



Sphincteroplasty for fecal incontinence in the era of sacral nerve modulation

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Abstract

The role of sphincteroplasty in the treatment of patients with fecal incontinence due to anal sphincter defects has been questioned because the success rate declines in the long-term. A new emerging treatment for fecal incontinence, sacral nerve stimulation, has been shown to be effective in these patients. However, the success rate of sphincteroplasty may depend of several patient-related and surgical-related factors and the outcome from sphincteroplasty has been evaluated differently (with qualitative data) from that after sacral nerve stimulation (quantitative data using scoring systems and quality of life). Furthermore, the data available so far on the long-term success rate after sacral nerve modulation do not differ substantially from those after sphincteroplasty. The actual data do not support the replacement of sphincteroplasty with sacral nerve stimulation in patients with fecal incontinence secondary to sphincter defects.

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INTRODUCTION

Sphincteroplasty was first described by Lockhart-Mummary^[1] in 1923, who reported only on the end-to-end apposition of the margins of the damaged anal sphincter, however, the operation become popular following a publication by Parks *et al*^[2], who first described the overlapping sphincteroplasty. Since then, this operation is generally believed to be the treatment of choice for incontinent patients with external anal sphincter defects in whom conservative management has failed. However, this operation has recently been questioned because of its long-term success rate, which like many other operations for functional diseases of the gastrointestinal tract, declines with time. On the other hand, the new procedure of sacral nerve modulation has been demonstrated to benefit patients, even those with damaged anal sphincter, and has raised the question of whether sphincteroplasty still has a role in the management of patients with fecal incontinence after sphincter damage. In this editorial, the reason for the failure of sphincteroplasty and the matter of using sacral nerve stimulation (SNS) instead of sphincteroplasty in patients with sphincter damage are discussed.

PROGNOSTIC FACTORS OF SPHINCTEROPLASTY

Sphincteroplasty is usually indicated after obstetric damage to a normal anal sphincter during childbirth or after an iatrogenic lesion to cure an abscess or a complex anal fistula. It is uncertain whether the etiology of the sphincter lesion can affect the outcome. One of the few papers dealing with this topic suggests that patients with surgical trauma do better than those with obstetric trauma^[3]. However, we did not find similar results in the Italian registry of fecal incontinence (data not shown). Of course, the extent of sphincter damage plays an important role in the outcome. It is easier and probably more effective to close a small gap of 30° than a gap of 120°, and in most of the papers dealing with this operation, patients with a gap in the anal defect greater than 120° are usually excluded from this procedure^[4]. Another possible factor influencing the success rate after sphincteroplasty could be the occurrence of pudendal neuropathy. Nowadays, the pudendal nerve terminal motor latency test is not generally considered to be predictive of the outcome of several procedures for fecal incontinence such as sacral nerve modulation, however, most of the papers on this topic^[5-9] demonstrated that patients without pudendal neuropathy did significantly better than patients with neuropathy (Table 1). The problem is that, almost all these studies are retrospective and it is not possible to demonstrate whether neuropathy existed prior to surgery. Another important factor potentially affecting the outcome is the age of these patients. The literature shows that patients less than 40 or even 50 years old do much better than older patients^[10].

Further possible factors which can influence the outcome of this operation are related to the surgical technique. There are many tips on the surgical techniques used which could play a role in the outcome of these patients. For example, early *vs* delayed repair. A recent study^[11] demonstrated that early repair, whenever possible, has better cost-effectiveness than delayed repair. In addition, a study by Sultan *et al*^[12] indicated that suturing the internal and external anal sphincter separately could give better results, although this data has never been confirmed.

It is generally believed that sphincter overlap is the preferred way to perform a sphincteroplasty. However, in the literature there are only 2 papers on this topic. In particular, the study by Fitzpatrick *et al*^[13], which had a very short follow-up, found no difference in outcome. However, the study by Fernando *et al*^[14], in a large group of patients, found a significantly better outcome at one year follow-up when the overlapping technique was used.

