

Biofeedback treatment in chronically constipated patients with dyssynergic defecation

Biofeedback aplicado al tratamiento de pacientes con estreñimiento crónico debido a defecación disinérgica

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Miguel A. Simón

Ana M. Bueno

Montserrat Durán

University of A Coruña, Department of Psychology, Research Group in Clinical and Health Psychology, Spain

Correspondence: Miguel A. Simón, Full postal address: Research Group in Clinical and Health Psychology, Department of Psychology, University of A Coruña, Campus of Elviña, 15071 A Coruña, Spain

Abstract

The aim of this study was to evaluate the effects of electromyographic biofeedback training in chronically constipated patients with dyssynergic defecation. With this purpose, ten patients (4 males, 6 females) with dyssynergic defecation unresponsive to dietary corrections and fibre supplements were selected and enclosed in the study on the basis of fulfilled the Rome III criteria for this functional gastrointestinal disorder. The study was carried out following a series of defined phases: clinical and psychophysiological assessment prior to the treatment (4 weeks), EMG-biofeedback treatment (8 sessions, two per week) and follow-up (4 weeks) one month later. In all phases, four clinical variables were assessed through self-monitoring (frequency of defecations per week, sensation of incomplete evacuation, difficulty evacuation level, and perianal pain at defecation); moreover, psychophysiological measures were obtained through electromyography (EMG) of the external anal sphincter. Results show significant improvements in psychophysiological measures (EMG-activity during straining to defecate and anismus index), as well as in clinical variables. Biofeedback's benefits were maintained at the follow-up period.

Resumen

El objetivo de este estudio fue evaluar los efectos del entrenamiento en biofeedback-EMG en pacientes con estreñimiento crónico debido a defecación disinérgica. Con este propósito, 10 pacientes (4 varones, 6 mujeres) con defecación disinérgica que no respondían a correcciones dietéticas y suplementos de fibra, fueron seleccionados e incluidos en el estudio sobre la base de cumplir los criterios Roma III para el diagnóstico de este trastorno funcional gastrointestinal. El estudio se llevó a cabo a lo largo de una serie de fases definidas: evaluación psicofisiológica y clínica previa al tratamiento (4 semanas), tratamiento por medio de biofeedback-EMG (8 sesiones, a razón de dos sesiones semanales) y seguimiento (4 semanas) un mes más tarde. En todas las fases, cuatro variables clínicas fueron evaluadas a través de autorregistro (frecuencia de defecaciones semanales, sensación de evacuación incompleta, nivel de dificultad de la evacuación y dolor perianal en la defecación); además, se obtuvieron medidas psicofisiológicas a través de electromiografía (EMG) del esfínter anal externo. Los resultados muestran mejoras significativas en las medidas psicofisiológicas (actividad-EMG durante el esfuerzo para defecar e índice de anismus), así como en las variables

Key words: dysynergic defecation; chronic constipation; functional defecation disorders; EMG-biofeedback treatment.

The functional defecation disorders are a subset of functional anorectal disorders, and are characterized by specific symptoms and abnormal manifestations in diagnostic tests. Two functional defecation disorders are currently recognized: dyssynergic defecation and inadequate defecatory propulsion. These disorders are frequently associated with symptoms such as excessive straining, feeling of incomplete evacuation, and digital facilitation of bowel movements (Rao, Tuteja, Vellema, Kempf, & Stessman, 2004).

During defecation, the puborectalis muscle and the external anal sphincter should relax to permit defecation. However, some chronically constipated patients inappropriately contract or fail to relax these pelvic floor muscles. This uncoordinated effort obstructs defecation (Heymen, Jones, Scarlett, & Whitehead, 2003). Since Preston and Lennard-Jones (1985) reported this paradoxical response pattern, several investigators have described this functional defecation disorder using a variety of terms, such as anismus (Miller et al., 1991; Preston & Lennard-Jones, 1985), spastic pelvic floor syndrome (Kuijpers & Bleijenberg, 1985), paradoxical puborectalis contraction (Jones, Lubowski, Swash, Path, & Henry, 1987), pelvic floor dyssynergia (Pucciani et al., 1998) and, in the current Rome III diagnostic criteria for functional gastrointestinal disorders, dyssynergic defecation (Bharucha, Wald, Enck, & Rao, 2006). This last consensus definition provides greater clarity in the definition and understanding of the problem, requiring criteria for functional constipation together with physiological evidence of the characteristic abnormal defecation dynamics through electromyography (EMG), anorectal manometry or imaging techniques such as defecography.

