Pelvic floor dyssynergia and bimodal rehabilitation: results of combined pelviperineal kinesitherapy and biofeedback training.

ORIGINAL ARTICLE

F. Pucciani · M. L. Rottoli · A. Bologna · F. Cianchi
S. Forconi · M. Cutellè · C. Cortesini

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Abstract Dyschezia may be caused by pelvic floor dyssynergia, which takes place when a paradoxical contraction or a failure to relax the pelvic floor muscles occurs during attempts to defecate. The aim of our study was to set up a new bimodal rehabilitation programme for pelvic floor dyssynergia, which combined pelviperineal kinesitherapy and biofeedback, and to evaluate the results of this treatment. Thirty-five patients (age range: 28–64 years; mean age: 42.5 years) from the outpatient unit of the Clinica Chirurgica of the University of Florence, Italy, and an age-matched group of 10 healthy control subjects (age range: 31–59 years; mean age 45.7 years) with normal bowel habits and without any defecatory disorders, were studied. The 35 patients were symptomatic for dyschezia without slow colonic transit and had been diagnosed as being affected by pelvic floor dyssynergia. No evidence of any organic aetiology was present but all demonstrated both manometric and radiological evidence of inappropriate function of the pelvic floor. All of the patients underwent bimodal rehabilitation, using the combined training programme Clinical evaluation, computerized anorectal manometry and defecography were carried out 1 week before and 1 week after a completed course in bimodal rehabilitation. The control group underwent manometric and defecographic examination. Their results were compared with those of the 35 patients before and after training. After the programme, all 35 patients had a very significant increase in stool frequency ($P<0.001$), while laxative and enema-induced bowel movements had become significantly less frequent ($P<0.001$). After bimodal rehabilitation, computerized anorectal manometry showed some peculiar results. Resting anal canal pressure had increased but not significantly. Pre-programme values that indicated a shorter duration ("exhaustio") of maximal voluntary contraction than found in the controls had returned to normal values. The rectoanal inhibitory reflex (RAIR), with incomplete relaxation, which had been shorter than that of controls, became normal by the end of the rehabilitation. All RAIR parameters were significantly different especially when pre- and post-treatment values were compared ($P<0.001$). No differences were found as regards rectal sensation parameters and rectal compliance between those before or after bimodal rehabilitation. Defecographic pretreatment X-ray films showed indentation of the puborectalis and poor anorectal angle (ARA) opening, at evacuation, with trapping barium of at 50%. After pelviperineal kinesitherapy and biofeedback training, the indentation had disappeared and the ARA had become significantly larger ($P<0.001$) during evacuation. No differences were found after rehabilitation, when both were compared with those of controls. The pelvic floor descent was also significantly deeper ($P<0.001$) than before the start of the programme. The bimodal rehabilitation technique can be considered a useful therapeutic option for functional dyschezia as shown by our clinical evaluations, manometric data and defecographic reports.

Key words Dyschezia · Arismus · Rehabilitation · Kinesitherapy

Résumé Une dyschézie peut être causée par une dyssynergie du plancher pelvien qui survient lorsque se produit une contraction paradoxale ou, à l'inverse, un défaut de relaxation de la musculature du plancher pelvien au cours d'un effort de défécation. Certaines formes de training, tel le biofeedback, sont connues pour pouvoir aider certains patients à relâcher la musculature striée du plancher pelvien au cours de l'exonération. Le but de notre étude a été de mettre au point un nouveau programme de réhabilitation bimodale en cas de dyssynergie pelvienne qui combine de la kinésithérapie pelvi-périnéale et do biofeedback ainsi que d'évaluer le résultat de ce traitement. Trente-cinq

F. Pucciani (✉) · A. Bologna · F. Cianchi · C. Cortesini
Istituto di Clinica Chirurgica Generale e Discipline Chirurgiche,
Università degli Studi di Firenze, Unità di Coloproctologia (UCP),
Viale Morgagni 85, I-50134 Firenze, Italy