Other surgical details include the use of resorbable or unresorbable sutures. Some older studies on sphincteroplasty were performed using catgut to approximate the sphincter margins, and this is of major importance when we look at the long-term results. The literature suggests that the use of PDS or prolene is better than Vicryl or Dexon because they need a longer time to be resorbed^[15].

Some authors^[16] have advocated the need for a diverting stoma to protect the sphincteroplasty, but there

Table 1 Effects of pudendal neuropathy on the outcome of sphincteroplasty for fecal incontinence

Author	n	Success without neuropathy (%)	Success with neuropathy (%)	P value
Laurberg <i>et al</i> ^[3] , 1988	19	42	5	< 0.05
Londono-Schimmer <i>et al</i> ^[6] , 1994	94	60	14	< 0.001
Sitzler <i>et al</i> ^[7] , 1996	29	48	24	< 0.05
Chen <i>et al</i> ^[8] , 1998	12	75	50	< 0.05
Gilliland <i>et al</i> ^[9] , 1998	77	62	17	< 0.01

Table 2 Short term outcome after sphincteroplasty for fecal incontinence

Author	n	Obstetric/ surgery	Results (%) excellent/good	Fair	Poor
Fleshman <i>et al</i> ^[20] , 1991	55	100	72	22	6
Wexner <i>et al</i> ^[21] , 1991	16	100	76	19	5
Engel <i>et al</i> ^[22] , 1994	55	100	79	-	21
Oliveira <i>et al</i> ^[23] , 1996	55	99	71	9	20
Felt-Bersma <i>et al</i> ^[24] , 1996	18	94	72	-	28
Nikiteas <i>et al</i> ^[3] , 1996	42	88	60	17	24
Sitzler <i>et al</i> ^[7] , 1996	31	87	74	-	26
Ternent <i>et al</i> ^[25] , 1997	16	100	44	31	25
Zorcolo <i>et al</i> ^[26] , 2005	93	100	65	9	27
Barisic <i>et al</i> ^[27] , 2006	65	86	74	17	9

is no evidence for this; on the contrary, there is evidence of morbidity following stoma closure and stoma-related disability^[17]. Almost all colorectal surgeons do not use a diverting stoma or bowel confinement after a sphincteroplasty and usually these patients can resume oral feeding immediately after surgery^[18].

Another interesting factor which potentially affects the outcome of sphincteroplasty, is the puborectalis sling contraction. Roche's group in Ginevra^[19] demonstrated that patients with good function of the puborectalis sling measured by perianal echography do better. This means that patients who still have some functionality of pelvic floor muscles have a better chance of obtaining a good result after sphincteroplasty.

FUNCTIONAL OUTCOME AFTER SPHINCTEROPLASTY

Patients with fecal incontinence have a normal life-expectancy, so we must look at the long-term results rather than the early results. Table 2 lists the studies dealing with the short-term results of sphincteroplasty, in most cases after obstetric trauma, indicating a very interesting rate of excellent/good results for a pooled good outcome of about 69%. However, if we look at the long-term results, after a follow-up ranging from 5 and 10 years (Table 3), the number of excellent/good results falls to 46%.

Why does the success rate deteriorate with time after sphincteroplasty? Some suture breaks in the muscle can occur in the postoperative period, and other patients may have an undetected cause of fecal incontinence. Furthermore, it is supposed that in women, a deteriora-

Table 3 Long term outcome after sphincteroplasty for fecal incontinence

Author	n	Median FU (mo)	Results (%) excellent/good	Fair	Poor
Pezim <i>et al</i> ^[28] , 1987	40	67	62	-	38
Londono-Schimmer <i>et al</i> ^[6] , 1994	94	59	50	26	24
Malouf <i>et al</i> ^[29] , 2000	46	77	50		
Halverson <i>et al</i> ^[30] , 2002	49	69	14	32	54
Vaizey <i>et al</i> ^[31] , 2004	21		52	10	38
Bravo Gutierrez <i>et al</i> ^[32] , 2004	130	120	22	19	57
Zorcolo <i>et al</i> ^[26] , 2005	62	70	45	10	45
Barisic <i>et al</i> ^[27] , 2006	65	80	48	13	39
Maslekar <i>et al</i> ^[33] , 2007	64	84	80		20
Oom <i>et al</i> ^[34] , 2009	120	111	38	23	40

tion in muscle trophism and innervation occur with age, particularly after the menopause due to the fall in estrogen levels^[35].

