

Influence of foot stool on defecation: a prospective study

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Abstract: Objective: The aim of this study was to determine the efficacy of adding a foot stool to help facilitate defecation in patients with fecal outlet obstruction. **Methods:** Patients (n=53) who experienced evacuation difficulties between June and October 2016 were enrolled in this prospective non-randomized single group study. Cinedefecography was performed with and without a foot stool. Anorectal angle (ARA), perineal plane distance (PPD), and puborectalis length (PRL) during rest and straining in both positions were measured from the radiographs. Rectal pressure was measured with the lateral position and sitting with and without a foot stool. **Results:** There was no significant difference between with and without a foot stool in ARA, PPD and PRL. In the upper body bent forward group, the time to evacuation was significantly shorter with a foot stool compared to without a foot stool (123 vs 91 sec, $p=0.04$). The difference of rectal pressure between the lateral position and sitting position significantly increased with a foot stool compared to without a foot stool (22.1 vs 16.7 mmHg, $p<0.01$). The difference of rectal pressure between with and without a foot stool increased in the upper body bent forward position compared to the upright sitting position (5.4 vs 1.9 mmHg, $p<0.01$). **Conclusion:** The findings suggest that using a foot stool with structure is a more efficient method for defecation. However, the upper body bent forward position is also important. This technique may be useful for retraining patients with constipation.

Keywords: Constipation; Defecation posture; Defecography; Fecal outlet obstruction; Foot stool.

INTRODUCTION

Fecal outlet obstruction lowers the quality of life (QOL) of patients with functional constipation. Outlet obstruction may be attributed to the following causes: non relaxation of the puborectalis muscle, anismus, rectal prolapse, rectocele and rectal hyposensitivity.

Tsuchino et al assessed rectal and anal pressure during defecation with the patient in a bending position rather than in a normal sitting position¹. Moreover, Takano et al reported the efficacy of bending the upper part of the body forward on defecation² and they named this posture the "Thinker Position". However, some patients have also experienced evacuation difficulties with this position.

Findings in the literature indicate that the squatting position is superior to the traditional upright sitting position for defecation^{3,4}. However, sudden changes in defecation habits such as altering the position from sitting to squatting or introducing a special commode may add psychological stress and cause incomplete evacuation. The closest position to squatting on a western commode is using a foot stool (foot step). We hypothesized that adding a foot stool in conjunction with structure would help facilitate defecation. Therefore, the aim of this prospective non-randomized single group study was to assess the efficacy of a foot stool on defecation.

PATIENTS AND METHODS

The risks of added x-ray exposure were disclosed to all the patients and informed consent to participate in the study was obtained. The inclusion criteria were patients experiencing constipation and who were scheduled to undergo cinedefecography. The indications for defecography were symptoms of evacuation difficulty and a feeling of incomplete evacuation. A diagnosis of constipation and outlet obstruction were made using the criteria for the functional defecation disorders of ROME IV. The exclusion criteria were patients who were under 18 years of age, pregnant and/or had prior rectal surgery. This study was approved by the institutional review board (IRB).

Cinedefecography technique

Patients were administered a phosphate enema 30 minutes prior to the procedure. They were then placed in the

left lateral decubitus position and approximately 100 mL of barium paste was injected into the rectum. The barium paste was mixed with oatmeal until it reached a Bristol type 4, stool consistency. The patient was then asked to sit on a commode and lateral films of the pelvis were taken during the pushing phase in a sitting position with and without a foot stool (Figure 1a).

Manometry technique

Pushing rectal pressure examinations were performed with and without a foot stool in the upright sitting position and the upper body bent forward position. Rectal pressure was assessed using an anorectal function testing kit (GMMS Gastrointestinal Manometry System: GMMS-200, Star Medical, Tokyo, Japan).

Interpretation of data

Patient characteristics (i.e. gender, age, comorbidity, and prior perianal surgery) were retrospectively obtained from the medical records. Anorectal angle (ARA), perineal plane distance (PPD), and puborectalis length (PRL) in rest and during straining were measured from the radiographs. ARA was defined as the angle between the axis of the anal canal and the distal half of the posterior rectal wall⁵⁻⁷. PPD was predetermined to be the vertical distance between the ARA position and an imaginary line drawn between the pubic symphysis to the tip of the coccyx. PRL was measured as the distance between the ARA and the pubic symphysis^{7,8}.