M. L. Rottoli
Radiodiagnostica 1, Dipartimento Fisiopatologia Clinica,
Università degli Studi di Firenze, Italy

S. Forconi · M. Cutellè
U.O. Riabilitazione, Ospedale Mauriziano, Torino, Italy

patients (âge: 28 à 64 ans; âge moyen: 42.5 ans) de l'unité ambulatoire de la Clinique de Chirurgie de l'Université de Florence en Italie et un groupe contrôle de 10 sujets de même âge (âge: 31 à 59 ans; moyen d'âge: 45.7) avec des habitudes d'exonération normales et sans trouble de la défécation ont été étudiés. Les 35 patients étaient symptomatiques pur une dyschézie sans inertie colique et ont été diagnostiqués comme étant porteurs d'une dyssynergie du plancher pelvien (PFD): aucune évidence de lésion organique n'est présente mais tous démontrent, tant à la manométrie que lors d'examens radiologiques, des évidences de fonctions inappropriées du plancher pelvien. Tous les patients ont subi une réhabilitation bimodale à l'aide d'un programme d'entraînement combiné. Une évaluation clinique, une manométrie anorectale digitalisée et une défécographie ont été réalisées une semaine avant et un mois après la fin du traitement de réhabilitation bimodale. Le groupe de contrôle a été soumis à une manométrie et une défécographie. Les résultats ont été comparés à ceux des 35 patients avant et après traitement. Après le programme, tous les 35 patients ont montré une augmentation significative de la fréquence des selles (*P*<0.001), une fréquence significativement abaissée de la consommation de laxatifs et de lavements pour induire l'exonération (*P*<0.001). Après la réhabilitation bimodale, la manométrie anorectale digitalisée montre des résultats particuliers. La pression de repos du canal anal est augmentée mais pas de manière significative. Les données avant traitement qui montraient une durée réduite de la contraction volontaire maximale comparativement aux témoins étaient retournées à des valeurs normales. Le réflexe recto-anal inhibiteur avec une relaxation incomplète qui était plus bref que chez les contrôles s'est normalisé à la fin du traitement. Toutes les valeurs préthérapeutiques de réflexe anorectal inhibiteur montrent des différences significatives si on les compare à ceux des contrôles. Ces valeurs sont toutefois significativement différentes, particulièrement lorsque les valeurs pré- et postthérapeutiques sont comparées (*P*<0.001). Aucune différence n'est retrouvée en ce qui concerne les paramètres de perception rectale et la compliance rectale de même qu'en ce qui concerne les données avant et après la réhabilitation bimodale. Les défécographies préthérapeutiques montrent une indentation de la sangle puborectale et un défaut de l'ouverture de l'angle anorectal au cours de l'évacuation lorsque 50% du baryum est retenu. Après la kinésithérapie pelvi-périnéale et le biofeedback, l'indentation disparaît et le réflexe anorectal inhibiteur est allongé au cours de l'exonération (*P*<0.001). Aucune différence n'est retrouvée après réhabilitation lorsque ces données sont comparées à celles de sujets contrôles. Le plancher périnéal est significativement abaissé (*P*<0.001) qu'avant le début di programme. La technique de réhabilitation bimodale peut être considérée comme une option thérapeutique utile en cas de dyschézie fonctionelle. Les données cliniques et des évaluations manométriques et défécographiques confirment ces observations.

Introduction

Pelvic floor dyssnergia may be defined as a faecal evacuation disorder which is a consequence of some functional outlet obstruction [1]. It is characterized by a paradoxical contraction or failure to relax the pelvic floor muscles during attempts at defecating. Clinical manifestations can include straining, feeling of incomplete evacuation and/or the need to digitally evacuate the rectum [2]. D. M. Preston and J. E. Lennard-Jones [3] suggested that some form or retraining might help patients to relax the striated muscles of the pelvic floor during defecation. Biofeedback appears to be effective for this form of dyschezia [4], even though the questions of how, when and why it works remain unanswered [5]. Pelviperineal kinesitherapy, which has been tried occasionally in cases of dyschezia [6], is a specific muscular re-education technique for the pelvic floor muscles [7].