The prevalence of dyssynergic defecation in the general population is not well known because it is necessary to use clinical tests to confirm diagnosis (American Gastroenterological Association, 1999). Nevertheless, is

clínicas. Los beneficios del biofeedback se mantuvieron en el período de seguimiento.

Palabras clave: defecación disinérgica; estreñimiento crónico; trastornos funcionales de la defecación; biofeedback-EMG.

thought to account for 25-50% of chronic constipation cases (Wald, Caruana, Freimanis, Bauman, & Hinds, 1990) and may be present in 50% of childhood constipation (Palsson, Heymen, & Whitehead, 2004).

Dyssynergic defecation is commonly considered to be a form of maladaptive behaviour because there is no discernable neurological or anatomical defect and because it can be successfully corrected by behavioural treatment (Chiarioni, Heymen, & Whitehead, 2006). In fact, biofeedback techniques (manometric biofeedback and EMG-biofeedback) have been successfully used to teach patients with dyssynergic defecation to relax their pelvic floor muscles while simultaneously applying a downward intraabdominal pressure to generate propulsive force (Valsalva maneuver) (Chiarioni, Whitehead, Pezza, Morelli, & Bassotti, 2006; Heymen et al., 2005; Rao et al., 2005; Rao, Welcher, & Pelsang, 1997). Several studies carried out in the last years show that biofeedback is more effective than laxatives (Chiarioni et al., 2006), relaxation training (Rao et al., 2005), pharmacological treatment (diazepam) and placebo (Heymen et al., 2005). Between the different biofeedback modalities (manometric or electromyographic), EMG-biofeedback has been the most widely utilized (Koh, Young, Young, & Solomon, 2008).

The review and analysis of the specialized literature carried out by Palsson et al. (2004) identified several shortcomings in this research domain that should be addressed by future work. Specific recommendations to be considered in the planning of research are the adoption of standard outcome measures and the homogeneity and clear characterization of participants enrolled in studies. An explicit criterion of quantifiable symptom status of the target symptoms, as experienced by the patients, should be the primary criterion for success.

Following these recommendations, in the present study multiple and different classes of dependent variables were

studied together with the purpose of evaluating the effects of EMG-biofeedback in the treatment of chronically constipated patients with dyssynergic defecation.

Method

Participants

Ten patients with dyssynergic defecation unresponsive to dietary corrections and fibre supplements were selected and enclosed in the study on the basis of fulfilled the Rome III criteria for dyssynergic defecation (Wald, Bharucha, Enck, & Rao, 2006). Criteria fulfilled for the last 3 months with symptom onset at least 6 months prior to diagnosis. All the patients had constipation, complaining of decreased bowel frequency (fewer than three defecations per week), sensation of incomplete evacuation, lumpy or hard stools at least 25% of defecations, and straining during at least 25% of defecations. Moreover, the paradoxical contraction of the external anal sphincter during straining to defecate was electromyographically evidenced. The mean age was 59.1 years (range, 21-83), and there were 4 men and 6 women. Duration of constipation symptoms varied between 3 and 36 years (mean, 14.7). Patients provided written informed consent after an explanation of the purpose of the study.

Measures

Four clinical variables were assessed through self-monitoring, including: frequency of defecations per week, sensation of incomplete evacuation (0 = no sense of incomplete evacuation, 5 = middle sense of incomplete evacuation, 10 = severe sense of incomplete evacuation), difficulty evacuation level (0 = no difficulty, 5 = middle difficulty, 10 = severe difficulty), and perianal pain at defecation (0 = no pain, 5 = middle pain, 10 = severe pain).