WHAT TO DO IN CASE OF EARLY OR LATE FAILURE OF SPHINCTEROPLASTY?

The first question is whether the same operation can be re-done. In the literature, there are two papers on this topic^[31,36], both claiming that 50% of these patients can recover their continence after a repeat sphincteroplasty, and that continence can be maintained in the long-term.

SACRAL NERVE STIMULATION VS SPHINCTEROPLASTY

In 1995, Matzel *et al*^[37] opened a new chapter in coloproctology, showing that sacral nerve stimulation can benefit patients with fecal incontinence. Since then, the indication for this procedure has been extended, even to patients with sphincter defects which were originally excluded. In the literature, there are already 7 papers^[38-44] published on this topic showing that there is a very interesting percentage of early success with SNS without doing anything to the damaged sphincter. The question now is, are we justified in skipping sphincteroplasty in the ideal “algorithm” to treat patients with sphincter defects by performing SNS directly? There are several issues that make this option questionable because the data available on sphincteroplasty and SNS have been poorly compared. There are two major issues that must be considered; the short- *vs* the long-term outcome and how the success rate is measured. Four papers dealing with the first topic were published in 2009 (Table 4)^[45-48].

When the data was amalgamated a 58% success rate in the long-term was observed. This was quite unexpected after the enthusiasm surrounding the early results of SNS. However, is this long-term outcome data truly comparable with those of sphincteroplasty? When dealing with SNS, we refer to mixed causes of incontinence, in both sexes, and, most importantly, the criterion used to define suc-

Table 4 Long term outcome after sacral nerve stimulation for fecal incontinence

Author	n	Success (%)	Length of follow-up (yr)
El-Gazzaz <i>et al</i> ^[45] , 2009	22	42	2.5
Altomare <i>et al</i> ^[46] , 2009	52	62	7
Matzel <i>et al</i> ^[47] , 2009	12	75	9
Vallet <i>et al</i> ^[48] , 2010	32	53	3

cess is more than a 50% reduction in major incontinence episodes. When we deal with sphincteroplasty, we look at patients with only one defect causing incontinence, the sphincter defect. Almost all patients are female and the criteria used to define success have been categorical and qualitative such as incontinence to solids, liquids or flatus. A good way of measuring the outcome of surgery for fecal incontinence would be patient satisfaction and quality of life, but few papers focus on these measurements. Most papers on sphincteroplasty just classify the outcome into categories of incontinence. In contrast, in all of the papers on SNS, incontinence scores are used. However, even in these cases confusion can arise due to the use of different incontinence scores (Wexner Score^[49], Vaizey's score^[50], Pescatori's score^[51], and many others), making the results between SNS and sphincteroplasty difficult to compare. Furthermore, the criteria for defining success used in SNS studies (< 50% of incontinence episodes) have never been adopted in sphincteroplasty studies.

Another argument based on the definition of success is related to the treatment of fecal incontinence, as the success of the techniques is defined by the statistically significant reduction of incontinence scores, however, this information does not give us what we need to know: how many of our patients have had their problems fixed, not the statistical changes in the global scores.

A very interesting recent paper^[34] reviewed 160 patients who had undergone sphincteroplasty, with a very long follow-up of about 10 years. The outcome was classified using the two main systems: categorical (excellent, moderate and poor results) and quantitative (number of incontinence episodes/week). The authors found that 37% of patients had an excellent/good result, 23% had a moderate result and 40% had a poor result. However, the group of patients with a moderate result had more than a 50% reduction in incontinence episodes. This means that, if we analyze the data on sphincteroplasty using the criteria generally adopted for patients undergoing SNS, the long-term success rate is 60%, which is at least comparable to that of SNS.