The aims of this study were to set up a new bimodal rehabilitation technique using both pelviperineal kinesitherapy and biofeedback, for pelvic floor dyssynergia, and to evaluate the results of this treatment.

Patients and methods

Thirty-five women (age range: 28–64 years; mean age: 42.5 years) from the outpatient unit of the Clinica Chirurgica of the University of Florence (Italy) and one group of 10 healthy age-matched female subjects (age range: 31–59 years; mean age 45.7 years) were studied and compared. All 45 women were multipara.

A the start of the study, the 35 patients were symptomatic for dyschezia, without slow colonic transit, and had been diagnosed as being affected by pelvic floor dyssynergia (PFD). Dyschezia was defined as difficult defecation during at least 25% of bowel movements over a period of at least 3 months. Diagnostic criteria for PFD were those of the Working Team Report on the "Functional disorders of the anorectum". There was no evidence of any organic aetiology. All patients showed both manometric and radiological evidence of inappropriate function of the pelvic floor [2]. All patients underwent bimodal rehabilitation, using both pelviperineal kinesitherapy and biofeedback training as defined below.

Computerized anorectal manometry and defecography were carried out 1 week before and 1 week after a completed course of bimodal rehabilitation.

The 10 control subjects had normal bowel habits and no defecatory disorders. All 10 also had computerized anorectal manometry and defecography. Their results were compared to those of the 35 patients both before and after rehabilitation.

Written consent had been obtained from all the participants before the start of the study.

Clinical evaluation

Information regarding bowel movements and concomitant diseases had been gathered from previously completed patient charts. Patients with any psychiatric illness, metabolic and/or endocrine disease, neurological diseases, obstetric sphincteric lesions, and those who had undergone anorectal and/or pelvic surgery were excluded from the study.

Computerized anorectal manometry

Anorectal manometry was performed using standard techniques [8]. Recordings and analyses of the tracings were made using a computerized system (Dyno System, Menfis s.r.l., Bologna, Italy) as previously described [9].

Anal Resting Pressure (ARP) was recorded in mmHg with the stationary pull-through technique and the computer identified the maximal pressure (P_{max}), the mean pressure (P_m) and the high pressure zone area (HPZ area), where HPZ area was $= \Sigma (Pi \times Li)$: Pi was the pressure value in mmHg at each sampling, and Li was the length in millimeters between two successive samplings. The maximal voluntary contraction (MVC) was examined by evaluating the voluntary contractions of the anal sphincter; amplitude was expressed in mmHg, duration in seconds. The rectoanal inhibitory reflex (RAIR) was elicited by inflating a soft balloon in the rectum at 10 cm from the anal verge wiith 40 ml of air, our normal value to induce complete relaxation [9]. The computer quantified the total duration of reflex (TDR) in seconds: TDR was equal to the complete amount of relaxation time (RT) in seconds plus contraction time (CT) in seconds, as suggested by Martelli [10]. The computer also quantified the maximal amplitude of relaxation (MAR) expressed in percent, the residual pressure at the lowest point of the RAIR (Pres in mmHg), the mean RAIR pressure (P_m RAIR in mmHg) and the area of the reflex where the RAIR area was $= \Sigma (Pi \times Li)$: Pi was the pressure value in mmHg at each sampling and Ti was the time in seconds between two successive samplings.

The first distension volume at which internal anal sphincter relaxation had occurred, i.e. the RAIR threshold, (RAIRT), and the distension volume at which an initial transient sensation had taken place, i.e. the conscious rectal sensitivity threshold, (CRST), were determined in all patients and controls. The maximal tolerated volume (MTV) was also measured in all subjects and it was considered an expression of rectal reservoir capacity. Compliance of the rectum was expressed by the ratio mmHg/ml of inflated air, measured by means of the pressure/volume curve. Manometric signs of PFD were high anal canal pressure (P_m; HPZ area) and impaired RAIR, i.e. incomplete relaxation with a short duration of the reflex [9].

