

1 History and evolution of stomas and appliances

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A study of history gives us a perspective on the present, and this chapter will **take** us on a journey from the most primitive responses to trauma and diseases of the **bowel to modern innovative surgical techniques**. The journey **takes** us from the most crude of **collecting devices**, past complex and **cumbersome** equipment, towards the technical **developments** which have enabled the production of the more **effective and discreet** appliances of **today**. **History** has seen the emphasis shift from the earliest attempts at curing disease to curing and **caring**, that is recognising the importance of the patient's quality of life after surgery.

STOMA SURGERY

Stoma surgery prior to the 19th century

Table 1.1 Key developments in stoma surgery prior to the 19th century

55BC–7AD	Celsus	Observations on damage to intestines
1707	Heister	First recorded stoma surgery
1756	Cheseiden	Transverse colostomy
1795	Daguesceau	Fashioned colostomy
1799	Larrey	Intestine stitched to abdominal wound

Earliest references to stomas and diseases of the bowel suggest a belief that damage to the **small intestine** was always fatal, whereas damage to the large intestine could offer a very faint **hope of recovery**. Celsus (55BC-7AD) wrote: 'sometimes the abdomen is penetrated by a stab of some sort, and it follows that intestines roll out. When this happens we must first examine whether they are uninjured, and then whether their proper colour persists. If the small intestine has been penetrated, no good can be done. The larger intestine can be sutured, not with any certain assurance, but because a doubtful hope is preferable to certain despair; for occasionally it heals up.'

There are occasional references to spontaneous breakdown of gangrenous hernia resulting in stoma formation and references to abdominal wounds that discharged faeces. George Deppe (Fig 1.1) was wounded at the Battle of Ramillies in 1706 and lived for 14 years with a prolapsed colostomy (Cromar, 1968). Despite this limited encouragement there was little surgical development until the early 18th century.



Fig 1.1 George Deppe

A surgeon named William Cheselden described his treatment of a patient, Margaret White (see Fig 1.2). She had an umbilical hernia from the age of 50, and when she was 73 she had a fit of colic and vomiting which caused the hernia to rupture; it prolapsed and became gangrenous. Cheselden had to remove about 26 inches of bowel and formed a transverse

colostomy. He wrote that White recovered and lived for many years and that she was taken out of bed and sat up every day (Cheselden, 1756).



Fig 1.2 Margaret White, the patient of William Cheselden

Two contemporaries of Cheselden, a Frenchman named Henri Le Dran and a German named Lorenz Heister, followed their armies into the battlefield and gained considerable experience of wounds, including those of the bowel. Le Dran had previously observed some patients who, in desperation, attempted to lance what they thought were boils and which were in fact painful inflamed ruptures. According to Le Dran the resulting wound, which was discharging faeces, would sometimes heal if it was cleansed and dressed regularly. He therefore surmised that it was safer to fix injured bowel outside the abdominal wound to stop faeces discharging into the belly and causing peritonitis (Le Dran, 1781).

Heister also described stitching injured gut to the abdominal wall with waxed thread and fixing it firmly with sticking plaster so that the gut could not slip back inside and no faeces could enter the peritoneal cavity. He visited the Dutch camp at Flanders in 1709 and gave a rare description of stoma management: 'there have been instances where the wounded intestine has been so far healed that the faeces which used to be voided per anum have been voided by the wound in the abdomen, which, from the necessity of wearing a tin or silver pipe, or keeping cloths constantly upon the part to receive the excrement, may seem to be very troublesome. But it is surely far better to part with one of the conveniences of life, than to part with life itself.'

As a result of his observations on the battlefields, Heister understood how the facility with which wounded gut adhered to other structures could be used to the patient's advantage (Heister, 1743).

Another instance of both stoma surgery and stoma management was described by a French surgeon called Daguesceau (Cromar, 1968). In 1795 a farmer had pierced his abdomen with a stake after he stumbled while loading wheat onto a cart. Daguesceau created a colostomy from the injury and the man lived until he was 81, managing the stoma by using a small leather drawstring bag as a collecting device.

Dominique Larrey developed his surgical skills on the Napoleonic battlefields and organised a system for dealing with casualties, offering both on-the-spot treatment and evacuation procedures. During the assault on Cairo in 1799 he described the treatment and subsequent recovery of a soldier who had a gunshot wound to the abdomen and intestine. He stitched the damaged intestine to the edge of the abdominal wound which was kept open until the injured intestine healed (Larrey, 1823).

