Impact of Multimedia CD Education on the Quality of Colon Preparation; A Single-Blind Randomized Study

Fardad Ejtehadi[1], Ali Reza Safarpour[1], Rasoul Nemati[1], Ladan Aminlari[1], Ehsan Zare[1], Gholam Reza Sivandzadeh[1], Ramin Niknam[1*]

[1]Gastroenterohepatology Research Centre, Shiraz University of Medical Sciences, Shiraz, Iran

[*]**Corresponding Author:**
Ramin Niknam, MD
Gastroenterohepatology Research Center, Shiraz University of Medical Sciences, Shiraz, Iran
Tel: +98 713 6281442
Fax: +98 713 6281442
Email: niknamramin@yahoo.com

Received : 16 Jan. 2022
Accepted : 19 Jul. 2022
Publieshed: 30 Oct. 2022

Abstract

Background:
Routine bowel preparation instructions are usually given to patients in the form of oral explanations with written instructions. The purpose of this study was to evaluate the effectiveness of multimedia training in the form of video CDs on the quality of colon preparation and other related indicators.

Methods:
201 outpatients in three referral academic colonoscopy centers were randomly assigned to two groups. The first group (n=100) received supplementary video CD education besides the routine instructions (VCD group). The second group (n=101) received only routine instruction, which included oral and printed instructions (non-VCD group).

Results:
Complete use of colon cleansing medication was statistically and significantly better in the VCD group (P=0.038). Duration of colonoscopy was shorter in the VCD group (P=0.001), demand for conscious sedation was lesser in the VCD group (P=0.049), and the quality of colon preparation was better in the VCD group (P<0.00). There was no statistically significant difference in pain sensation (P=0.1), cecal intubation rate (P=0.3), and technical difficulty of the colonoscopy (P=0.1) in both groups.

Conclusion:
Supplementary education in the form of multimedia CD increases the patients' compliance to cleansing mediation consumption, improves the quality of bowel preparation, and decreases the duration of colonoscopy with lesser demands for conscious sedation.

Keywords:
Colonoscopy, Colon preparation, Multimedia training

Please cite this paper as:
Ejtehadi F, Safarpour AR, Nemati R, Aminlari L, Zare E, Sivandzadeh GR, et al. Impact of multimedia CD education on the quality of colon preparation; a single-blind randomized study. *Middle East J Dig Dis* 2022;14(4):431-436. doi: 10.34172/mejdd.2022.304.

Introduction

Colonoscopy is the gold standard for diagnosing colon mucosal lesions. The degree of colon preparation has a great impact on the quality, ease of accuracy, and need for repeat procedures.[1] Proper cleansing of the colon and intestines is important for optimal colonoscopy and complete and acceptable observation of the mucosa. Inadequate preparation of the colon and the retention of contents and stools in it may hide mucosal lesions, such as the early stages of colon carcinoma and polyps.[2,3] Patient

involvement in the use of medications and drinking adequate amounts of water play an important role in the quality of preparation.

Patients are instructed on how to take the medication orally, along with simple written instructions. Many patients, due to their incomplete knowledge, do not take the medication correctly and present with an unprepared colon, which reduces the quality and accuracy of colonoscopy, and in some cases, even leads to cancellation or repeat procedure. Many colonoscopy centers are unable to provide a high rate of appropriate colon preparation for colonoscopy. Studies have found that 20%-40% of preparations are unsuitable in most centers.[4] Incomplete colon and intestinal preparation can lead to failure in the diagnosis of neoplastic lesions and increase the risk of adverse events.[5,6] Sidhu and colleagues conducted a study on all people who had colonoscopies from 2005 to 2010. Of the 8910 people who underwent colonoscopy, 693 were colonoscopically incomplete (about 7.8%, of whom 58% were women aged 61 years), and inadequate preparation was the most common cause of incomplete colonoscopy.[7]

In a European multicenter study, the results of studies showed that high-quality intestinal preparation is associated with shortened colonoscopy duration and time of labor entry, whereas poor intestinal preparation was of poor quality.[8] It was also found that poor bowel preparation in patients is associated with a 12-22% increase in the cost of colonoscopy compared with a high-quality bowel preparation.[2]

Some studies have been designed to identify the predictors of incomplete colon preparation for colonoscopy[5,9] and have found that defective preparation is common in patients with a previous history of incomplete bowel preparation, non-English speaking (non-native language), medical insurance, marital status or single hospitalization, multiple medications (especially opioids such as opium), history of constipation, low literacy, poor patient associations, failure to use split-dose, obesity, old age, male sex, and underlying diseases such as diabetes, stroke, amnesia, and Parkinson's disease.[10,11]