Defecography

All patients and controls underwent defecography according to the methods suggested by the Italian Working Team [11]. The radiological assessment was carried out at rest, during contraction, and during expulsion of the barium. The anorectal angle (ARA) was measured between the longitudinal axis of the anal canal and the tangential line to the posterior rectal wall, and was expressed in degrees. The pelvic floor descent (PFDe), which was defined as the vertical distance between the pubococcygeal line and the anorectal junction, was expressed in millimetres. A qualitative evaluation, diagnostic for pelvic floor dyssynergia, was made by noting the persistence of the puborectalis indentation during evacuation.

Bimodal rehabilitation

All patients underwent bimodal rehabilitation. A single cycle consisted of ten outpatient sessions. Each session lasted 1 hour and took place twice a week. The first step was pelviperineal kinesitherapy. This was then combined with biofeedback training from the fifth session until the end of the cycle.

From the start to the end of treatment, patients were asked to record stool frequency. They were also asked to indicate whether laxatives and/or enema assistance had been required.

a) Pelviperineal kinesitherapy

The cycle of pelviperineal kinesitherapy followed the standard sequence listed below, but was adapted to the individual woman. During each session two essential steps were taken: the exercises of the

last lesson were reviewed and new exercises were introduced so as to ensure continuing and accurate patient response.

1st session:
- preliminary lesson on relaxed breathing and corporeal consciousness (used at the start of all sessions),
- diaphragmatic breathing,
- marking of perineal area, made easier by peri- and intra-anal digital manipulation,
- location and focusing of agonist, antagonist and synergic muscles on the perineal plane.

2nd session:
- antiversion and retroversion pelvic movements,
- short anal contractions,
- some exercises of short anal relaxation,
- perianal and perivaginal stretching,
- stretch reflexes of the puborectalis, elicited by the therapist but "contra" a simultaneous voluntary anal contraction.

3rd session:
- perianal and perivaginal stretching,
- stretch reflexes of the puborectalis,
- the learning of abdominal press principles (diaphragm, pelvic floor, abdominal wall, paravertebral muscles, iliopsoas).

4th session:
- perianal and perivaginal stretching,
- stretch reflexes of the puborectalis,
- abdominopelvic synergy (the abdominal press force vectors are directed to the posterior perineum while simultaneous voluntary sphincterial anal relaxation occurs),
- simulation of defecation by expelling the therapist's forefinger, but without any abnormal muscular recruitment.

5th session:
- abdominopelvic synergy and simulation of defecation with slight pelvic floor descent (used from this session until the end of the cycle),
- consciousness reinforcement with the correct execution of anal relaxation,
- start of biofeedback (learning of techniques and some exercises regarding anal contractions/relaxation).

6th session:
- visual control of pelvic floor descent using a mirror,
- anal corticalization stage: some anal contraction exercises are introduced (bending down, coughing, or the use of Valsalva's manoeuvre in supine, upright, sitting positions),
- biofeedback (some exercises of anal relaxation).

7th session:
- response modulation: gradualness in sphincteric recruitment/inhibition,
- biofeedback (response modulation).

8th session:
- response modulation in sphincter inhibition with slight pelvic floor descent,
- biofeedback (some exercise of anal relaxation with modulation technique).

9th session:
- revision exercises on abdominopelvic synergy and gradual anal relaxation,
- biofeedback (revision exercises).

10th session:
- revision exercises,
- biofeedback,
- final interview (stool frequency, laxative-enema assistance).

b) Biofeedback

Biofeedback (BF) was performed using Contimed manometric BF equipment (Hollister, Libertyville, Ill., USA). Once its function had been explained to the patients, the equipment was used from the fifth session to the end of rehabilitation. While the patient was lying in the left lateral position, a BF probe was introduced into the anorectum. Patients were required to use their anal muscles as they had

Table 1 Clinical evaluation

	Controls (10)	Patients (35) (pre)	Patients (35) (post)
Stool frequency (n°/week)	6.1±1.2	2.7±1.8[a]	6.3±2.0
Laxative assistance (n°/week)	–	1.2±0.3[a]	0.4±0.2
Enema assistance (n°/week)	–	1.6±0.6[a]	0.6±0.1
Digital evacuation (n° patients/total patients)	–	26/35	–
Obstructed micturition (n° patients/total patients)	–	8/35	3/35

[a] Patients (pre) vs Patients (post) or vs Controls: $P<0.001$

learned to do during kinesitherapy. Feedback was noted by changes in the coloured lights on the Contimed meter.

