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Original article

The Effect of Educational Compilation through Video Tutorials and Visual Aids on the Quality of Bowel Preparation in Patients Undergoing Colonoscopy

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SUMMARY

Background/Aims. High-quality bowel preparation is a prerequisite for colonoscopy. The aim of this study was to determine the effect of educational compilation through educational videos and visual cards on the quality of bowel preparation in colonoscopy.

Materials and methods. The present study was carried out in Imam Khomeini Hospital in Urmia,Iran, 2018. In this experimental study, 180 colonoscopy candidate outpatients, who were eligible to participate in the study, were selected. Next, the participants were randomly assigned to an intervention group (n = 90) and a control group (n = 90). The data collection tools included a demographic questionnaire and Boston Bowel Preparation Scale. Before the colonoscopy, the intervention group was provided with the educational videos and visual cards. However, the control group received the usual education. After collecting the data, they were statistically analyzed using SPSS software version 16. The researcher used Chi-square, independent t-test, and logistic regression tests to analyze the data.

Results. The bowel preparation score in the intervention group (8.46±0.90) was higher than the bowel preparation score in the control group (4.34 ± 2.09) (t178 = -17.10, p < 0.001). Multivariate analysis controlled the effect of demographic variables and showed that the intervention significantly increased the quality of bowel preparation in the intervention group (odds ratio 141.70, p < 0.001).

Conclusion. Education compilation through educational videos and visual cards was effective in increasing the quality of bowel preparation in the case of patients who received colonoscopy. Therefore, it is recommended that this kind of education be used during invasive diagnostic and treatment methods such as colonoscopy.

Keywords: **visual aids, patient education, colonoscopy, colon, polyethylene glycol**

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INTRODUCTION

The use of colonoscopy for the detection and treatment of colonic disease and colon cancer screening depends upon complete examination of the colon (1). Its effectiveness is closely related to the quality of bowel preparation (2). The optimal bowel preparation can lead to further diagnosis of adenoma (3). Nonetheless, it has been reported that approximately 30% of Asian patients are unable to achieve adequate bowel preparation (4). Factors associated with inadequate bowel preparation include patient-related factors (advanced age, male gender, obesity, previous improper bowel preparation, and constipation medications), and factors associated with underlying diseases (diabetes mellitus, stroke, dementia, and Parkinson's disease) and improper patient education (poor adherence to instructions, bowel preparation time, and waiting time for colonoscopy) (5). On the other hand, improper bowel preparation mainly stems from the patients' lack of compliance with the instructions (6), which is closely related to patient education (7). In most of the cases, this education is provided by physicians for one time using oral or written instructions during the initial appointment. Strong evidence has shown that various teaching methods, including booklet (8), telephone (9), reminder messages (10), smartphone applications (11), social media (12), and online movies (13, 14) have been used to educate patients with variable efficacy. These methods can increase the patients' motivation to improve the quality of bowel preparation (15). Although the patients' understanding of colonoscopy and bowel preparation facilitates the relevant procedure and results in the success of its stages, the studies, which have evaluated patient education, have focused on the patients' psychological factors such as anxiety about the results and stages of procedure and have not dealt with the impact of patient education on bowel preparation (16). Today, nurses use a variety of methods in order to educate patients. Each of these methods can have different effects on patients' learning. Therefore, a decision should be made on the selection of the appropriate educational method before providing the patients with the necessary education (17). Therefore, we designed instructions in video tutorials and visual aids form for patients on how to undergo colonoscopy. We explained the effect of bowel preparation and its influence during colonoscopy to patients by using video tutorials and visual aids, hypothesizing that this would improve rates of complete bowel preparation. Our study was performed to determine whether such video tutorials and visual aids could improve the quality of bowel preparation for colonoscopy.