In 18th century civilian life surgeons were slowly becoming more respected. They knew their limitations and, on the whole, were unwilling to take unnecessary risks or use untried techniques, preferring to intervene only to help nature. There were exceptions who were willing to push the boundaries further and suggest more radical intervention. Alexis Littre spoke at the Royal Academy of Sciences in Paris in 1710 and described a post-mortem where he had found the six-day-old baby to have an imperforate anus. He described the rectum as being in two parts joined by threads of tissue; the upper part filled with meconium and the lower part empty. Littre had two suggestions for dealing with this: either open the two closed ends and stitch them together or bring the upper end out on the abdomen to function as an anus (Littre, 1710).

We do not have any records of attempts to try Littre's suggestions until 1783 Antoine Dubois created a colostomy for a three-day-old child who lived for ten days afterwards (Dubois, 1797) and in 1793 a French surgeon called Duret created a successful colostomy on a three-day-old child with imperforate anus – the patient lived until the age of 45 (Duret, 1798).

Stoma surgery during the 19th century

Table 1.2 Key developments in stoma surgery during the 19th century

1815	Freer	First elective stoma surgery
1887	Allingham	Loop colostomy
1895	Paul/Miculicz	Temporary stoma

The first elective surgery recorded in the UK was a colostomy created on a neonate by George Freer in 1815 but the baby died three weeks later (Pring, 1821). These stoma operations in infancy were performed on desperately ill babies with colorectal malformations and, naturally enough at this time, deaths were very common. This type of intervention was slow to gain either professional or social approval.

Professor Gross of Philadelphia, writing in 1859, was astonished 'that anyone possessed of the proper feeling of humanity should seriously advocate a procedure so fraught with danger and followed, if successful, by such disgusting consequences'. He continued: 'I cannot, I must confess, appreciate the benevolence which prompts a surgeon to form an artificial outlet for the discharge of faeces, in a case of imperforate anus.' (Gross, 1866)

Although colostomies were still unusual enough to attract interest on an individual basis, we cannot be sure of the true incidence during Victorian times. Many patients were operated on in their own homes without records being kept. In 1887 William Allingham described his creation of a double lumen loop colostomy held in place with a glass rod. A similar type of temporary diverting procedure is still used today.

A significant step forward in surgery of the large bowel was what became known as a Paul/Miculicz operation, named after two surgeons working in the late 19th and early 20th centuries. It is a temporary stoma in which the diseased colon is resected and the two cut ends are joined together inside the abdomen to make a spur. Later, the continuity of the bowel is

restored without further surgery by crushing the spur (Paul, 1900; von Miculicz, 1903).

Stoma surgery in the 20th century

Table 1.3 Key developments in stoma surgery in the 20th century

1913	Brown	Temporary ileostomy
1923	Hartmann	End colostomy
1943	Miller	Proctocolectomy and ileostomy
1950	Bricker	Ileal conduit
1952	Brooke	Eversion ileostomy
1969	Kock	Internal pouch
1978	Parks	Preserved anal sphincter
1980	Mitrofanoff	Internal reservoir for urine

It is not until the early years of the 20th century that moves were made to treat colitis with surgical intervention and ileostomy if medical treatment failed. John Young Brown of St Louis reported in 1913 on the successful management of ulcerative colitis by creating a temporary ileostomy. Continuity of the bowel was restored by anastomosis when he felt the colon had healed. Although this became accepted surgical treatment in the USA, mortality rates were very high as patients were usually desperately ill before referral (Brown, 1913).

The basic technique of colostomy formation has remained unchanged since the middle of the 19th century. We have a description from 1923 of Hartmann's operation for rectosigmoid cancers. This was originally a single operation involving the excision of the upper rectum and sigmoid colon, closing of the rectal stump and formation of a terminal colostomy.

Surgeons were very reluctant to accept ileostomies as permanent and originally it had been intended that ileostomies should be temporary until the disease had been cured and the normal function of the anus could be restored. It became apparent that in many cases not only had the disease returned after rejoining the bowel, but that chronically diseased bowel had a high incidence of malignancy. There seemed no alternative to removing the colon and creating a permanent ileostomy. In the 1930s this was done as a four-stage procedure with several weeks between each stage. First the ileostomy was created, then the right colon was removed, and the proximal end brought to the surface. Then the left colon was removed and the sigmoid was brought to the surface. Finally an abdominoperineal

resection was performed. By the 1940s the second and third stages could be done together because of improvements in drugs, anaesthetics and surgical science (Richardson, 1973). In 1943 in Montreal Gavin Miller combined the first two stages of the procedure, performing a proctocolectomy on a young girl with severe ulcerative colitis (Miller, 1949). Miller and his team were the first to perform a one-stage panproctocolectomy, excision of colon, rectum and anal canal and formation of a permanent ileostomy from the terminal ileum.