Statistical analysis

Results were expressed as mean±standard deviations (SD). Student's t-test for paired and unpaired samples was used for statistical analysis.

Results

Clinical symptoms

Table 1 shows a comparison of clinical characteristics of controls and patients.

All 35 patients had a very significant increase in bowel movement frequency ($P<0.001$) after bimodal rehabilitation. The frequency of laxative-induced ($P<0.001$) and enema-induced ($P<0.001$) bowel movements was significantly reduced, and the need to digitally evacuate the rectum (74.2% of our patients had used this technique) was no longer necessary after the therapeutic treatment. Only 3 women still had obstructed micturition at the end of the ten sessions.

Computerized anorectal manometry

After bimodal rehabilitation, anal canal pressure had increased, but not significantly. Maximal pressure ($P<0.01$), mean pressure ($P<0.01$), and HPZ area ($P<0.05$) were significantly higher than those of the controls (Table 2). After treatment, MVC had no significant differences in amplitude when compared with pre-treatment values. MVC

duration, which had been significantly ($P<0.001$) shorter ("exhaustio") in patients than in controls before kinesitherapy, returned to significantly normal values after the rehabilitation (Table 2). The RAIR parameters are reported in Table 3.

TDR was statistically shorter in women with pelvic floor dyssynergia ($P<0.01$) given that they had had a shorter CT ($P<0.001$) before rehabilitation when compared to controls. After rehabilitation treatment, no significant differences were found as regards either TDR or CT in patients and controls. In the patient group, the residual pressure at the lowest point of reflex was statistically higher ($P<0.001$) than in controls while MAR, RAIR area and mean RAIR pressure were statistically lower ($P<0.001$). At the end of rehabilitation, the 35 patients had Pres, MAR, RAIR area and P_m RAIR values which were similar to those of the controls. These values were also significantly different ($P<0.001$) from those noted before the treatment. RAIRT was not significantly different when patients and controls were compared. No differences were found as regards CRST, MTV or rectal compliance, before and after bimodal rehabilitation. All 35 patients had tolerated a volume of 180–200 ml of air and all had compliance of the rectum.

Defecography

Defecographic results are reported in Table 4.

Before the rehabilitation treatment, all patients had shown indentation of the puborectalis and a poor ARA opening at evacuation ($P<0.001$). Rectal emptying had also been impaired to some degrees, as verified by barium trapping results (50%). At the end of treatment, ARA was significantly higher ($P<0.001$) during evacuation, and was then similar to that of controls. Indentation of the puborectalis had disappeared, and barium trapping was lower (25%). After bimodal rehabilitation, the patients showed a significantly deeper PFDe at evacuation ($P<0.01$) than controls. This was also a statistically significant difference between pre- and post-course values.

Discussion

Dyschezia, defined as difficult bowel movements, may be brought on by pelvic floor dyssynergia as a consequence

Table 2 Anal canal pressures

	P_{max} mmHg	P_m mmHg	HPZ area Σ (Pi×Li)	MVC	
				P (mmHg)	T (s)
Controls	78.0±10.2	41.8±6.6	1678.4±279.3	124.1±3.7	24.3±7.3
Patients (pre)	97.1±11.1[b]	51.6±8.6[b]	2685.1±374.3[a]	151.1±15.6[a]	17.3±5.1[c]
Patients (post)	110.2±17.4[b]	52.8±6.8[b]	2871.6±178.9[a]	163.7±20.4[a]	24.5±6.8

[a] Patients (pre) or Patients (post) vs Controls: $P<0.05$
[b] Patients (pre) or Patients (post) vs Controls: $P<0.01$
[c] Patients (pre) vs Patients (post) or vs Controls: $P<0.001$