MATERIALS AND METHODS

This experimental study made an effort to examine the effect of educational compilation through educational videos and visual cards on the quality of bowel preparation in the case of 180 outpatients who were referred to the colonoscopy center of Urmia University of Medical Sciences from November 1 to December 30, 2018. Convenience sampling was used to select the samples of the study. The relevant samples were randomly assigned to an intervention group and a control group. Considering the 99% confidence interval, 95% test power, and the results of the study by Tae et al. (18), the calculated sample size for each of the groups was 126. Considering the 30% probability of sample loss, the size of the final sample was calculated to be 180 people in total and 90 people for each of the groups (Figure 1), using the following formula:

$$n = \frac{\left(Z_{1-\frac{\alpha}{2}} + Z_{1-\beta}\right)^2 (S_1^2 + S_2^2)}{(\mu_1 - \mu_2)^2} = \frac{(2.575 + 1.28)^2 (2.2^2 + 1.9^2)}{(1)^2} = 126$$

α= 0.01, $Z_{1-\frac{\alpha}{2}}$ = 2.575, $Z_{1-\beta}$=1.28, β=0-1, S1=2.2, S2=1.9, μ1- μ2=1

The inclusion criteria included: being in the 18 - 65 age range, not having a previous history of colonoscopy, not having an urgent colonoscopy order, being acquainted with Persian or Azeri or having a companion who is acquainted with these languages, not having a physical disability which prevents the patient from receiving education, having an order to receive colonoscopy at least two days before the selection of samples, not being addicted to drugs, not using strong painkillers, not having severe pain due to the nature of the disease (cancer), and expressing a desire to receive intervention. Patients' refusal to participate in the study for any reason was considered as the exclusion criterion.

The data collection tools in this study involved a demographic questionnaire (information about age, sex, marital status, level of education, smoking status, adequacy of income, and place of residence), and Boston Bowel Preparation Scale. The Boston Bowel Preparation Scale (BBPS) is a numerical scoring system which is used for three parts of the colon (right colon, transverse colon, and left colon) after washing, cleaning, and suctioning the colon. This Scale was first designed by the researchers at Boston Medical University. The results of the study by Lai et al. in 2008 confirmed its validity and reliability and it was suggested as a measure of the quality of bowel preparation.

To ensure the validity and reliability of the (BBPS) in the present study, after translating this scale into Persian using backward-forward method, the questionnaire was given to 10 faculty members and professors (gastroenterologists) of Urmia University of Medical Sciences in order to confirm its content validity. After considering their opinions, the final edition of the questionnaire was developed. In order to examine the reliability of this scale, a pilot study, which involved 30 individuals, was conducted. During the pilot study, the scale was simultaneously completed by two specialists for the patients. Next, the kappa coefficient was calculated. The values of this coefficient for all of the three parts of the colon were LC = 0.051, TC = 0.656, and RC = 0.825. These results indicated an agreement between the two experts and confirmed the reliability of the instrument.

Designing bowel preparation education as images which could be easily understood and used by the patients was the first step in starting this study. The visual cards contained 16 images. These cards were designed in the form of conversations between the nurse or doctor and the colonoscopy candidate patient in order to improve the patients' understanding of their content. Images of good and bad bowel preparations were produced in a way that the patients could recognize the importance of bowel preparation. Moreover, the cards contained images about the proper use of polyethylene glycol and the foods which should be avoided before colonoscopy. Furthermore, the images explained the reasons behind these issues. In addition, it was clearly explained that the insufficient preparation of bowel could result in dangerous complications such as colon perforation.

In order to collect the samples of the study, the researcher visited the colonoscopy unit of the educational-medical center of Imam Khomeini Hospital in Urmia and informed the patients about the goals of the study and the fact that participation in the study was voluntary. Then, participants completed a demographic questionnaire. After selecting the participants based on the inclusion criteria, the researcher randomly assigned them to the intervention group and the control group. For this purpose, the researcher put 90 pieces of cardboard on which number 1 was written and 90 pieces of cardboard on which number 2 was written in a bag according to the group (intervention or control). Next, he asked each of the patients to take out one piece of cardboard out of the bag. The participants who took out the cardboard pieces on which number 1 was written were assigned to the intervention group. On the other hand, the participants who took out the cardboard pieces on which number 2 was written were assigned to the control group.