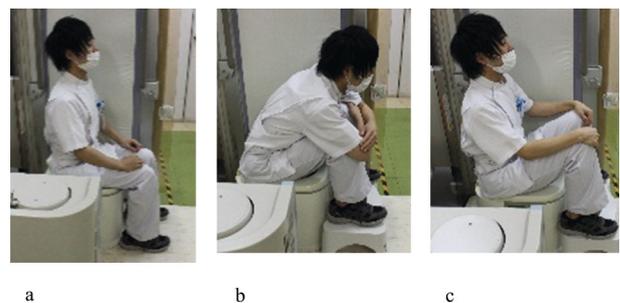


Figure 1. – a, Upright sitting position without a foot stool; b, Upper body bent forward position with a foot stool; c, Upper body backward with a foot stool

TABLE 1. Comparison of cinedefecography measurements between with and without foot stool. ARA anorectal angle, PPD perineal plane distance, PRL puborectalis length.

	Without foot stool	With foot stool	p value
ARA (o)	140.1	143.5	0.41
PPD (cm)	98.9	98.3	0.89
PRL (cm)	128.3	130.1	0.62
Length to evacuation (min)	100.7	95.8	0.32
Evacuation rate (%)	60.1	67.4	0.25
Evacuation volume (g)	144.9	167.7	0.12

TABLE 2. Comparison of pushing rectal pressure between the vertical position and upper body bent forward without/with foot stool.

	Without foot stool	With foot stool	p value
Sitting strait	85.1	86.9	0.71
Bending forward	84.5	89.9	0.18

Sacral Slope (SS) was measured from the radiography and defined as the angle between the superior line of the sacrum and the horizontal line. The difference of SS between with and without a foot stool was calculated. When the patient bent the upper body forward with a foot stool the SS became wider, and when the patient bent the upper body backwards the SS became narrower.

Statistical analysis

Previous studies have determined that the mean pelvic floor location increased from 1.3 cm compared to the recumbent and sitting positions⁸. Therefore, the effect size to determine a clinically relevant difference for this study was preset at 1.3 cm for PPD. With an alpha of 0.05 and a beta of 0.9, approximately 20 patients were needed for this study. The paired t-test was used to compare the sets of measurements for both positions and P values less than 0.05 were considered statistically significant.

RESULTS

Out of the 53 patients enrolled in the study, 25 of them were female with an average age of 70.2 (range: 21-90) years. Twenty-three of the patients used the upper body bent forward position with a foot stool and 30 of them used the upper body bent backwards position. The mean values of ARA, PPD and PRL during straining with or without a foot stool are shown in Table 1. There was no significant difference between with and without a foot stool in ARA, PPD or PRL.

Pushing rectal pressure showed no significant difference between with and without a foot stool in both the upright sitting position and the upper body bent forward position (Table 2).

In the upper body bent forward group, the time to evacuation was significantly shorter with a foot stool compared to without a foot stool (123 vs 91 sec, p=0.04). The difference of rectal pressure between the lateral position and the upright sitting position significantly increased with a foot stool compared to without a foot stool (22.1 vs 16.7 mmH₂O, p<0.01). The difference of rectal pressure between with and without a foot stool increased in the upper body bent forward position compared to the upright sitting position (5.4 vs 1.9 mmH₂O, p<0.01). The results for time to evacuation, rectal pressure comparing the lateral position and the upright sitting position, and rectal pressure compar-

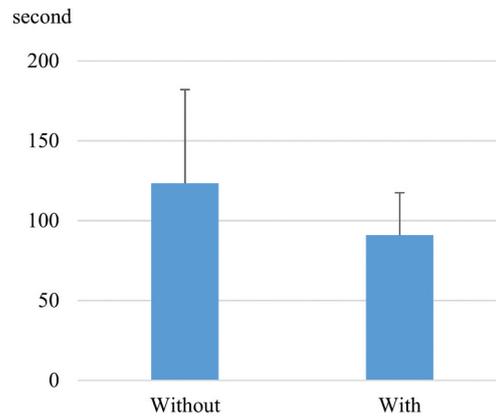


Figure 2. – Time to evacuation using valium paste without/with a foot stool. Time to evacuation is shorter with a foot stool than without a foot stool.