Some studies revealed that adverse preparation is predictable in significant quantities. There are two sets of predictors in this section, one of which includes medical factors and the other one deals with socio-economic status, education level, type of insurance, and community health literacy.[11,12]

Appropriate education to patients on how to prepare the colon significantly improves the quality of bowel preparation. It has been shown that educational booklets and smartphone applications improved the quality of colon preparation.[13-17]

The aim of this study was to investigate the effect of adding a multimedia CD to common methods of colon preparation instructions on the quality of bowel preparation, patients' demand for sedation and pain sensation, success rate, and difficulty of the colonoscopy.

Materials and Methods

This study was conducted on 201 consecutive adult patients in three referral academic out patient department (OPD) colonoscopy centers at Shiraz University of Medical Sciences. Patients were assigned to two groups randomly.

Patients with hospitalization, chronic kidney disease and dialysis, history of bowel surgery, and inability to consume fluids according to the standard protocol due to underlying disease were excluded from the study.

All patients received a standard colon preparation regimen, including polyethylene glycol solution (4000 cc) in split doses 1 day prior to the procedure, Senna powder, and bisacodyl tablets. Standard instructions, including oral explanations and printed instructions, were given to all patients by trained nurses.

In addition to the above education, in the video CD group (VCD), besides the standard oral and printed instructions, the patients received a multimedia CD, which explained the reasons for colonoscopy, how to use colon preparation medicines, and pictures of the unprepared colon with the lesions, which remain hidden and unrecognized in these cases.

One hundred and one patients in the non-VCD group received only standard oral and written instructions.

The gastroenterologist and assistant nurses were blinded to the randomization. All colonoscopies were done in three academic centers by three national gastroenterology board-certified gastroenterologists experienced in performing more than 5000 colonoscopies.

Demographic data, quality of consumption of colon cleansing medication, and the effectiveness of educational CD (VCD group) were recorded in a questionnaire.

Successful rate of procedure which was defined by reaching the cecum, demand for sedative medications (maximum 2.5 mg of midazolam), and quality of colon preparation according to Boston Bowel Preparation Scoring System[18] were recorded. The difficulty of colonoscopy (very easy to very difficult) was measured by the visual analogue scale (VAS) in 10 scores. The patients' pain sensation was measured quantitatively by the VAS. On this scale, pain intensity was graded from 0 (no pain) to 10 (very severe pain).

Statistical analyses were done using SPSS software (SPSS, Chicago, IL, USA) version 6.0 for Windows. In order to compare means independent t test was used, and Chi-squared test was conducted for categorical variables. $P<0.05$ was considered statistically significant.

Results

A total of 201 participants (109 male and 92 female patients) were enrolled in this study. After randomization, 100 patients (50 men and 50 women) were assigned to the VCD group, and 101 patients (59 men and 42 women) were assigned to non-VCD group (101 patients). There was no statistically significant difference between the sexes in both groups ($P=0.231$).

The mean age of participants was 51 years (18-88 years). The mean age was 54.3 years in the VCD group and 48 years in the non-VCD group. There was a statistically significant difference between the mean age of the two groups ($P=0.004$).

The effectiveness of video CD in improving the quality of colon preparation from the patients' point of view was measured by VAS scores from 0 to 10. 72 patients rated the effect of video CD with a score of 7 (75%) or higher.

Patients in each group were also assessed for the complete use of colonoscopy preparations drugs. 92 patients in the VCD group and 83 patients in the non-VCD group completely followed the preparation instruction with statistically significant difference ($P=0.038$).

The mean duration of colonoscopy was 12.65 minutes in the VCD group and 17.75 minutes in the non-VCD group, which was significantly shorter in the VCD group ($P=0.001$).

The need for conscious sedative medication was significantly lower in the VCD group compared with the non-VCD group; 58 vs. 72 patients, respectively ($P=0.049$).

The mean pain sensation score measured by VAS by the patients was 4 in the VCD group and 4.4 in the non-VCD group. Although the pain sensation was lower in the VCD group, it was not statistically different ($P=0.1$)

The quality of colon preparation was measured by Boston Bowel Preparation Scoring System. The mean score of colon preparation in the VCD group was 7.8 compared with 6.49 in the non-VCD group, which showed a statistically significant difference ($P=0.00$)

Cecum and terminal ileum could be reached in 94 patients in the VCD group and 98 patients in the non-VCD group, which was not statistically different ($P=0.3$).