Two days before the colonoscopy, in one of the rooms of the endoscopy unit of Imam Khomeini Hospital in Urmia, the intervention group and the researcher met, and the researcher provided the explanations for a time period from 15 -25 minutes in addition to the routine education of the colonoscopy unit which was provided in oral and written forms. The educational content included: patients' education before the procedure, explanation of all of the steps before, during and after the colonoscopy, promotion of the patients' awareness of the possible benefits and risks of colonoscopy, and creation the opportunities for the patients to express their feelings, to ask questions, and to receive answers to their questions.

Furthermore, a 9.5-minute educational video was shown to the patients during the education. It described the digestive system and the various parts of the large intestine to the patients using pictures of their different parts. Moreover, it explained the indications for colonoscopy and the procedures which are performed by colonoscopy for patients. Furthermore, it explained the proper bowel preparation, the diet for bowel preparation, and the use of medications during bowel preparation to the patients. The researcher provided the patients in the control group with the routine oral and written education of the colonoscopy unit.

On the day of colonoscopy, the bowel preparation of the patients in both the intervention and control group was assessed during the procedure by a gastroenterologist who did not have any information about these groups using the Boston bowel preparation questionnaire. The data were collected and were entered into SPSS software version 16. Descriptive statistics (frequency, percentage, mean, standard deviation, diagram, etc.) were used to analyze the data and inferential statistics (Chi-square, Independent t-test, and Regression) were used to test the research hypotheses. The significant level was considered as $p \leq 0.05$.

Ethical approval for this study was obtained from the Committee of Ethics of the Urmia University of Medical Sciences, Urmia, Iran (#IR.umsu.rec.1397, 297). This study was registered under the Iranian Registry of Clinical Trials (#20161116030926N3). Written informed consent was obtained from all participants prior to their inclusion in the study.

RESULTS

This study involved 180 patients who were assigned to an intervention group (n = 90) and a control group (n = 90). Most of the participants in the control group were female (54.4%) and married (71.1%). In regard to the education level, 37.8% in the intervention group and 28.9% in the control group had a high school diploma. The mean age was 44.27 ± 10.23 years in the intervention group and 44.30 ± 10.21 years in the control group. Based on the results,

Table 1. *Baseline characteristics*

Characteristic		Groups				Total	Chi-squared test
		intervention		control			
		N	Percentage	N	Percentage		
Sex	Male	45	50	41	45.6	86	$x^2 = 0.356$
	Female	45	50	49	54.4	94	$p = 0.551$
Smoking	Yes	37	41.1	41	45.6	78	$x^2 = 0.362$
	No	53	58.9	49	54.4	102	$p = 0.547$
Area	Urban	70	77.8	59	65.6	129	$x^2 = 3.311$
	Rural	20	22.2	31	34.4	51	$p = 0.69$
Marital status	Married	63	70	64	71.1	127	$x^2 = 0.027$
	Unmarried	27	30	26	28.9	53	$p = 0.87$
Employment status	Employed	46	51.1	45	50	91	$x^2 = 0.022$
	Unemployed	44	48.9	45	50	94	$p = 0.881$
Income status	Enough	39	43.3	37	41.1	76	$x^2 = 0.091$
	Insufficient	51	56.7	53	58.9	104	$p = 0.763$
Level of education	Illiterate	10	11.1	6	6.7	16	$x^2 = 0.836$
	High school	20	22.2	32	35.6	52	$p = 0.184$
	High school diploma	34	37.8	26	28.9	60	
	College education	26	28.9	26	28.9	52	
Variable	Mean ± SD		Mean ± SD			Independent t-test	
Age	44.27 ± 10.23		44.30 ± 10.21			$t = 0.356$ $p = 0.551$	

there was not a significant difference between the two groups in terms of these variables. In other words, the two groups were exactly the same ($p < 0.05$) (Table 1).

The mean bowel preparation score was 8.46 ± 0.90 in the intervention group. Moreover, it was 4.34 ± 2.09 in the control group. The results of the independent t-test showed that there was a difference between the control group and the intervention group in terms of average bowel preparation score ($t = -17.10$, $df = 178$, $p < 0.0001$). In the control group, 32 people (35.6%) had poor bowel preparation, 46 (51.5%) had moderate bowel preparation, and 12 (13.3%) had good bowel preparation. On the other hand, in the intervention group, 5 people (5.6%) had moderate bowel peroration and 85 (94.4%) had good bowel preparation. The Chi-square test results showed that there was a significant difference between the two groups ($p < 0.0001$) (Table 2).