Table 3 RAIR

	RT (s)	CT (s)	TDR (s)	P$_m$ mmHg	P$_{res}$ mmHg	MAR (%)	RAIR area Σ (P×Ti)
Controls	9.1±0.2	20.4±2.5	29.5±2.7	22.6±2.4	1.3±0.7	97.4±2.2	654.7±39
Patients (pre)	7.8±1.6	12.5±0.3[c]	20.2±1.9[b]	15.9±9.8[a]	12.0±3.7[c]	79.0±3.0[c]	365.1±32[c]
Patients (post)	7.7±3.1	19.9±4,8	26.6±8.7	19.4±7.3	2.1±0.4	96.8±3.1	612.6±56

[a] Patients (pre) vs Patients (post) or vs Controls: $P<0.05$
[b] Patients (pre) vs Patients (post) or vs Controls: $P<0.01$
[c] Patients (pre) vs Patients (post) or vs Controls: $P<0.001$

Table 4 Defecography (R resting, E evacuation)

	ARA (degrees)		Pelvic flor descent (mm)		Barium trapping (%)	Puborectalis indentation (n° patients/total patients)
	R	E	R	E		
Controls	94±3	110±3	39.4±11	69.4±11	10	–
Patients (pre)	85±6[a]	87±4[b]	32.6±18	49.5±12[a]	50	35/35
Patients (post)	87±2[a]	106±9	37.6±15	82.3±13[a]	25	–

[a] Patients (pre) or Patients (post) vs Controls: $P<0.05$
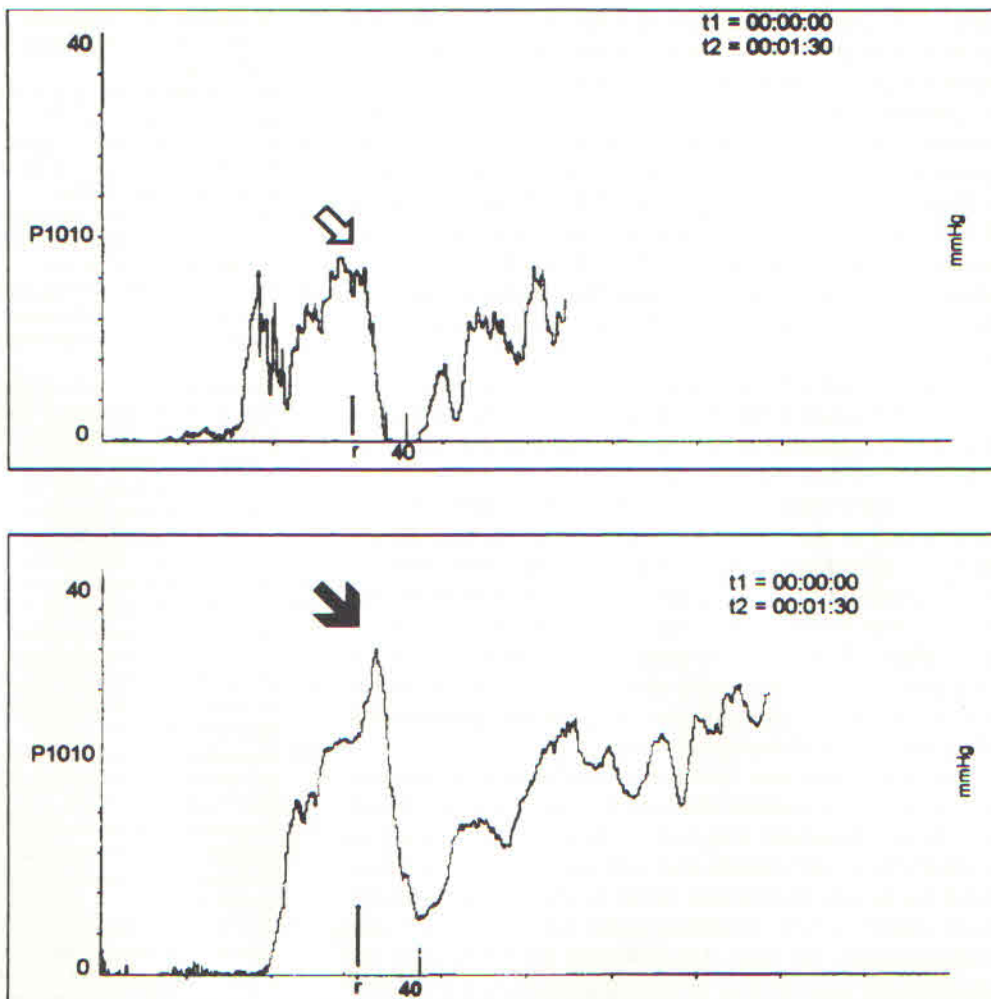[b] Patients (pre) vs Patients (post) or vs Controls: $P<0.001$