The difficulty of performing a colonoscopy for the gastroenterologist was scored by VAS. The mean score was lower in the VCD group compared with the non-VCD group (4.4 vs 4.9) but it showed no statistically significant difference ($P=0.1$). The results are summarized in Table 1.

Discussion

The effect of any additional instruction, besides the conventional method of simple explanation to patients, in improving the quality of colon preparation has been investigated in several studies. Rosenfeld et al reported that a simple consultation session on justifying the reason for colon preparation significantly increased the quality of bowel preparation.[19] Tae et al studied the effect of cartoon visual aids on colon preparation among two groups of 91 patients and revealed that the simple cartoon visual aid, measured by Boston Bowel Preparation Score, increased the quality of bowel preparation and had statistically significant improvement.[20] Prakash et al reported that a short educational video (67 patients) had a statistically significant impact on the quality of bowel preparation measured by the Ottawa Bowel Preparation Quality scale compared with routine

Table 1. The effect of multimedia CD (VCD group) on different colonoscopic parameters in comparison with the control group (non-VCD group)

	VCD group	Non-VCD group	*P* value
Complete use of colon cleansing medication (n, %)	92 (92)	83 (82)	0.038
Mean duration of colonoscopy (minutes)	12.65	17.75	0.001
Need for conscious sedation (n, %)	58 (58)	72 (71)	0.049
Mean pain sensation score	4	4.4	0.1
Mean quality of colon preparation score	7.8	6.49	0.00
Colonoscopy success rate (n, %)	94 (94)	98 (97)	0.3
Mean colonoscopy difficulty score	4.4	4.9	0.1

instructions (66 patients).[21] Kang et al studied the effect of sending interactive information via a social media network and revealed that the quality of bowel preparation had statistically significant improvement in the intervention group (387 patients) compared with routine instructions (383 patients).[22] Garg et al studied the effect of comprehensive multimedia education on bowel preparation quality which showed statistically significant better quality in the 48 patients who received multimedia instruction compared with 46 patients in the control group.[23] In contrast to the above results, Calderwood et al showed that a simple 4×6 inch visual aid picture had no significant effect on the quality of bowel preparation.[24] The result of our study is in line with the findings of most of the above research and shows statistically significant improvement in the quality of bowel preparation by using a multimedia educational video CD ($P=0.00$).

Kang et al reported that the cecal intubation rate had no statistically significant difference among the patients who received interactive information via social media networks compared with standard instructions.[22] Our result similarly showed no statistically significant difference in colonoscopy success rate in the VCD group compared with the non-VCD group ($P=0.3$). In the Kang et al study, the cecal insertion time was significantly shorter in the intervention group compared with the group with routine instructions, but scope withdrawal time had no significant difference.[22] In the Garg et al study, neither the cecal insertion time nor the scope withdrawal time showed any statistically significant difference in the group that received multimedia education compared with the group with standard instruction.[23] According to our result, the total time of colonoscopy (cecal insertion+scope withdrawal time) was statistically shorter in the VCD group compared with the non-VCD group ($P=0.00$).

Incomplete compliance of patients was evaluated in the Kang et al study and was significantly lower in the patients who received additional information through social media networks. In the intervention group, 12.2% had incomplete compliance to bowel preparation, while in the control group, 30.1% of the patients had non-compliance.[22] Our result is similar to this report as 92% of the patients in the VCD group completely used the colon preparation compared with 82% of the patients in the non-VCD group, with a significant difference ($P=0.038$). Our study revealed that in the VCD group, the patients had significantly more tolerance and were willing to take the colon preparation medications completely.

Patients' satisfaction was studied by Prakash et al, and a five-point scale was used to show satisfaction with the preparation process. They showed no significant statistical difference in the group who received short educational video compared with standard instructions.[21] We used a VAS in 10 scores for quantitative measurement of the effectiveness of the content of the video CD. 75% of the patients gave a score of 7 or higher on the usefulness of the video CD content. The demand for conscious sedation during the procedure, which is usually due to pain or anxiety, was significantly lower in the VCD group compared with the non-VCD group ($P=0.049$). We also evaluated the pain sensation of the patients by VAS and found no significant difference between the two groups.