In order to control the effects of possible disrupters, a multivariate analysis was performed. More specifically, the researcher used the logistic regression with the Enter method. For this purpose, the variables of age, gender, education, marital status, place of residence and the groups of the study were entered into the model simultaneously and their effects on the group were examined as dependent variables based on Boston scores (less than 5 and above 5). In the end, only the variable of group (intervention and control) was significant in the model. That is, the odds ratio (OR) was equal to 141.70 (CI 95% 42.35 - 472.11) ($p < 0001$) and showed that the control of the other variables of study resulted in the effectiveness of the intervention and the chance of success in bowel preparation (based on a Boston score above 5) in the intervention group was 141.70 times greater than the chance of success in bowel preparation in the control group (Table 3).

Table 2. *Comparison of bowel preparation status after training between two intervention and control group*

Groups	Status	N	Percentage	The results of the squared test
Control	Fair	32	35.6	
	Moderate	46	51.1	
	Excellent	12	13.3	
	Total	90	100	**$X^2 = 119.899$**
Intervention	Fair	0	0	**$P < 0.0001$**
	Moderate	5	5.6	
	Excellent	85	94.4	
	Total	90	100	

Table 3. *Logistic analysis of factors for bowel preparation*

Factors	Univariate analysis			Multivariate analysis		
	OR	95% CI	P value	OR	95% CI	**P value**
Groups	110.500	37.241 – 327.867	0.0001	141.702	42.352 – 474.108	**0.0001**
Age	0.994	0.966 – 1.024	0.708	0.985	0.910 – 1.065	**0.703**
Sex	1.128	0.627 – 2.029	0.687	2.529	0.750 – 8.526	**0.135**
Education	1.111	0.816 – 1.513	0.504	1.172	0.523 – 2.624	**0.700**
Smoking	1.203	0.666 – 2.174	0.540	0.737	0.230 – 2.360	**0.608**
Region	0.546	0.284 – 1.052	0.070	0.856	0.272 – 2.696	**0.791**
Marital status	1.062	0.559 – 2.019	0.854	1.723	0.488 – 6.078	**0.398**

DISCUSSION

According to the results, the mean bowel readiness Boston score of the patients in the intervention group was significantly increased after the intervention in comparison with the control group. Poor bowel preparation leads to missed polyps, frequent examinations, patient discomfort, and higher health care costs (19). Educational interventions are significantly effective in improving the quality of patients' bowel preparations (20). However, the level of training of health care staff, including physicians and nurses, may affect the effectiveness of patient education (21). These results are in line with the results of a number of studies including the study by Ziqi Ye et al. which aimed to determine the effect of educational video that improve bowel preparation in patients undergoing colonoscopy (22), the study by Walter et al. which made an endeavor to improve the quality and acceptance of colonoscopy preparation by means of patient education that was reinforced with short-message services (10), and the study by Yi Zhao et al. which made an effort to examine the effect of educational virtual reality videos in improving bowel preparation quality and satisfaction of outpatients undergoing colonoscopy (23). The results of the above-mentioned studies indicated an improvement in the quality of bowel preparation after the intervention and were in line with the results of the present study. Nonetheless, the results of the study by Calderwood et al. showed that there was not a change in the quality of bowel preparation of patients in the intervention group in comparison with the quality of bowel preparation of patients in the control group. Therefore, the relationship between education and bowel preparation using simple visual cards was not significant in this study (24) and its results did not support the results of the present study.

In the present study, the determination of the predictive power of intervention and the effect of the demographic characteristics on the quality of bowel preparation in both the control group and the intervention group using regression analysis showed that none of the quantitative and qualitative demographic variables were related to the quality of bowel preparation. In line with the present study, in the study by Liu et al., not all of the demographic variables were significant in the logistic regression analysis (25). However, the variable of age was significant in the study by Tae et al. (18).

