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ORIGINAL ARTICLE

Usefulness of psyllium in rehabilitation of obstructed defecation

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Abstract
Background Rehabilitation is the first therapeutic step of obstructed defecation, after failure of conservative therapy with high-fiber diet and laxatives. This study evaluates the usefulness of psyllium, a bulk-forming agent, when used during rehabilitation of obstructed defecation.
Methods Between January 2008 and December 2010, 45 patients affected by obstructed defecation were included in the study. Two randomized groups were selected. Group 1 (21 women; age range 25–67 (mean, 51.8) years) continued to consume a high-fiber diet (approximately 30 g fiber per day) during rehabilitation. Group 2 (24 women; age range 46–71 (mean, 59.8) years) consumed only psyllium (3.6 g × 2/day; Psyllogel® Fibra, Nathura, Montecchio Emilia, Italy) during the rehabilitative cycle. After a preliminary clinical evaluation, including the obstructed defecation syndrome (ODS) score, patients underwent defecography and anorectal manometry as well as rehabilitative treatment according to the "multimodal rehabilitative program" for obstructive defecation. At the end of the program, patients were reassessed by clinical evaluation and anorectal manometry. Post-rehabilitative ODS scores were used for an arbitrary schedule of patients divided into three classes: Class I, good (score ≤ 4); Class II, fair (score > 4 to ≤ 8); Class III, poor (score > 8).
Results The number of bowel movements per week did not increase significantly after rehabilitation. Both groups had a significantly better Bristol stool form scale score (Group 1: $P < 0.034$; Group 2: $P < 0.02$). The overall mean ODS score from Groups 1 and 2 showed significant improvement after treatment ($P < 0.001$). Twenty-eight patients (82.3%) were Class I (good results) without significant differences between groups. Nine women were symptom-free. Significant differences were found between pre-rehabilitative and post-rehabilitative manometric data from the straining test ($P < 0.001$) and duration of maximal voluntary contraction (Group 1: $P < 0.004$; Group 2: $P < 0.02$). A significant difference was found between the pre-rehabilitative and post-rehabilitative conscious rectal sensitivity threshold (CRST) in Group 2 women ($P < 0.02$). The Group 2 women who underwent volumetric rehabilitation (11 patients) had significantly lower post-rehabilitative CRST values than pre-rehabilitative values ($P < 0.002$); the length of volumetric rehabilitation was also significantly shorter in Group 2 patients ($P < 0.04$) than in Group 1 patients.
Conclusions After rehabilitation of obstructed defecation, some patients became symptom-free and many had an improved ODS score. Psyllium is helpful for volumetric rehabilitation: patients who consumed psyllium had lower post-rehabilitative CRST values than subjects were on high-fiber diet.

Keywords Obstructed defecation · Rehabilitation · Biofeedback · Bulking laxatives · Psyllium

Introduction

Psyllium, derived from the seed husk of *Plantago ovata Forsskaol*, is a type of mucilage used for the treatment of constipation [1–3]. The gelatinous mass increases fecal volume, produces soft stool and promotes peristalsis. Therefore, psyllium decreases the time necessary to pass bowel movements, increases the number of bowel

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movements per day and increases the amount of stool passed [1]. First-line treatment of chronic constipation may involve the use of bulk-forming agents but it is unclear if psyllium is useful for obstructed defecation. Obstructed defecation is a subset of constipation and its pathophysiology differs from slow transit constipation, due to pelvic outlet obstruction and anorectal dysmotility [4]. This article discusses the usefulness of psyllium when given to patients affected by obstructed defecation who undergo rehabilitation. The specific aims were (1) to compare high-fiber diet and psyllium during the rehabilitative treatment of obstructed defecation, (2) to evaluate the influence of psyllium on rehabilitation and (3) to identify the working mechanism of psyllium.

Materials and methods

Between January 2008 and December 2010, 212 patients affected by obstructed defecation with negative coloscopy were referred to the outpatient unit of the Surgery Clinic of the University of Florence. All their data were entered into a prospectively constructed database. Seventy-nine (37.2%) failed to respond to conservative medical treatment and were referred for rehabilitative therapy. Exclusion criteria for rehabilitation were: age older than 75 years, impaired general health status, neurological disease, physical handicap, general problems (language, distance from the outpatient unit, non-collaboration). Case histories excluded 34 patients from the rehabilitative treatment: 12 patients were over 75 years old, 4 were affected by advanced pulmonary diseases, 5 had a neurological disease, 5 a physical handicap and 8 had general problems.

