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### The physiology of continence and evacuation

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Continence is maintained by the coordinated function of the pelvic floor, rectum and anal sphincters. Evacuation occurs through a relaxed pelvic floor. The rectum acts to either store or expel stool both of which require cortical sensory awareness acting in conjunction with intramural and spinal reflexes that ensure timely defecation. The anal sphincters act individually and in unison in response to rectal distension and the sensation of rectal filling. Reflex relaxation of the internal anal sphincter has an additional sensory function in allowing sampling of rectal contents in the upper anal canal. Voluntary control of the external anal sphincter is key in the voluntary deferring of evacuation until a socially opportune moment. This review describes the physiological roles of each of these continence organs in order to understand the complex process of defecation

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#### Introduction

The twin function of the colon can broadly be summarised as being able to propel intestinal content distally, whilst reabsorbing liquid from that content. Approximately 90% of the whole gut transit time is accounted for by colonic transit [1]. This prolonged transit is essential in permitting the colon to fulfil specific homeostatic functions: (1) absorption of water and electrolytes (2) absorption of nutrients and (3) storage and controlled evacuation of faecal material [2–4]. The right colon (caecum and ascending colon) plays a major role in water and electrolyte absorption and fermentation of undigested sugars, and the left colon (descending colon, sigmoid colon and rectum) is predominantly involved in storage and evacuation of stool. The anal sphincter is a relatively simple structure that undertakes the relatively complex function of maintaining continence. Not only do the anal sphincters regulate faecal

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continence, but also they are increasingly recognised as controlling defaecation and are integral to our understanding of the physiology of defaecation and continence. The motor component of the mechanism involves both involuntary and voluntary muscle, as such there is a delicate interplay between the anal sphincter, rectum and pelvic floor. There is also a sensory component through the pelvic nerves which also have somatic and visceral function. As such there is interplay between motor and sensory function, mediated through pelvic muscle and pelvic nerves.

### *Symptoms*

Constipation affects up to a quarter of the general population. It can be broadly categorised as occurring either due to:

- (1) pelvic floor dysfunction, or
- (2) slow whole gut transit, or
- (3) a combination of these two

In patients with constipation due to pelvic floor dysfunction, the predominant problem is an inability to completely evacuate the contents of the rectum. Slow transit constipation (STC) implies delayed colonic transit resulting from disordered colonic motor function. This prolonged colonic transit time allows for greater water absorption, and hence stools are hard and can make evacuation difficult [5]. As such, a significant proportion of STC patients report co-existing rectal evacuation difficulty. Nevertheless, approximately two-thirds of hospital referrals with constipation have rectal evacuation difficulty as their primary problem [6], and it is likely that this prevalence is even greater in the general community.

Faecal incontinence is the other cardinal symptom of anorectal dysfunction. Obstretic anal trauma is one of the most well-recognised aetiological factors, with sphincter defects associated with both abnormal physiology and symptoms of faecal incontinence [7]. However, in the majority sphincter injury alone does not result in incontinence [7,8] and abnormal anal canal manometry correlates poorly with symptoms [9,10]. The rectum plays an important role in the continence mechanism highlighted by poor functional outcome after surgical rectal excision where symptoms of incontinence correlate with the length of rectal tissue excised [11,12]. It is therefore clear that sphincter function alone is not solely responsible for maintaining faecal continence. There is growing evidence that aberrant anorectal reflexes as well as rectal sensorimotor dysfunction are key contributors in the pathophysiology of faecal incontinence [13,14].

### *The dynamics of defaecation*

Defaecation commences with rectal sensory awareness at a critical level of filling which is relayed to the cerebral cortex as the perception of the need to evacuate the rectum [15]. The actual threshold volume depends on the nature of the contents (volume, consistency) and the rectum (mucosal inflammation, rectal wall compliance). When the subject is in a socially appropriate setting for defaecation, the person adopts a sitting, or squatting, position. The latter position, facilitated by hip flexion, results in optimal straightening of the rectal angle and allows more effective propulsion of contents [16]. The rectal contents provoke reflex relaxation of the anal sphincters and puborectalis and the subject then performs a Valsalva manoeuvre (holding the breath and forcibly trying to exhale against a closed glottis, creating a pushing down effect) [17,18]. Abdominal pressure is raised, and the muscles of the anterior abdominal wall tense up to funnel the pressure down to the pelvis. The relaxation of the pelvic floor then allows some stool to enter the lower rectum. This in turn tends to initiate the spontaneous giant recto-sigmoid contractions which pushes stool through the relaxed anal canal [19]. Further large propulsive contractions of the rectum occur until the rectum is empty. A sensory input from the anus maintains this propulsive activity until the rectum is fully voided [20]. This seems to be a reflex mediated at spinal cord level since even spinally injured patients can void a complete stool from the rectum, once initiated [21]. As the stool passes through the anal canal it

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