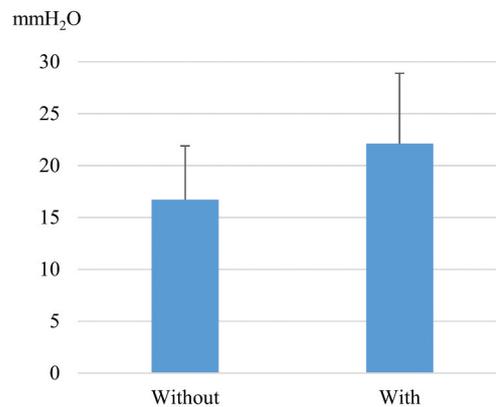


Figure 3. – The difference of rectal pressure between the lateral position and the sitting position without/with a foot stool. The difference is larger using a foot stool than without one.

ing with and without a foot stool are shown in Figures 2, 3 and 4, respectively.

DISCUSSION

Defecation is a very important part of human life. Fecal outlet obstruction is defined as “difficulty in evacuation or emptying of the rectum which may occur even with frequent visits to the washroom”. Moreover, body position during defecation is an important element of defecation. Historically, humans have squatted in order to defecate^{3,9} and this practice still continues today in underdeveloped countries¹⁰. While squatting for defecation continues to be the principal position in Asia and Africa, Western populations have become accustomed to sitting on a commode³. The widespread use of a sitting toilet began during the 19th century when sewage systems were developed to improve sanitation as cities and populations grew¹¹. Compared with the sitting position, squatting was associated with significantly less time to achieve a sensation of satisfactory bowel emptying and a lower degree of subjectively assessed straining³. Rad found that ARA and PPD were greater in subjects who squatted versus those who sat (ARA 132 vs 92; PPD 8.4 vs 6.6 cm, respectively)¹². The rectoanal angle of squatting (126°) for defecation was larger than the normal sitting position (100°) (P < 0.05), and was also larger than the hip-flex sitting position (99°) (P < 0.01)⁴. Tagart found that the ARA straightens with fully flexed hips—corresponding to the squatting position assumed for defeca-

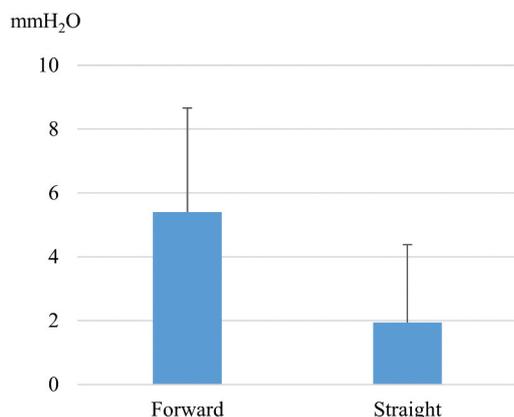


Figure 4. – The difference of rectal pressure between the upper body bent forward position and the backward position without and with a foot stool.

tion—and converts the rectoanal outlet into a straight canal, thereby facilitating rectal emptying¹³. Takano found that 22 patients were unable to evacuate the barium paste and therefore underwent cindefecography in the upper body bent forward (Thinker) position. “The Thinker” position had a significantly wider ARA than the sitting position (113° vs. 134°, respectively; $p = 0.03$), larger PPD (7.1 vs. 9.3 cm, respectively; $p = 0.02$), and longer PRL (12.9 vs. 15.2 cm, respectively; $p = 0.005$) during straining. Eleven patients experienced complete evacuation in “The Thinker” position².

The present study demonstrated a wider ARA, larger PPD and longer PRL but no significant difference was found between with a foot stool and without a foot stool. The difference between our study and the previous study is the selection of the patients. In the previous study conducted by Takano et al, all 21 patients were unable to defecate in the upright sitting position². However, in this study the patients who experienced evacuation difficulties were all enrolled whether or not the patient was able to evacuate the barium paste. Therefore, ARA, PPD and PRL did not reveal a significant difference. Now we have data for 22 patients who were unable to evacuate the barium paste without a foot stool and who underwent cindefecography with a foot stool. Cindefecography revealed a wider ARA with a foot stool than without a foot stool.