The remaining 45 patients (45 women; age range, 25–73 (mean, 55.2) years) were included in a randomized single blind study. Patients were randomized into two arms, high-fiber diet vs psyllium and two randomized groups were selected. Randomization was obtained by throwing dice: odd numbers were assigned to Group 1, even numbers to Group 2. The 21 women in Group 1 (age range 25–67 (mean, 51.8) years) continued to consume a high-fiber diet (approximately 30 g fiber per day) during rehabilitation. The 24 women of Group 2 (age range 46–71 (mean, 59.8) years) consumed only psyllium (3.6 g $\times$ 2/day; Psyllogel® Fibra, Nathura, Montecchio Emilia, Italy) during the rehabilitative cycle. All patients received a preliminary clinical evaluation and were studied by means of defecography and anorectal manometry. Afterward, all 45 underwent rehabilitative treatment, performed according to the algorithm of the "multimodal rehabilitation program" [5]. At the end of the rehabilitative program, all patients were reassessed by means of clinical evaluation and anorectal manometry. The study was approved by the Ethics Committee of the University of Florence Faculty of Medicine. In accordance with the ethical guidelines, all of the participants provided written informed consent for their participation in the study with full knowledge of the procedures to be undertaken.

Clinical evaluation

All patients underwent a clinical evaluation. Information regarding number of bowel movements/week and stool form according to the Bristol stool form scale [6] was gathered. Constipation symptoms according to the Rome Criteria III [7] and pathological conditions were noted. We recorded previous pelvic and/or anal surgery, and deliveries, noting obstetric tears and episiotomy. In all 45 patients, obstructed defecation was classified according to the obstructed defecation syndrome (ODS) score [8]; the scores ranged from 0 to 31. Post-rehabilitative ODS scores were arbitrarily assigned to three classes: Class I, good (score $\leq$ 4); Class II, fair (score $>$ 4 to $\leq$ 8); Class III, poor (score $>$ 8).

Defecography

All patients underwent defecography, according to the methods suggested in the national working team report on defecography [9]. The radiological measurements included the anorectal angle (ARA) and pelvic floor descent (PFD). Qualitative evaluation was made by noting rectocele, rectoanal intussusception and persistence of the puborectalis indentation during evacuation.

Anorectal manometry

All patients underwent anorectal manometry before and after rehabilitation, using standard techniques [10].

Among the anal resting pressures (ARP), computerized analysis identified the maximal anal pressure (P_{max}) and the mean pressure (P_m) of the anal canal. The maximal voluntary contraction (MVC) was evaluated by asking the subject to voluntarily contract the anal sphincter for as long as she could. The computer quantified the amplitude in mmHg and duration in seconds. The rectoanal inhibitory reflex (RAIR) was elicited by inflating a soft rubber balloon in the neorectum at 10 cm from the anal verge: the volume was increased every 20 ml according to the method proposed by Martelli et al. [11]. The first distension volume at which internal sphincter relaxation occurred (RAIR threshold, RAIRT) and the distension volume for which an initial transient sensation occurred (conscious rectal sensitivity threshold, CRST) were determined in all patients. The maximal tolerated volume (MTV) was also measured

in all patients; it was considered an expression of rectal reservoir capacity. Compliance of the rectum (expression of the ratio mmHg/ml of inflated air) was detected by means of the pressure/volume curve. The manometric procedure ended by measuring anal pressures during attempted defecation (straining test). The straining test was considered positive if an inappropriate rise in pressure or less than 20% relaxation of basal resting pressure occurred.

At the end of the rehabilitative program, all patients were reassessed by anorectal manometry.