Psychophysiological measures were obtained through electromyography (EMG) of the external anal sphincter, including EMG-activity (μV) during resting, squeezing, and straining to defecate. The anismus index was defined as the quotient between EMG-activity during straining to defecate and EMG-activity during squeezing. The EMG was performed using an intra-anal plug electrode (12 mm. diameter and 45 mm. total length) connected to an integrated electromyograph (model 129/9, Biociber, Spain).

Design

An A/B design with multiple subjects, continuous assessment of several dependent measures and follow-up was used.

Procedure

The study was carried out following a series of defined phases: clinical and psychophysiological assessment prior to the treatment (baseline), EMG-biofeedback treatment and follow-up.

The initial assessment was performed at baseline period along one month. In this phase, the subjects filled out self-monitoring of each defecatory episode and were psychophysiological assessed once a week. The four sessions of psychophysiological assessment were performed with the patient in left lateral decubitus position with the hips flexed at 90°. After an initial adaptation period (15 min.), we repeatedly assessed the EMG-activity during resting, squeezing (10 exercises), and straining to defecate (10 exercises). These conditions were counterbalanced along each session to avoid a possible order effect. The duration of each session was approximately 45-60 minutes.

EMG-biofeedback training consisted of eight sessions, twice a week, for the period of one month. The aim of the biofeedback was to eliminate inappropriate contraction of the external anal sphincter during defecation attempts. No bowel preparation was required. The training procedure was conducted with the patient in the same position that in the initial assessment. Using the EMG device described above, EMG-activity during straining to defecate was recorded and displayed to the subject in the form of visual and auditory feedback. Each session consisting of approximately 15-20 defecation attempts. The duration of these treatment sessions was one hour. In this treatment phase the subjects were still completing the self-monitoring.

Follow-up was carried out one month after biofeedback treatment. In this phase, the patients were assessed in the same way that in the baseline period (self-monitoring of each defecatory episode and four sessions of psychophysiological valuation).

Data analysis

Data are presented as mean (\pm SD). Statistical analysis was performed using non-parametric tests. Friedman’s analysis of variance by ranks was used to check statistical significance of differences between baseline, treatment and follow-up. Pairwise comparisons were performed using Wilcoxon’s Test.

Results

The results obtained showed improvements in psychophysiological measures as well as in clinical variables. Table 1 shows mean scores and standard deviations obtained in all dependent measures during baseline, treatment and follow-up.

All patients learned to relax external anal sphincter during straining to defecate. The results of the Friedman’s analysis of variance revealed significant differences in EMG-activity during straining to defecate between baseline, treatment and follow-up ($F = 16.8$; $p \leq 0.01$). Pairwise comparisons using Wilcoxon’s Test revealed significant differences in mean scores between baseline and treatment ($p \leq 0.01$), baseline and follow-up ($p \leq 0.01$), and treatment and

follow-up ($p \leq 0.05$). Figure 1 shows the results of the continuous assessment of EMG-activity during straining to defecate along the study.

Changes evidenced in the anismus index along the study were statistically significant ($F = 16.2$; $p \leq 0.01$). There are significant differences in mean scores between baseline and treatment ($p \leq 0.01$), baseline and follow-up ($p \leq 0.01$), and treatment and follow-up ($p \leq 0.01$). The evolution of this dependent measure can be seen in the Figure 2.

As can be seen in the Figure 3, the frequency of defecations per week ranged in the expected direction between phases of the study; these changes were statistically significant ($F = 17.45$; $p \leq 0.01$). Wilcoxon’s Test revealed significant differences in mean scores between baseline and treatment ($p \leq 0.01$), baseline and follow-up ($p \leq 0.01$), and treatment and follow-up ($p \leq 0.01$).

Finally, significant differences between baseline, treatment and follow-up were found in sensation of incomplete evacuation ($F = 17.45$; $p \leq 0.01$), difficulty evacuation level ($F = 20$; $p \leq 0.01$), and perianal pain at defecation ($F = 20$; $p \leq 0.01$) (Figure 4). In these three variables, there are significant differences in all pairs analyzed ($p \leq 0.01$).