We also measured the difficulty of colonoscopy which is related to factors such as quality of colon preparation and patient's pain sensation.[1] Colonoscopist used VAS in 10 scores to measure the difficulty of the

procedure. There was no significant difference in the mean difficulty score in the VCD group compared with the non-VCD group ($P=0.1$).

Strengths of this study include its prospective type, multicentric, single-blind design, and randomization. Also, assessment of patients' pain and demand for sedation, as well as the difficulty of colonoscopy performed by gastroenterologists, are among the factors that were not addressed in previous studies. The limitation of our study is the number of participants. Although it is comparable to similar published studies, the greater number of participants makes the result more accurate. Another limitation of this study is that it has been conducted in three academic centers in one city, which may not fully reflect the cultural characteristics of a community in the use of multimedia devices.

Conclusion

According to the result of our study, it can be concluded that supplementary multimedia education and instruction, besides the routine oral explanation and printed direction, increase the patients' compliance with the consumption of colon cleansing medication, decrease the duration of colonoscopy and improve the quality of bowel preparation and decrease the demand for sedation. However, it has no effect on the technical difficulty of the procedure and the cecal intubation success rate. Therefore, the use of brief multimedia education in addition to routine instruction and oral explanation for patients is effective in enhancing the quality of colonoscopy and is recommended.

Acknowledgments

This study is supported by the Vice Chancellor for Research, Shiraz University of Medical Sciences (SUMS).

Conflict of Interest

The authors declare no conflict of interest related to this work.

Ethical Approval

This study was approved by the Ethics Committee of Shiraz University of Medical Sciences (IR.SUMS.REC.1395.S1077).

References

1. Oh SY, Sohn CI, Sung IK, Park DI, Kang MS, Yoo TW, et al. Factors affecting the technical difficulty of colonoscopy. *Hepatogastroenterology* 2007;54(77):1403-6.
2. Rex DK, Imperiale TF, Latinovich DR, Bratcher LL. Impact of bowel preparation on efficiency and cost of colonoscopy. *Am J Gastroenterol* 2002;97(7):1696-700. doi: 10.1111/j.1572-0241.2002.05827.x
3. Law WL, Choi HK, Chu KW, Ho JW, Wong L. Bowel preparation for colonoscopy: a randomized controlled trial comparing polyethylene glycol solution, one dose and two doses of oral sodium phosphate solution. *Asian J Surg* 2004;27(2):120-4. doi: 10.1016/s1015-9584(09)60324-9
4. Ness RM, Manam R, Hoen H, Chalasani N. Predictors of inadequate bowel preparation for colonoscopy. *Am J Gastroenterol* 2001;96(6):1797-802. doi: 10.1111/j.1572-0241.2001.03874.x
5. Chokshi RV, Hovis CE, Hollander T, Early DS, Wang JS. Prevalence of missed adenomas in patients with inadequate bowel preparation on screening colonoscopy. *Gastrointest Endosc* 2012;75(6):1197-203. doi: 10.1016/j.gie.2012.01.005
6. Wexner SD, Beck DE, Baron TH, Fanelli RD, Hyman N, Shen B, et al. A consensus document on bowel preparation before colonoscopy: prepared by a task force from the American Society of Colon and Rectal Surgeons (ASCRS), the American Society for Gastrointestinal Endoscopy (ASGE), and the Society of American Gastrointestinal and Endoscopic Surgeons (SAGES). *Gastrointest Endosc* 2006;63(7):894-909. doi: 10.1016/j.gie.2006.03.918
7. Sidhu S, Geraghty J, Karpha I, Wark L, Logan C, Sarkar S. Outcomes following an initial unsuccessful colonoscopy: a 5-year complete audit of teaching hospital colonoscopy practice. *Gut* 2011;60(Suppl 1):A201. doi: 10.1136/gut.2011.239301.423
8. Froehlich F, Wietlisbach V, Gonvers JJ, Burnand B, Vader JP. Impact of colonic cleansing on quality and diagnostic yield of colonoscopy: the European Panel of Appropriateness of Gastrointestinal Endoscopy European multicenter study. *Gastrointest Endosc* 2005;61(3):378-84. doi: 10.1016/s0016-5107(04)02776-2
9. Rex DK, Bond JH, Winawer S, Levin TR, Burt RW, Johnson DA, et al. Quality in the technical performance of colonoscopy and the continuous quality improvement process for colonoscopy: recommendations of the U.S. Multi-Society Task Force on Colorectal Cancer. *Am J Gastroenterol* 2002;97(6):1296-308. doi: 10.1111/j.1572-0241.2002.05812.x
10. Hassan C, Fuccio L, Bruno M, Pagano N, Spada C, Carrara S, et al. A predictive model identifies patients most likely to have inadequate bowel preparation for colonoscopy. *Clin Gastroenterol Hepatol* 2012;10(5):501-6. doi: 10.1016/j.cgh.2011.12.037
11. Nguyen DL, Wieland M. Risk factors predictive of poor