Multimodal rehabilitation

Multimodal rehabilitation involved pelviperineal kinesitherapy (PK), biofeedback (BF), volumetric. rehabilitation (VR) and electrostimulation (ES) and all of the rehabilitation procedures were guided by manometric data [5]. Pelviperineal kinesitherapy is a type of muscular training that selectively targets the levator ani muscles. A cycle of pelviperineal kinesitherapy following a standard sequence was performed twice weekly in ten outpatient sessions [12]. Biofeedback is an operant conditioning method for the defecation reflex, which consists of pelvic floor strengthening exercises together with visual/verbal feedback training. During their first training session, patients.received instructions on how to contract and relax the external anal sphincter and puborectalis muscle and how to improve their strength by using modified Kegel exercises. The number of sessions was customized for each patient and was performed at home by using portable devices, twice per day for 20 min. The sessions lasted 1 month. The aim of volumetric rehabilitation was to increase the patient's ability to perceive the rectal distension induced by feces or flatus ("rectal sensation") [13]. Volumetric rehabilitation involved twice daily administration of a tepid water enema. The initial volume was equal to the maximally tolerated manometric volume. The patient held the liquid using the strongest possible anal contraction for the longest period of time possible. In the days following, the enema volume was gradually decreased (30 ml at a time), until the patient achieved a normal value of rectal sensation. The purpose of anal electrical stimulation was to induce muscle contraction by direct stimulation or indirectly via peripheral nerve stimulation. The electrostimulation rehabilitative cycle was performed daily for 3 months by the patient in a home environment. Biofeedback plus PK were indicated when there was a positive straining test and/or weak MVC. Volumetric rehabilitation (sensory retraining) was indicated for disordered rectal sensation and/or impaired rectal compliance. Electrostimulation was only a preliminary step when the patient needed to improve the sensation of the anoperineal plane. The usual sequence of procedures was: (1) VR; (2) ES, if necessary; (3) PK (4); BF.

Table 1 Clinical evaluation

	Group 1 (15 *P*)	Group 2 (19 *P*)
Deliveries	1.46 ± 0.99	1.21 ± 0.85
Obstetric tears	6/15	6/19
Episiotomy	2/15	3/19
Previous pelvic surgery	0	1/19
Previous anal surgery	4/15	2/19
Bristol stool form scale score	2.7 ± 1.9	2.5 ± 1.5

Statistical analysis

The results are expressed as the mean ± standard deviation (SD). Student's *t* test for paired and unpaired samples was used for statistical analyses. All correlations were evaluated using Spearman's rank correlation coefficient (rho: ρ_s). A $P \geq 0.05$ was chosen for rejection of the null hypothesis.

Results

Thirty-four patients (75.5%) completed the rehabilitative cycle. Eleven of them (6 women in Group 1, 5 women in Group 2) stopped treatment for several reasons: 3 because of problems at home, 5 due to the burden of carrying out the rehabilitative process, 2 due to the occurrence of cardiac or pulmonary diseases, 1 because of a car accident. Table 1 shows the clinical characteristics of both patient groups.

Group 1 and Group 2 were homogeneous. No significant differences in the number of deliveries or other clinical data were noted between groups. The mean overall pre-rehabilitative ODS score of the patients was 13.9 ± 4.1. Table 2 shows ODS scores of both patient groups. There was no significant difference between pre-rehabilitative scores. Correlations between clinical reports and the pre-rehabilitative ODS scores showed that there was no significant correlation between ODS score and obstetric tears (Group 1: ρ_s 0.24; Group 2: ρ_s 0.17), episiotomy (Group 1: ρ_s 0.14; Group 2: ρ_s 0.13), or previous anal surgery (Group 1: ρ_s 0.34; Group 2: ρ_s 0.21). No significant correlations were found between ODS score and number of bowel movements per week (Group 1: ρ_s 0.25; Group 2: ρ_s 0.31) or between ODS score and Bristol stool form scale score (Group 1: ρ_s 0.28; Group 2: ρ_s 0.32). Pre-rehabilitative defecography data showed that the pelvic floor descent values in patients were high at rest and during evacuation. Twenty patients had a poor anorectal angle opening at evacuation and puborectalis indentation was a defecography sign in 12 patients (30.7%), (5 patients from Group 1

Table 2 Cumulative ODS scores, number of bowel movements per week and Bristol stool form scale scores before and after rehabilitation

	Before rehabilitation	After rehabilitation
ODS score for all patients (34 pts)	13.9 ± 4.1	2.41 ± 2.69*
Group 1 ODS score (15 pts)	12.6 ± 4.4	2.06 ± 3.03*
Group 2 ODS score (19 pts)	14.8 ± 3.6	2.26 ± 1.85*
Group 1 number of bowel movements/week	5.60 ± 5.44	6.43 ± 3.45
Group 2 number of bowel movements/week	5.15 ± 4.64	7.10 ± 5.08
Group 1 Bristol stool form scale score	2.7 ± 1.9	4.0 ± 0.6°
Group 2 Bristol stool form scale score	2.5 ± 1.5	3.7 ± 0.8#