One of the major drawbacks in creating a permanent ileostomy was the quality of life of the patient after surgery due to inadequate postoperative care. Lester Dragstedt of Chicago used skin grafts around the ileostomy to try to overcome the problem of excoriation but unfortunately these grafts resulted in a high incidence of stenosis, ulceration and sometimes fistula (Dragstedt, 1941). In 1952 Bryan Brooke of Birmingham devised an improved technique for fashioning an ileostomy which involved everting the end of the withdrawn small bowel and suturing it into position to form a 'spout' (Fig 1.3). This helped overcome stenosis and other problems associated with a poorly constructed stoma (Brooke, 1952).

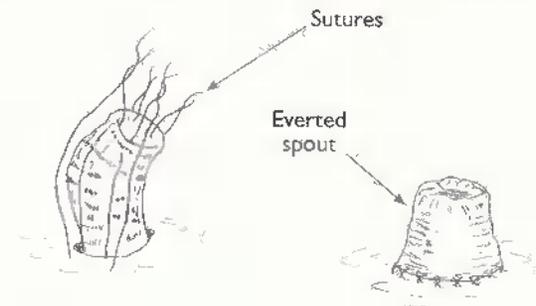


Fig 1.3 Eversion of stoma

During the 20th century surgeons became more and more concerned with improving the patient's quality of life after surgery. Some wanted to find alternatives to both the stoma and the necessity of wearing an appliance. New procedures were tried that offered a degree of continence. In 1969 Professor Nils Kock, a Swedish surgeon, reported on his technique of creating an internal pouch from the terminal ileum to act as a reservoir for faeces (Fig 1.4). The pouch is intubated and emptied with a catheter via a nipple valve. This procedure is not suitable for patients with Crohn's

disease because of the risk of recurrence within the bowel which makes up the reservoir (Kock, 1969).

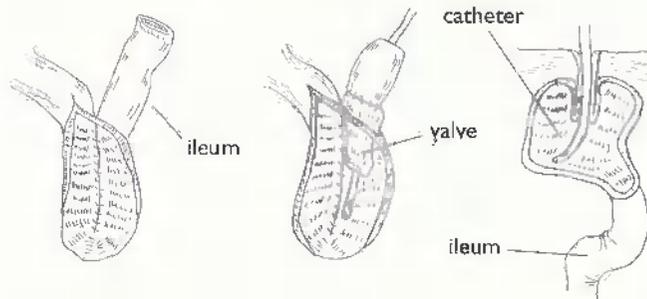


Fig 1.4 'Kock's pouch' – continent ileostomy

In 1978 Sir Alan Parks described his procedure for forming a reservoir from a length of terminal ileum. The ileum is fashioned into a J or W shape, opened and formed into a pouch (Fig 1.5). The tip of the pouch is anastomosed to the anus and, as the sphincters are intact, the patient's continence is restored (Parks, 1980).

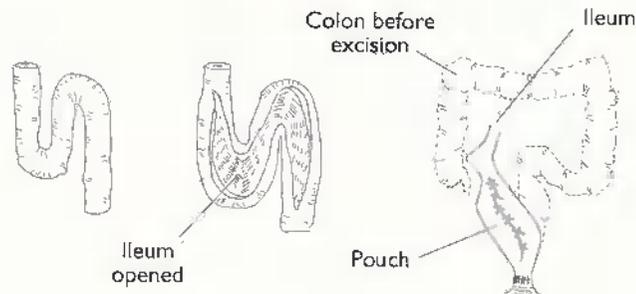


Fig 1.5 Formation of 'Parks pouch'

An alternative to a stoma was sought for those patients who suffered severe faecal incontinence because of loss of the normal function of the anal sphincter. This could be for a variety of reasons such as congenital abnormality, accident, disease or childbirth. A procedure was pioneered in Maastricht and The Royal London Hospital known as dynamic graciloplasty. The gracilis muscle from the thigh is transposed to create a new sphincter, which has to be electrically stimulated to function. This

procedure is now available in several centres but patients are warned that it is not always successful.

Urinary diversion

Urinary diversion may be necessary because of cancer and abnormalities of the bladder, to preserve renal function or to restore continence, and there are few records of attempts at intervention before the 20th century. In 1851 John Simon created a channel between the ureters and the rectum to divert a boy's urine but after passing urine in this way for some months he eventually died (Simon, 1855).