CONCLUSION

From the literature, overlapping sphincteroplasty can achieve satisfactory long-term results, and, at the moment, they are at least comparable to SNS. Repeat sphincteroplasty may be performed and should be considered as the treatment of choice in the case of failure of previous sphincter repair. Sacral Nerve Stimulation is an effective,

fascinating but expensive technique which should be offered to patients who have failed a previous surgical attempt to repair the sphincter.

REFERENCES

- 1 **Lockhart-Mummery JP.** Diseases of the rectum & colon and their surgical treatment. Toronto: MacMillan, 1923: 685-686
- 2 **Parks AG, McPartlin JF.** Late repair of injuries of the anal sphincter. *Proc R Soc Med* 1971; **64**: 1187-1189
- 3 **Nikiteas N, Korsgen S, Kumar D, Keighley MR.** Audit of sphincter repair. Factors associated with poor outcome. *Dis Colon Rectum* 1996; **39**: 1164-1170
- 4 **Tjandra JJ, Chan MK, Kwok SY, Yeh CH, Tan JJ, Sloane K, Carey MP.** Predictive factors for faecal incontinence after third or fourth degree obstetric tears: a clinico-physiologic study. *Colorectal Dis* 2008; **10**: 681-688
- 5 **Laurberg S, Swash M, Henry MM.** Delayed external sphincter repair for obstetric tear. *Br J Surg* 1988; **75**: 786-788
- 6 **Londono-Schimmer EE, Garcia-Duperly R, Nicholls RJ, Ritchie JK, Hawley PR, Thomson JP.** Overlapping anal sphincter repair for faecal incontinence due to sphincter trauma: five year follow-up functional results. *Int J Colorectal Dis* 1994; **9**: 110-113
- 7 **Sitzler PJ, Thomson JP.** Overlap repair of damaged anal sphincter. A single surgeon's series. *Dis Colon Rectum* 1996; **39**: 1356-1360
- 8 **Chen AS, Luchtefeld MA, Senagore AJ, Mackeigan JM, Hoyt C.** Pudendal nerve latency. Does it predict outcome of anal sphincter repair? *Dis Colon Rectum* 1998; **41**: 1005-1009
- 9 **Gilliland R, Altomare DF, Moreira H Jr, Oliveira L, Gilliland JE, Wexner SD.** Pudendal neuropathy is predictive of failure following anterior overlapping sphincteroplasty. *Dis Colon Rectum* 1998; **41**: 1516-1522
- 10 **Rasmussen OO, Puggaard L, Christiansen J.** Anal sphincter repair in patients with obstetric trauma: age affects outcome. *Dis Colon Rectum* 1999; **42**: 193-195
- 11 **Tan EK, Jacovides M, Khullar V, Teoh TG, Fernando RJ, Tekkis PP.** A cost-effectiveness analysis of delayed sphincteroplasty for anal sphincter injury. *Colorectal Dis* 2008; **10**: 653-662
- 12 **Sultan AH, Monga AK, Kumar D, Stanton SL.** Primary repair of obstetric anal sphincter rupture using the overlap technique. *Br J Obstet Gynaecol* 1999; **106**: 318-323
- 13 **Fitzpatrick M, O'Herlihy C.** Short-term and long-term effects of obstetric anal sphincter injury and their management. *Curr Opin Obstet Gynecol* 2005; **17**: 605-610
- 14 **Fernando RJ, Sultan AH, Radley S, Jones PW, Johanson RB.** Management of obstetric anal sphincter injury: a systematic review & national practice survey. *BMC Health Serv Res* 2002; **2**: 9
- 15 **Kettle C, Johanson RB.** Absorbable synthetic versus catgut suture material for perineal repair. *Cochrane Database Syst Rev* 2000; CD000006
- 16 **Hasegawa H, Yoshioka K, Keighley MR.** Randomized trial of fecal diversion for sphincter repair. *Dis Colon Rectum* 2000; **43**: 961-964; discussion 964-965
- 17 **Richard C, Bernard D, Morgan S, Tassé D, Wassef R.** [Results of anal sphincteroplasty for post-traumatic incontinence: with or without colostomy] *Ann Chir* 1994; **48**: 703-707
- 18 **Nessim A, Wexner SD, Agachan F, Alabaz O, Weiss EG, Nogueras JJ, Daniel N, Billotti VL.** Is bowel confinement necessary after anorectal reconstructive surgery? A prospective, randomized, surgeon-blinded trial. *Dis Colon Rectum* 1999; **42**: 16-23
- 19 **Zufferey G, Perneger T, Robert-Yap J, Rubay R, Lkhagv-abayar B, Roche B.** Measure of the voluntary contraction of the puborectal sling as a predictor of successful sphincter repair in the treatment of anal incontinence. *Dis Colon Rectum* 2009; **52**: 704-710