Values are means with standard deviations

* After versus before: $P < 0.001$

° After versus before: $P < 0.034$

After versus before: $P < 0.02$

Table 3 Rehabilitative treatment

	Group 1 (15 *P*)	Group 2 (19 *P*)
PK + BF	6/15	7/19
V + PK + BF	6/15	10/19
E + PK + BF	3/15	1/19
E + V + PK + BF	0	1/19

and 7 from Group 2) who were considered to be affected by pelvic floor dyssynergia because of the coexistence of positive manometry results during the straining test. Rectoanal intussusception was noted in 14 (41.1%) of all patients and was combined with rectocele in 9 of them (64.2%). Rectocele was present in 20 patients (58.8%). No signs of enterocele, sigmoidocele or megarectum were found. All 34 patients received a rehabilitation cycle using the multimodal approach (Table 3). None of them were treated with only one rehabilitative technique. The mean length of the rehabilitation cycle was 4.46 ± 2.2 months for Group 1 patients and 3.78 ± 1.4 months for Group 2 patients ($P = 0.14$). The number of bowel movements per week did not increase significantly after rehabilitation. Both groups had a significantly better Bristol stool form scale score (Group 1: $P < 0.034$; Group 2: $P < 0.02$) (Table 2). The overall mean ODS score, the Group 1 ODS score, and the Group 2 ODS score showed significant improvement after treatment ($P < 0.001$; Table 2). A narrower, not significant, distribution of post-rehabilitative ODS scores at lowest values was noted in Group 2 (Fig. 1). The patient classification (Fig. 2) shows that 28 patients (82.3%) were considered Class I (good results) without significant differences between groups. Nine women were symptom-free. Only one Group 1 patient (7.0%) was considered Class III (bad results); this patient had a post-rehabilitative ODS score that was significantly different from her pre-rehabilitation score ($P < 0.030$). Table 4 shows the pre- and post-rehabilitative distribution of anal manometry data. No significant differences were found between pre- and post-rehabilitative basal anal pressures (P_{max} and P_m). In both patient groups, the mean post-rehabilitative MVC duration (MVC-T) was significantly different when compared with pre-rehabilitative values (Group 1: $P < 0.004$; Group 2: $P < 0.02$). A significant difference was found between pre- and post-rehabilitative CRST in Group 2 women ($P < 0.02$). The Group 2 women who underwent volumetric rehabilitation (11 patients) had post-rehabilitative CRST values which were significantly lower than pre-rehabilitative values ($P < 0.002$) (Table 5, Fig. 3); the length of volumetric rehabilitation was also significantly shorter in Group 2 patients ($P < 0.04$) than in Group 1 patients (Table 5). No significant differences were noted between pre-rehabilitative and post-rehabilitative CS, MTV and RAIRT data. The rectoanal inhibitory reflex was detected in all patients. The straining test was considered positive in 16 patients. After rehabilitation only one Group 2 patient continued to have inappropriate rise of anal resting pressure during attempted defecation ($P < 0.001$). No modifications of rectal compliance were noted before or after rehabilitation cycles.

Discussion

Rehabilitation is the first therapeutic step for obstructed defecation, after failure of conservative therapy with high-fiber diet and laxatives [14, 15]. There are no universally accepted recommendations for rehabilitative treatment nor criteria to evaluate its efficacy. The methods used in treatments such as biofeedback, kinesitherapy, electrostimulation and volumetric rehabilitation can differ greatly, resulting in a considerable variation in rehabilitation programs between centers [16]. For this reason, the results of different studies may not be comparable [17–19].