In 1911 Robert Coffey diverted the urine by implanting the ureters into the lumen of the sigmoid colon (Coffey, 1911). Technical improvements followed and the wet colostomy or caecostomy came into vogue. The resulting mixture of urine and faeces resulted in frequent skin excoriation and infection and was socially abhorrent.

In 1950 Eugene Bricker from St Louis reported on the improved version of his ileal conduit. Urine passes from the ureters into an isolated section of ileum, one end of which is brought to the surface of the abdomen and a stoma is formed. The continuity of the ileum is restored by anastomosis (Bricker, 1950).

There are three ways of diverting urine: by inserting a tube into part of the urinary tract and changing it at intervals; by diverting the urine internally into another organ, such as the colon; or it may be brought to the surface of the body where it opens by a stoma (Todd, 1978). The ileal conduit remains the preferred type of urinary diversion and different surgeons adopt their own techniques and improvements. Some surgeons implant the ureters separately and others prefer to anastomose the ureters together before implantation.

In the 1980s, in an attempt to avoid the need to wear an appliance, a number of urinary diversions using the Kock ileal pouch were carried out in the USA with some early encouraging results. The Kock Urinary Reservoir is rarely undertaken today because of the technical problems encountered in constructing a continent valve. A French surgeon, Paul Mitrofanoff, has given his name to the Mitrofanoff principle for the formation of a continent pouch, which is the construction of a reservoir, either from the existing bladder or from bowel. The reservoir can then be

drained using the appendix to construct a flush stoma which acts as a port for a catheter (Mitrofanoff, 1980). Different surgeons have adapted the technique using alternatives to the appendix such as ureter, vein, urethra, fallopian tube and skin tube.

Stoma surgery has travelled on a long journey since Celsus wrote, 'if the small intestine has been penetrated, no good can be done'. We now know that good can be done and hope for even more in the future. An artificially grown bladder has been implanted in a dog and it has functioned successfully; the next step is an artificially grown bladder implanted into a human (Tomorrow's World, BBC, March 1999).

STOMA APPLIANCES

Stoma appliances prior to the 20th century

Table 1.4 Key developments in stoma appliances prior to the 20th century

1707	Heister	Tins, silver pipes, cloths
1795	Daguesceau	Leather drawstring bag
19th century		Pads, absorbent dressings, binders

Having discussed the tremendous advances in surgical techniques we will now look at something that was essential to the well being and quality of life of the patient, that is the development of an effective appliance. We have brief descriptions of stoma management by the early ostomists. In the 18th century we heard of battle casualties at Flanders who used tins, silver pipes and cloths to collect their faecal output. In the late 18th century Daguesceau gave us his description of the farmer he had operated on who managed by using a small leather bag with a drawstring which he adjusted to fit his stoma.

During the 19th century patients generally relied on pads, absorbent dressings and binders and little had changed at the beginning of this century.

Stoma appliances in the 20th century

Table 1.5 Key developments in stoma appliances in the 20th century

1910	Heavy surgical belts with plastic cups
1930s	Thick heavy rubber bags
1944	Koenig-Rutzen bag
1960s	Thin odourproof disposable plastic bags Karaya gum Hydrocolloid skin barriers Stoma Care Nurses appointed
1980s	Plug system Toilet-flushable colostomy bags

From 1910 onwards some patients were managing their stomas by wearing heavy surgical belts with straps and buckles. The belts, which doubled up as support garments, incorporated a plastic cup over the stoma. The patient would line the cup with cotton wool, lint or gauze dressing, which would be changed as necessary. We can only imagine how restrictive and uncomfortable it must have been and how hot and unpleasant in warm weather.

Surgeons faced the dilemma that by creating an ileostomy to cure a patient they would seriously restrict his quality of life afterwards unless they could also offer an effective collecting appliance - one which would cope with the more liquid output of the ileostomist. Therefore they only considered creating an ileostomy if the patient was in a desperate state and this obviously had implications for his recovery afterwards.

In the early 1940s the first rubber bags were manufactured commercially and it became possible to obtain ileostomy appliances. These first rubber bags were a great improvement on what had been available but they still brought major problems for the wearer. They were large and took a considerable amount of time to fit, as they had to be attached to the skin with adhesives. The adhesives used were often so strong that they caused severe irritation to the skin. The bags were used in rotation and carefully washed out, hung up to dry and turned inside out to be powdered. With frequent use the bags began to absorb odours and became smelly.