Table 1
Mean scores and standard deviations in baseline, treatment and follow-up

Measures	Baseline	Treatment	Follow-up
EMG-activity during straining to defecate	11.01 (2.65)	5.98 (1.28)	4.93 (0.67)
Anismus index	0.68 (0.18)	0.39 (0.11)	0.29 (0.06)
Frequency of defecations per week	2.31 (0.46)	4.91 (0.40)	5.25 (0.41)
Sensation of incomplete evacuation	6.73 (1.01)	4.32 (0.57)	3.52 (0.50)
Difficulty evacuation level	7.32 (0.90)	3.69 (1.29)	3.48 (1.17)
Perianal pain at defecation	4.81 (1.95)	2.04 (0.75)	1.19 (0.55)

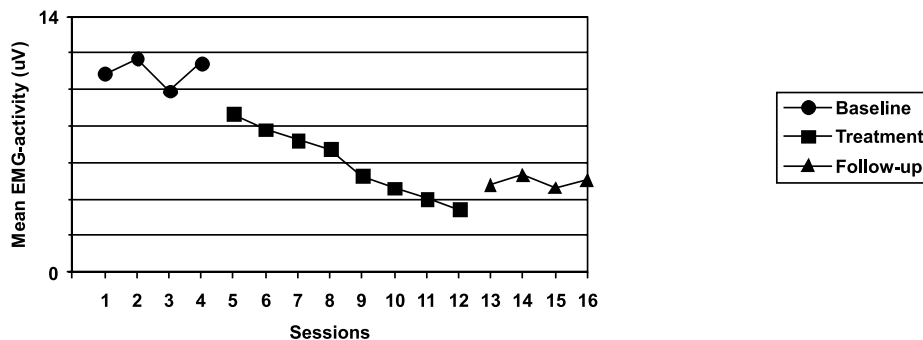


Figure 1. Mean EMG-activity during straining to defecate along the study

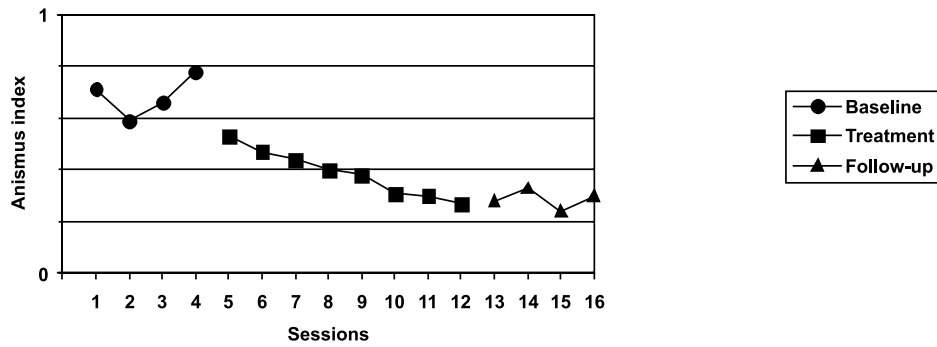


Figure 2. Mean scores in anismus index along the study

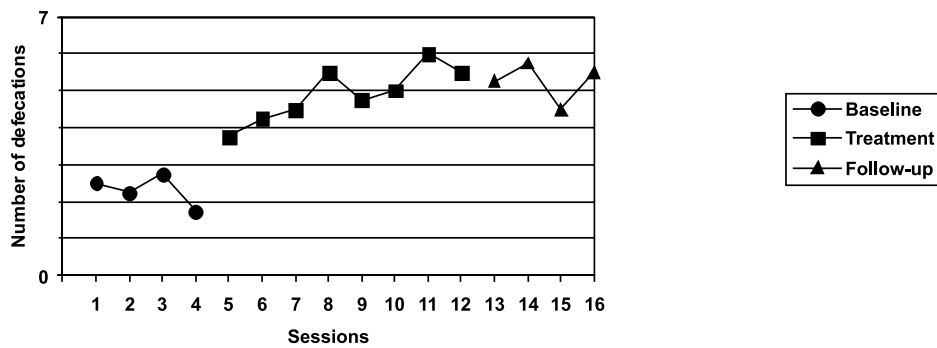


Figure 3. Mean scores in frequency of defecations per week along the study

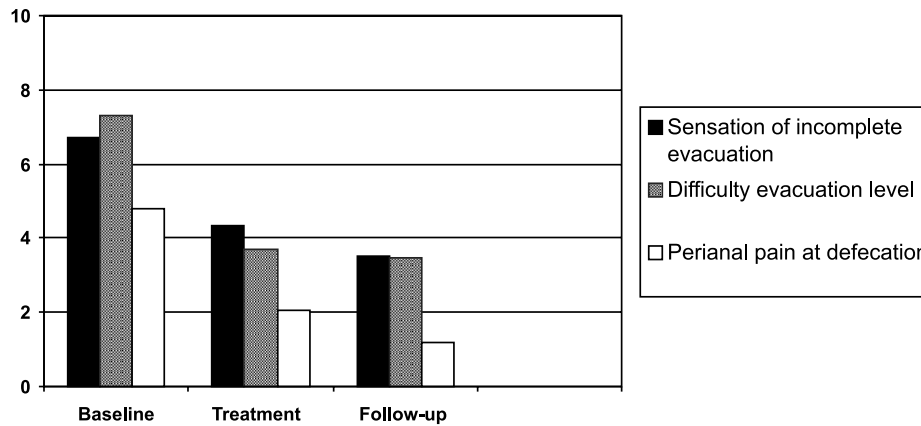


Figure 4. Evolution of the sensation of incomplete evacuation, difficulty evacuation level and perianal pain at defecation along the study

Discussion

The results obtained in the present study show the clinical usefulness of the EMG-biofeedback in the treatment of chronically constipated patients with dyssynergic defecation. Using EMG-biofeedback, the patients learned to relax external anal sphincter to permit defecation, decreasing

significantly the anismus index. As a result of this learning process, the subjects obstructive symptoms reduced, with a significant increase in the frequency of defecations per week as well as a significant decrease in sensation of incomplete evacuation, difficulty evacuation level and perianal pain at defecation. Treatment's benefits were sustained, even improved, at the follow-up period one month later. This

interesting discovery may be a result of the generalization effects of behavioural treatment and of the defecatory process normalization as a result of proper practice.

Our selection of patients for behavioural treatment was based on most recent international criteria for functional defecation disorders –Rome III criteria–, and the consideration of several dependent measures, including psychophysiological measures as well as clinical variables assessed through self-monitoring, have shown usefulness. These subjective assessments are very important in the clinical diagnosis, as well as to evaluate the evolution's disorder.