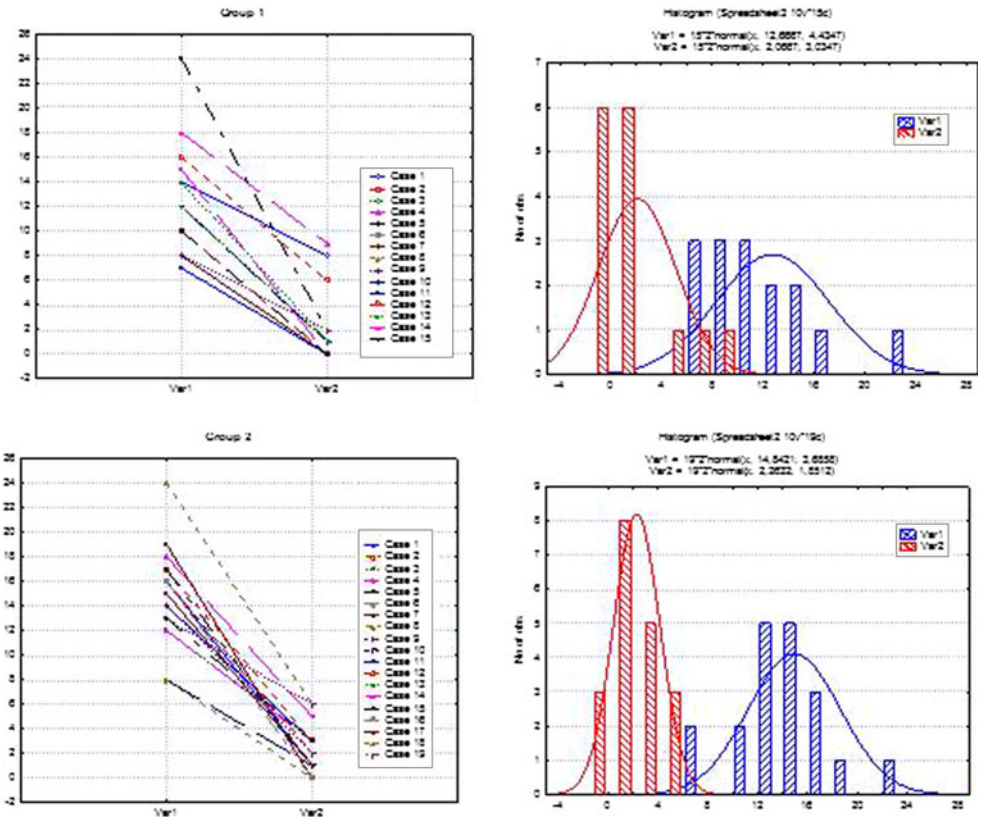

Fig. 1 ODS scores: case profiles. *Line plots* (*upper*) and histograms (*down*). Pre-rehabilitative data: Var 1; post-rehabilitative data: Var 2

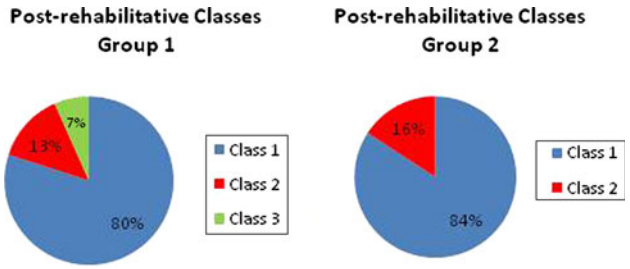

Fig. 2 Post-rehabilitative classes

A rehabilitation cycle usually lasts several months and the multiple procedures can be burdensome for some patients. In our study, 11.1% of patients dropped out of rehabilitative treatment. In any case, a functional rehabilitation plan requires reliable defecation with stools that reach the rectum. Therefore, a convenient fiber supply is adopted to ensure that an appropriate fecal volume is excreted. A high-fiber diet (no less than 30 g of fiber) and some bulking agents such as psyllium are used for this purpose, but it is not clear where and when to

Table 4 Anorectal manometry data

	Pre-rehabilitation		Post-rehabilitation	
	Group 1	Group 2	Group 1	Group 2
P_{max}	72.1 ± 24.2	85.7 ± 25.5	73.1 ± 21.3	76.6 ± 22.1
P_m	37.4 ± 12.4	38.6 ± 12.5	35.7 ± 10.9	38.4 ± 11.1
MVC-P	78.6 ± 45.5	64.3 ± 29.3	66.1 ± 34.2	67.0 ± 33.6
MVC-T	18.6 ± 11.6	22.6 ± 15.5	30.1 ± 12.6*	32.6 ± 10.6°
CRST	66.6 ± 33.5	81.5 ± 44.2	56.6 ± 11.7	61.0 ± 23.5°
MTV	177.3 ± 32.8	192.6 ± 35.4	175.3 ± 14.5	188.4 ± 19.2