In the present study, all of the patients' questions were answered and their ambiguities were resolved due to the use of integrated education (visual cards and educational videos), face-to-face education, and simplicity of education. Providing the patients with face-to-face education and answering their questions, explaining the stages in the procedure, and clarifying the concepts that may be incomprehensible to the patients can furnish the patients and their companions with a large amount of information and useful education. This point was one of the strengths of the present study. On the other hand, in the studies by Ziqi Ye et al. (22), Walter et al. (10), and Yi Zhao et al. (23), there was not any assurance that the patients would receive the education and follow the instructions due to the limitations of the above-mentioned methods in regard to the provision of information and education and the existence of ambiguities in education which stemmed from the lack of the patients' access to the staff and the educator. The limitations of the present study included not using a number of variables such as BMI history of diabetes and history of abdominal surgery in the patients' medical history, duration of colonoscopy, and rate of polyp diagnosis. Another limitation of the study was the difficulty of coordinating patients to participate in the study due to the prolonged waiting time for colonoscopy. Moreover, it was difficult to communicate effectively with a number of patients due to the fact that they were old. In order to solve this problem, the researcher spent more time patiently to provide these patients with the explanations and the education and took advantage of the help of the patients' companions to communicate with the patients.

CONCLUSION

Based on the results of the present study, a simple, low-cost and risk-free method such as the use of visual cards and educational videos about the bowel preparation, which is very simple and easy to teach to patients and the families, along with the routine education, improves the quality of bowel preparation. It is recommended that other education methods be used to improve the quality of bowel preparation who receive colonoscopy in colonoscopy units. Furthermore, the future studies should exam-

ine the effect of this intervention on the other variables (duration of procedure, polyp diagnosis, etc.) and on inpatients or sedentary patients. The results of this study can be used in research areas and in the fields of nursing services, patient education, and student education units.

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Conflicts of interest

The authors declare that there are no conflicts of interest.

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Efekat edukativne kompilacije u formi video zapisa i vizuelnih pomagala na kvalitet pripreme creva kod bolesnika koji se podvrgavaju kolonoskopiji

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SAŽETAK

Uvod/Ciljevi. Visokokvalitetna priprema creva jeste preduslov za kolonoskopiju. Cilj ove studije bio je utvrditi efekte primene edukativne kompilacije u formi edukativnih video-zapisa i vizuelnih kartica na kvalitet pripreme creva u kolonoskopiji.

Materijal i metode. Ova studija je sprovedena u bolnici „Imam Homeini" u Urmiji u Iranu 2018. godine. Za potrebe eksperimentalne studije odabrano je 180 ambulantnih bolesnika koji su bili kandidati za kolonoskopiju i koji su ispunjavali kriterijume za učešće u studiji. Učesnici su zatim nasumično raspoređeni u interventnu (n = 90) i kontrolnu grupu (n = 90). Alati za prikupljanje podataka obuhvatali su demografski upitnik i Bostonsku skalu za pripremu creva. Pre kolonoskopije, interventnoj grupi dostavljeni su edukativni video-zapisi i vizuelne kartice; kontrolna grupa pak dobila je uobičajenu edukaciju. Prikupljeni podaci statistički su analizirani korišćenjem SPSS softvera (verzija 16). Za analizu podataka istraživač je koristio Hi-kvadrat test, nezavisni T-test i testove logističke regresije.

Rezultati. Skor skale za pripremu creva u interventnoj grupi (8,46 ± 0,90) bio je viši od skora u kontrolnoj grupi (4,34 ± 2,09) (t178 = -17,10, p < 0,001). Multivarijantna analiza kontrolisala je efekat demografskih varijabli i pokazala da je intervencija značajno povećala kvalitet pripreme creva u interventnoj grupi (odnos verovatnoće 141,70; p < 0,001).

Zaključak. Edukativna kompilacija u formi edukativnih video-zapisa i vizuelnih kartica bila je efikasna u povećanju kvaliteta pripreme creva kod bolesnika podvrgnutih kolonoskopiji. Stoga, primena ovakve edukacije se preporučuje tokom izvođenja invazivnodijagnostičkih i terapijskih metoda poput kolonoskopije.

Ključne reči: **vizuelna pomagala, edukacija bolesnika, kolonoskopija, debelo crevo, polietilen-glikol**