- 20 **Fleshman JW, Dreznik Z, Fry RD, Kodner IJ.** Anal sphincter repair for obstetric injury: manometric evaluation of functional results. *Dis Colon Rectum* 1991; **34**: 1061-1067
- 21 **Wexner SD, Marchetti F, Jagelman DG.** The role of sphincteroplasty for fecal incontinence reevaluated: a prospective physiologic and functional review. *Dis Colon Rectum* 1991; **34**: 22-30
- 22 **Engel AF, van Baal SJ, Brummelkamp WH.** Late results of anterior sphincter plication for traumatic faecal incontinence. *Eur J Surg* 1994; **160**: 633-636
- 23 **Oliveira L, Pfeifer J, Wexner SD.** Physiological and clinical outcome of anterior sphincteroplasty. *Br J Surg* 1996; **83**: 502-505
- 24 **Felt-Bersma RJ, Cuesta MA, Koorevaar M.** Anal sphincter repair improves anorectal function and endosonographic image. A prospective clinical study. *Dis Colon Rectum* 1996; **39**: 878-885
- 25 **Ternent CA, Shashidharan M, Blatchford GJ, Christensen MA, Thorson AG, Sentovich SM.** Transanal ultrasound and anorectal physiology findings affecting continence after sphincteroplasty. *Dis Colon Rectum* 1997; **40**: 462-467
- 26 **Zorcolo L, Covotta L, Bartolo DC.** Outcome of anterior sphincter repair for obstetric injury: comparison of early and late results. *Dis Colon Rectum* 2005; **48**: 524-531
- 27 **Barisic GI, Krivokapic ZV, Markovic VA, Popovic MA.** Outcome of overlapping anal sphincter repair after 3 months and after a mean of 80 months. *Int J Colorectal Dis* 2006; **21**: 52-56
- 28 **Pezim ME, Spencer RJ, Stanhope CR, Beart RW Jr, Ready RL, Ilstrup DM.** Sphincter repair for fecal incontinence after obstetrical or iatrogenic injury. *Dis Colon Rectum* 1987; **30**: 521-525
- 29 **Malouf AJ, Norton CS, Engel AF, Nicholls RJ, Kamm MA.** Long-term results of overlapping anterior anal-sphincter repair for obstetric trauma. *Lancet* 2000; **355**: 260-265
- 30 **Halverson AL, Hull TL.** Long-term outcome of overlapping anal sphincter repair. *Dis Colon Rectum* 2002; **45**: 345-348
- 31 **Vaizey CJ, Norton C, Thornton MJ, Nicholls RJ, Kamm MA.** Long-term results of repeat anterior anal sphincter repair. *Dis Colon Rectum* 2004; **47**: 858-863
- 32 **Bravo Gutierrez A, Madoff RD, Lowry AC, Parker SC, Buie WD, Baxter NN.** Long-term results of anterior sphincteroplasty. *Dis Colon Rectum* 2004; **47**: 727-731; discussion 731-732
- 33 **Maslekar S, Gardiner AB, Duthie GS.** Anterior anal sphincter repair for fecal incontinence: Good longterm results are possible. *J Am Coll Surg* 2007; **204**: 40-46
- 34 **Oom DM, Gosselink MP, Schouten WR.** Anterior sphincteroplasty for fecal incontinence: a single center experience in the era of sacral neuromodulation. *Dis Colon Rectum* 2009; **52**: 1681-1687
- 35 **Donnelly V, O'Connell PR, O'Herlihy C.** The influence of oestrogen replacement on faecal incontinence in postmenopausal women. *Br J Obstet Gynaecol* 1997; **104**: 311-315
- 36 **Giordano P, Renzi A, Efron J, Gervaz P, Weiss EG, Nogueras JJ, Wexner SD.** Previous sphincter repair does not affect the outcome of repeat repair. *Dis Colon Rectum* 2002; **45**: 635-640
- 37 **Matzel KE, Stadelmaier U, Hohenfellner M, Gall FP.** Electrical stimulation of sacral spinal nerves for treatment of faecal incontinence. *Lancet* 1995; **346**: 1124-1127
- 38 **Brouwer R, Duthie G.** Sacral nerve neuromodulation is effective treatment for fecal incontinence in the presence of a sphincter defect, pudendal neuropathy, or previous sphincter repair. *Dis Colon Rectum* 2010; **53**: 273-278
- 39 **Boyle DJ, Knowles CH, Lunniss PJ, Scott SM, Williams NS, Gill KA.** Efficacy of sacral nerve stimulation for fecal incontinence in patients with anal sphincter defects. *Dis Colon Rectum* 2009; **52**: 1234-1239
- 40 **Chan MK, Tjandra JJ.** Sacral nerve stimulation for fecal incontinence: external anal sphincter defect vs. intact anal sphincter. *Dis Colon Rectum* 2008; **51**: 1015-1024; discussion 1024-1025
- 41 **Melenhorst J, Koch SM, Uludag O, van Gemert WG, Baeten**