Values are means with standard deviations

* After versus before: $P < 0.004$

° After versus before: $P < 0.02$

Table 5 Conscious rectal sensitivity threshold (CRST) and volumetric rehabilitation (VR)

	CRST before VR	CRST after VR	VR Length (months)
Group 1	93.3 ± 39.3	56.6 ± 15.0	6.0 ± 2.1
Group 2	102.7 ± 47.7	63.6 ± 25.0*	4.1 ± 1.4°

Values are means with standard deviations

* After vs before: $P < 0.002$

° Group 2 VR length versus Group 1 VR length: $P < 0.04$

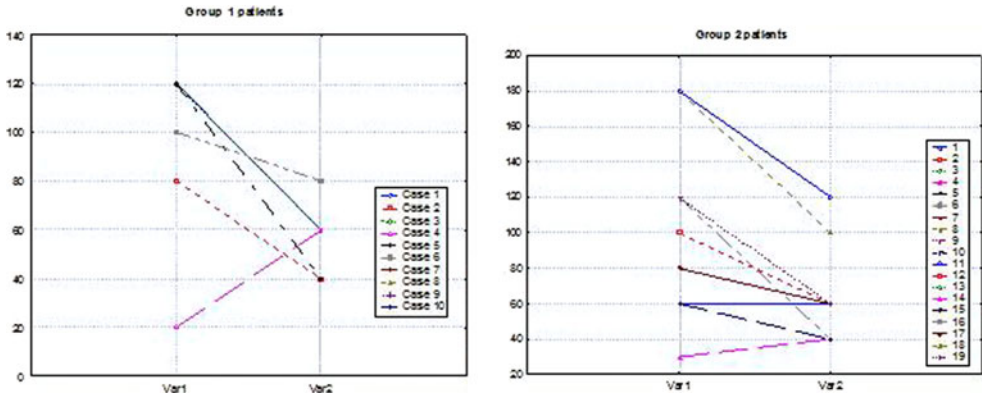

Fig. 3 Volumetric rehabilitation data. Pre-rehabilitative values (VAR 1) and post-rehabilitative values (VAR 2) are reported

use one or the other. Fiber supplementation appears to benefit constipated older patients, and it improves colonic transit time, but it does not normalize the most frequent underlying abnormality, pelvic floor dyssynergia [20]. There are no randomized clinical trials comparing high-fiber diet to psyllium in the treatment of chronic constipation. One recent study compared the effects of dried plums and psyllium in patients with chronic constipation, showing that the stool consistency scores improved significantly with dried plums when compared to psyllium [21]. However, there are no evaluations of patients affected by obstructed defecation and/or patients to be cured by rehabilitative treatment. Our study provides suggestions for selecting the best option for the rehabilitation of obstructed defecation. There are no significant differences between use of a high-fiber diet or psyllium during rehabilitation. After rehabilitation, the ODS score is significantly lower, with a success rate of about 80% for both options. There are no significant differences in the number of bowel movements per week, stool form, and mean length of the rehabilitation cycle, even if Group 2 patients showed an insignificant trend toward the lowest ODS scores and one Group 1 patient had bad results. Nevertheless, psyllium is more efficient than a high-fiber diet when used during volumetric rehabilitation. Patients reach significant post-rehabilitative CRST values, which are lower than pre-rehabilitative values ($P < 0.002$) (Table 5, Fig. 3). The duration of volumetric rehabilitation was also significantly shorter in Group 2 ($P < 0.04$) than in Group 1 (Table 5). We cannot explain the differences in these results. Perhaps psyllium is more beneficial than high-fiber diet in producing stools that are bulkier and moister [1]. Some studies have shown that psyllium increases the concentration of water in stool, produces a slick stool that is easy to pass and increases rectal sensation [22, 23]. However, 57.8% of Group 2 patients benefited when they used psyllium during volumetric rehabilitation.

Conclusions

There is a high success rate with rehabilitative treatment of obstructed defecation. Both high-fiber diet and psyllium have the same positive influence on rehabilitation, but we strongly recommend psyllium and it is more suitable than a high-fiber diet in terms of volumetric rehabilitation.

Conflict of interest The authors declare that they have no actual or potential conflict of interest related to the publication of this article.

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