlet, made from educational films, was given to subjects in the experimental group to strengthen impression from educational films. This study procedure could contaminate the experimental effect from educational films. Finally, the timing of watching education films was after visiting the doctor, which might reduce patients' attention due to limited time intervals for staying.

5. Conclusion

An education film can provide consistency and easy-to-follow bowel cleaning methods and related information leading to a

confirmed increase in bowel cleanliness, especially those who are older or who have difficulty reading. In addition, by repeatedly playing the “Preparation for Bowel Cleanliness” film in the clinic not only reduced the nurses’ workload, but also increased patient compliance for the examination. Therefore, we suggest that this method can be used as a standard and basis for the development of clinical care measures to continuously promote care quality.

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