of obstructed defecation, which occurs when pelvic floor muscles fail to relax during attempts to defecate. Biofeedback has been considered the best training method for this common functional disorder [4]. Biofeedback is an operant conditioning; it is voluntary, employs a trial and error process by which learning takes place, and the subject must be aware of the desired response (graphic drawings or coloured lights for the normal response). However, success is not always guaranteed and there is an absence of any predictive factor. Moreover, it is not certain when and how it works [5]. Even in view of these factors, it has been considered a cortical reconditioning method for the defecation reflex [12]. Pelviperineal kinesitherapy is a specific muscular re-education technique for the uncoordinated pelvic floor muscles. This muscular training programme works particularly well on elevator ani, by improving performance, extension and elasticity. However, since the pelviperineal area has poor sensorial "consciousness" it has been hypothesized that pelviperineal kinesitherapy might require biofeedback to strengthen the re-education process. Moreover, once this method has been learnt, it might make it easier, in a few sessions, to achieve the biofeedback response desired. Therefore, a new bimodal rehabilitation procedure using both techniques was set up for the treatment of pelvic floor dyssynergia and, for the reasons stated above, we did not compare bimodal rehabilitation with biofeedback alone. Before therapy, all of our patients had been affected by dyschezia and had had diagnostic signs of PFD, such as higher than normal anal canal pressure with impaired RAIR. Defecographic images at evacuation with indentation of the puborectalis and poor ARA opening had also been characteristic of the 35 patients.

After bimodal rehabilitation, all the women showed improvement: they had a significant increase in bowel movement frequency ($P<0.001$) and use of laxatives and ene-

mas had decreased ($P<0.001$). The need to digitally evacuate the rectum disappeared and only three patients showed obstructed micturition, with hesitancy. These symptomatic improvements were confirmed by manometric-proctographic data.

After treatment, manometric results showed that anal canal pressure was higher (Table 2) and that there was a normal rectoanal inhibitory reflex (Table 3). Anal resting pressure was statistically higher than that of the controls, but it was not significantly different from pre-treatment values. This was also shown by the defecographic resting ARA which remained unchanged and was statistically more narrow than that of controls ($P<0.05$). It is difficult to say what might have been the functional mechanism which determined the anal canal hypertonia. The failure of anorectal myectomy to resolve anismus [3], the absence of any anal fissure, and recent advances in morphological evaluation using sonography [13] suggest that the internal anal sphincter cannot be responsible. On the other hand, since the influence of striated sphincter muscles on resting anal tone values is well known (15–30%) [14, 15], it is possible that stronger contractions of the puborectalis muscle and the external anal sphincter might have induced the increased anal canal pressure. But we do not know what the aetiological factor is. Furthermore, the fact that there were minimally higher changes in ARP (Table 2) with increased anal squeeze pressure has also been reported by others after the use of biofeedback [5]. Nevertheless, anal hypertonia does not seem to be an important factor for defecation retraining if correct pelvic floor function can be obtained. Anal canal hypertonia is a physical and/or manometric sign which indicates increased anal sphincteric strength: it does not offer any information on anal sphincteric muscle coordination. Such strength is only one aspect of anal function. On the contrary, the coordination of agonist, antagonist and synergic muscles of the pelviperineal plane is the crucial

Fig. 1 P1010=manometric channel. t1; t2=manometric sample window: times at the start (t1), at the end (t2). RAIR elicited: r/40=inflation of balloon −40 ml air. *Upper tracing:* normal subject at r/40 (empty arrow). *Lower tracing:* patient with pelvic floor dyssynergia. Note the high excitatory response at r/40 (*full arrow*) and the incomplete relaxation during reflex

voluntary step for arriving at normal defecation. Bimodal rehabilitation exercises did improve voluntary coordination. This can be demonstrated in our patients by the longer duration of MVC after the sessions ($P<0.001$), and by the fact that the sphincteric recruitment had improved and there had been longer endurence without any further assisted-influence, given that these changes left the MVC amplitude unchanged.