Methods and protocols of biofeedback therapy in the management of dyssynergic defecation varied widely between studies (Palsson et al., 2004; Rao, 1998), but no difference was described when EMG-based biofeedback was compared to manometry-based biofeedback (Glia, Gylin, Gulberg, & Lindberg, 1997), or when visual or auditory feedback was given (Koutsomanis, Lennard-Jones, Roy, & Kamm, 1995). Recent reviews have generally concluded that biofeedback shows a high degree of success for constipation management (Heymen et al., 2003; Jorge, Habr-Gama, & Wexner, 2003; Palsson et al., 2004; Rao, 2003), based mostly of the many uncontrolled studies in this area. On the basis of this observation, a clear recommendation for future research work is the use of control groups and randomization into groups. Conducting additional sizable and well-designed studies that conclusively determine and quantify the value of biofeedback treatment in the management of dyssynergic defecation should be the top priority in this field.

Additionally, researchers should evaluate specifically some aspects related to the psychophysiological response pattern in patients with dyssynergic defecation. The psychophysiological literature distinguishes between individual response specificity and situational response specificity. Individual response specificity is characterized by two principles: uniqueness and consistency (Hinz, Hueber, Schreinicke, & Seibt, 2002), that consists in the existence of individual differences in the response patterns and the trans-situational consistency of these individual patterns.

The future work of our research group will focus in the study of psychophysiological response patterns in these patients (particularly in the empirical study of the stability

of specificity) and in the evaluation of EMG-biofeedback's effects using randomized controlled trials.

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