Other studies have found differences among the various positions. Altomare et al noted that when the patient sits on a commode, the ARA opens wider than it does in the standing position¹⁴. Rao et al reported on the influence of body position on defecation using a water-filled balloon and manometry. In the prone position, one third of the subjects had dyssynergia and half of them could not expel the paste (artificial stool). When sitting with a distended rectum, most subjects displayed normal defecation patterns and the ability to expel stool. The authors reported that the sitting position appears to be more conducive to defecation than the lying position. In addition, the manometric recordings during attempted defecation showed that the intrarectal pressure was lower in the left lateral position than in the sitting position¹⁵.

The findings revealed in this study suggest that the rectal pressure is higher in patients who use the upper body bent forward position with a foot stool than without a foot stool. The average age of the patients in our present study is higher than in our previous study (Takano et al, 2014). This seems to indicate that for older patients, rectal pressure is more important for defecation than the relaxation of the pelvic muscles.

Tsuchino et al found that there was a higher rectal pressure and lower anal pressure in the upper body bent forward position. Furthermore, they stated that this position creates a higher intraabdominal pressure that seems to help facilitate evacuation¹.

CONCLUSIONS

The findings suggest that a foot stool in conjunction with structure is a more efficient method for defecation. However, the upper body bent forward position is also very important. This technique may be useful for retraining patients with constipation. However, this study has some methodological limitations. Further studies are needed to verify these findings.

DISCLOSURE STATEMENTS

We declare no conflict of interest.

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Multidisciplinary UroGyneProcto Editorial Comment

To improve the integration among the three segments of the pelvic floor, some of the articles published in *Pelviperroneology* are commented on by **Urologists, Gynecologists, Proctologists/Colo Rectal Surgeons** or **other Specialists**, with their critical opinion and a teaching purpose. Differences, similarities and possible relationships between the data presented and what is known in the three fields of competence are stressed, or the absence of any analogy is indicated. The discussion is not a peer review, it concerns concepts, ideas, theories, not the methodology of the presentation.

Gyneco... Takano's article is quite interesting if considered from an obstetrical point of view. The postural postpartum attitude is in fact an effective procedure to solve many obstructed labor situations, as demonstrated by the Authors in case of fecal outlet obstruction.

The degree of inclination of the delivery channel is a fundamental point in the dynamics and mechanics of labor, such as the alignment of the anal canal for stool ejection. This alignment creates the ideal conditions for the pelvic entrance to be in line with the uterine and fetal body, making the uterine contraction more ergonomic and the progression of the fetus without difficulty.

The type of dorsal curvature, the anti or retroversion of the pelvis, the type of contracture of the muscles, the position and orientation of the lower limbs condition the movements of each individual element of the pelvis which constitutes a functional unit.

It is known that, in the presence of a slowing down or stopping of the progression of the part presented in the second stage of labor, it is useful to make the woman taking up the crouched position on the heels, which increases the bispyinous and bituberal diameter by 2 cm and 1 cm respectively.

Another useful position to align the fetus with the pelvis and to increase the diameters of the pelvic inlet is the sitting position reclined forward.

These postures accelerate the fetal descent into the delivery channel in obstetrics and reduce the expulsive effort with respect to the horizontal position, as well as Takano shows a significant decrease of time to fecal evacuation and increased rectal pressure in the upper body bent forward.

Finally, as in obstetrics the different postures have different indications depending on the cause of obstructed labor and of the proper stage, it would be interesting to evaluate the effect of different postures depending on the cause of fecal outlet obstruction due to relaxatio (rectocele or rectal prolapse) compared to those from hypertone (anismus or contracture of puborectalis muscle).

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Uro... The authors suggest that using a foot stool with structure is a more efficient method for defecation. We know that micturition in the woman takes place in a sitting position and that normally the urine emission is facilitated by a straightening of the urethra without a "thinker position". In the male this does not happen because a rectilinealization of the urethra is not possible for the length of the male urethra and for the presence of surrounding anatomical structures.

In this context it is clear that the "thinker position" is not necessary for urination in both sexes and that the assumption of a possible thinker position becomes necessary exclusively to increase the intravesical pressure during urination in patients who are affected by detrusor acontractility or in those who have an orthotopic neobladder.

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