quality preparation during average risk colonoscopy screening: the importance of health literacy. *J Gastrointestin Liver Dis* 2010;19(4):369-72.
12. Smith SG, von Wagner C, McGregor LM, Curtis LM, Wilson EA, Serper M, et al. The influence of health literacy on comprehension of a colonoscopy preparation information leaflet. *Dis Colon Rectum* 2012;55(10):1074-80. doi: 10.1097/DCR.0b013e31826359ac
13. Saltzman JR, Cash BD, Pasha SF, Early DS, Muthusamy VR, Khashab MA, et al. Bowel preparation before colonoscopy. *Gastrointest Endosc* 2015;81(4):781-94. doi: 10.1016/j.gie.2014.09.048
14. Spiegel BM, Talley J, Shekelle P, Agarwal N, Snyder B, Bolus R, et al. Development and validation of a novel patient educational booklet to enhance colonoscopy preparation. *Am J Gastroenterol* 2011;106(5):875-83. doi: 10.1038/ajg.2011.75
15. Veldhuijzen G, Klemt-Kropp M, Noomen C, Van Esch AA, Tjwa ET, Drenth J. Computer-assisted instruction before colonoscopy is as effective as nurse counselling, a clinical pilot trial. *Endosc Int Open* 2017;5(8):E792-E7. doi: 10.1055/s-0043-110813
16. Brief J, Chawla A, Lerner D, Vitola B, Woroniecki R, Morganstern J. The impact of a smartphone app on the quality of pediatric colonoscopy preparations: randomized controlled trial. *JMIR Pediatr Parent* 2020;3(2):e18174. doi: 10.2196/18174
17. van der Zander QEW, Reumkens A, van de Valk B, Winkens B, Masclee AAM, de Ridder RJJ. Effects of a personalized smartphone app on bowel preparation quality: randomized controlled trial. *JMIR Mhealth Uhealth* 2021;9(8):e26703. doi: 10.2196/26703
18. Gerard DP, Foster DB, Raiser MW, Holden JL, Karrison TG. Validation of a new bowel preparation scale for measuring colon cleansing for colonoscopy: the Chicago bowel preparation scale. *Clin Transl Gastroenterol* 2013;4(12):e43. doi: 10.1038/ctg.2013.16
19. Rosenfeld G, Krygier D, Enns RA, Singham J, Wiesinger H, Bressler B. The impact of patient education on the quality of inpatient bowel preparation for colonoscopy. *Can J Gastroenterol* 2010;24(9):543-6. doi: 10.1155/2010/718628
20. Tae JW, Lee JC, Hong SJ, Han JP, Lee YH, Chung JH, et al. Impact of patient education with cartoon visual aids on the quality of bowel preparation for colonoscopy. *Gastrointest Endosc* 2012;76(4):804-11. doi: 10.1016/j.gie.2012.05.026
21. Prakash SR, Verma S, McGowan J, Smith BE, Shroff A, Gibson GH, et al. Improving the quality of colonoscopy bowel preparation using an educational video. *Can J Gastroenterol* 2013;27(12):696-700. doi: 10.1155/2013/292636
22. Kang X, Zhao L, Leung F, Luo H, Wang L, Wu J, et al. Delivery of instructions via mobile social media app increases quality of bowel preparation. *Clin Gastroenterol Hepatol* 2016;14(3):429-35.e3. doi: 10.1016/j.cgh.2015.09.038
23. Garg S, Girotra M, Chandra L, Verma V, Kaur S, Allawy A, et al. Improved bowel preparation with multimedia education in a predominantly African-American population: a randomized study. *Diagn Ther Endosc* 2016;2016:2072401. doi: 10.1155/2016/2072401
24. Calderwood AH, Lai EJ, Fix OK, Jacobson BC. An endoscopist-blinded, randomized, controlled trial of a simple visual aid to improve bowel preparation for screening colonoscopy. *Gastrointest Endosc* 2011;73(2):307-14. doi: 10.1016/j.gie.2010.10.013