- CG. Is a morphologically intact anal sphincter necessary for success with sacral nerve modulation in patients with faecal incontinence? *Colorectal Dis* 2008; **10**: 257-262
- 42 **Conaghan P**, Farouk R. Sacral nerve stimulation can be successful in patients with ultrasound evidence of external anal sphincter disruption. *Dis Colon Rectum* 2005; **48**: 1610-1614
- 43 **Jarrett ME**, Dudding TC, Nicholls RJ, Vaizey CJ, Cohen CR, Kamm MA. Sacral nerve stimulation for fecal incontinence related to obstetric anal sphincter damage. *Dis Colon Rectum* 2008; **51**: 531-537
- 44 **Ratto C**, Litta F, Parello A, Donisi L, Doglietto GB. Sacral nerve stimulation is a valid approach in fecal incontinence due to sphincter lesions when compared to sphincter repair. *Dis Colon Rectum* 2010; **53**: 264-272
- 45 **El-Gazzaz G**, Zutshi M, Salcedo L, Hammel J, Rackley R, Hull T. Sacral neuromodulation for the treatment of fecal incontinence and urinary incontinence in female patients: long-term follow-up. *Int J Colorectal Dis* 2009; **24**: 1377-1381
- 46 **Altomare DF**, Ratto C, Ganio E, Lolli P, Masin A, Villani RD. Long-term outcome of sacral nerve stimulation for fecal incontinence. *Dis Colon Rectum* 2009; **52**: 11-17
- 47 **Matzel KE**, Lux P, Heuer S, Besendörfer M, Zhang W. Sacral nerve stimulation for faecal incontinence: long-term outcome. *Colorectal Dis* 2009; **11**: 636-641
- 48 **Vallet C**, Parc Y, Lupinacci R, Shields C, Parc R, Tiret E. Sacral nerve stimulation for faecal incontinence: response rate, satisfaction and the value of preoperative investigation in patient selection. *Colorectal Dis* 2010; **12**: 247-253
- 49 **Jorge JM**, Wexner SD. Etiology and management of fecal incontinence. *Dis Colon Rectum* 1993; **36**: 77-97
- 50 **Vaizey CJ**, Carapeti E, Cahill JA, Kamm MA. Prospective comparison of faecal incontinence grading systems. *Gut* 1999; **44**: 77-80
- 51 **Pescatori M**, Anastasio G, Bottini C, Mentasti A. New grading and scoring for anal incontinence. Evaluation of 335 patients. *Dis Colon Rectum* 1992; **35**: 482-487

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