Therefore, the higher resting anal canal pressures at the start of the study might not have been specific signs of pelvic floor dyssynergia; however, the impairment of RAIR most probably was.

All the patients who had been affected by failure to relax the pelvic floor muscles during attempts to defecate had impaired RAIR, with incomplete relaxation (MAR: $P<0.001$; RAIR area: $P<0.001$) and with a duration which had been shorter than that of controls (TDR: $P<0.01$). After rehabilitation, patient RAIR became normal, and the RAIR parameters showed no significant differences in relation to those of controls. On the other hand, there was a significant difference between pre- and post-treatment values ($P<0.001$) (Table 3). This seems to be the key to understanding some aspects of the pathophysiology of pelvic floor dyssynergia. RAIR impairment cannot be caused by any organic internal anal sphincter damage, for the reasons stated above. RAIR is an intramural rectal reflex with an off-on response: it is independent of any cortical influence. In fact, to understand this anal dysfunction better, it is important to remember that, in normal subjects, the response to rectal distension includes two recto-anal reflexes: relaxation of the internal anal sphincter (RAIR), and contractions of the puborectalis and the external anal sphincter (Recto-Anal Excitatory Reflex: RAER). Both striated muscles act, functionally, as one unit [16–18]. Relaxation of the internal sphincter allows for the rectal content to come into contact with the sensory epithelium of the anal canal ("anal sampling") [19]. The reflex excitatory response, which proximally involves the puborectalis in the upper anal canal and distally the external anal sphincter in the lower anal canal [20], prevents the loss of faecal or flatus sampling. Concerning defecation, after anal sampling, voluntary inhibition of both the striated muscles occurs and rectal evacuation takes place. In our patients with pelvic floor dyssynergia, proximal RAER might be higher than in normal subjects as regards the paradoxical puborectalis activity and thus might overcome the inhibitory response (Fig. 1), causing RAIR impairment and outlet obstruction. In fact, impaired RAIR weakens the anal sampling and in-

creases the pressure gradient between the anal canal and rectum at evacuation, so that defecation does not begin. After rehabilitation treatment, the coordinated activity of the puborectalis seemed to be restored, as suggested by the normal defecographic anorectal angle at evacuation. The proximal excitatory response had improved and had less influence on the pressure profile of RAIR. Finally, distal RAER, which is not considered be a true reflex but an "autonomic learned response" [21] given that it is under voluntary control [20], could be modified during the muscular retraining sessions of the bimodal rehabilitation programme.

Defecographic X-ray films were a determining factor for the evaluation of the therapeutic results. After rehabilitation, the anorectal angle showed a normal excursion at evacuation. There was a significant difference when compared with pre-treatment values ($P < 0.001$) (Table 4). The indentation of the puborectalis was shown to have disappeared in all patients. The mechanical obstruction, induced by the paradoxical contraction or the failure to relax this muscle, was no longer blocked, as evidenced by the lower percentage of barium trapping. Pelvic floor descent at evacuation was significantly deeper ($P < 0.01$) after rehabilitation and the dynamic excursion of the puborectalis sling was restored during straining [13].

In conclusion, our bimodal rehabilitation techniques seems to be a successful therapeutic option for functional dyschezia. However, long-term follow up is necessary to evaluate long-term results and validation in comparison to other retraining programme could be the next step. Moreover, studies on the influence of the puborectalis on anal canal pressure, the role of RAER, and the function of the elevator any muscle may be necessary to arrive at a fuller explanation of the multiple, functional and anatomical factors most probably involved in PFD.

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