Some members of the Ileostomy Association, a patient self-help group, wrote about their experiences during this period:

'My ileostomy was born to the days of the non-adhesive bag, when to lie down meant bandages from chest to knees... In the daytime, in order to

in position a horrible monstrosity of a red rubber smelly bag, one had to wear so stiff a corset that to bend (except at the knees) was impossible. As a single young person, I looked pregnant when returning from hospital.'

'I had my ileostomy given to me in January 1949 by a young surgeon called Bryan Brooke. At that time both ends of the ileum were brought out as two stomas. There were no stick-on bags available in this country, but they were being made in America, but to import a set of three into this country cost £15 which was about three weeks' wages then. Many 'do it yourself' efforts were tried out, including cutting up drawsheets and stitching the parts together with Bostik to form bags. Unfortunately when the Bostik was tried but there were leaks through the stitch holes. An ever-bright idea was to use a surgical rubber glove with the cuff turned over to form a rubber ring to form the flange. This was coated with latex and stuck over the active stoma. When the glove filled up it looked like a hand sticking out of the stomach, then one of the finger-ends of the glove was cut off and the contents emptied with a milking action. The finger was then sealed with a rubber band. (Ileostomy Association Midlands Divisions, 1981)

Stoma care for ileostomists took a giant leap forward in 1944 with the introduction of a bag developed in Chicago by an engineering student called Koenig. The Koenig-Rutzen bag was made of thin rubber and was attached to the skin with latex adhesive. The upper opening of the bag had a small disc covered with rubber and made in different sizes to fit different stomas (Fig 1.6). It brought a new freedom for many patients because it was both discreet and effective compared with what they had before.

Although rubber bags remained popular we were entering the plastic age and people began to see the advantages of lightweight disposable appliances, which did not have to be washed, dried and reused. Attaching rubber and early plastic pouches to the skin was a complex process, involving the use of strong adhesives such as latex and zinc oxide and the need to apply extra pressure for security (Fig 1.7). Skin allergy and irritation was common and the fact that these adhesives left behind a sticky residue added to the problem. Cotton covers in different shades and patterns were used to make the pouches more acceptable in appearance and also to help prevent excessive perspiration.

There was increasing awareness of the need to protect the skin around the stoma effectively. Karaya gum is collected from trees of the Sterculia family in India and its peculiar property is its enormous swelling

power. A teaspoonful, in powder form, placed in a glass of water will form a solid jelly-like mass within a few hours. This property made karaya gum powder useful in the textile, cosmetic and food industry and a very common use was for holding dentures in place.

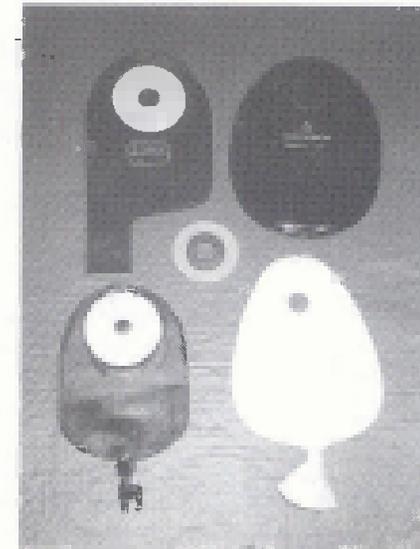


Fig 1.6 Rubber bags

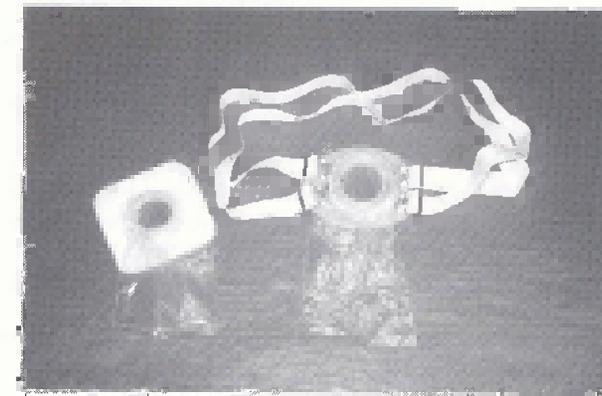


Fig 1.7 Two-piece appliances before Karaya or hydrocolloids

In the 1980s a manufacturer introduced a system described as a plug, which was designed to give the user temporary freedom from wearing a pouch (Fig 1.8). It is suitable for colostomists with a descending colostomy and with regular bowel frequency. When inserted into the stoma, the plug swells like a tampon and can be kept *in situ* for up to twelve hours.

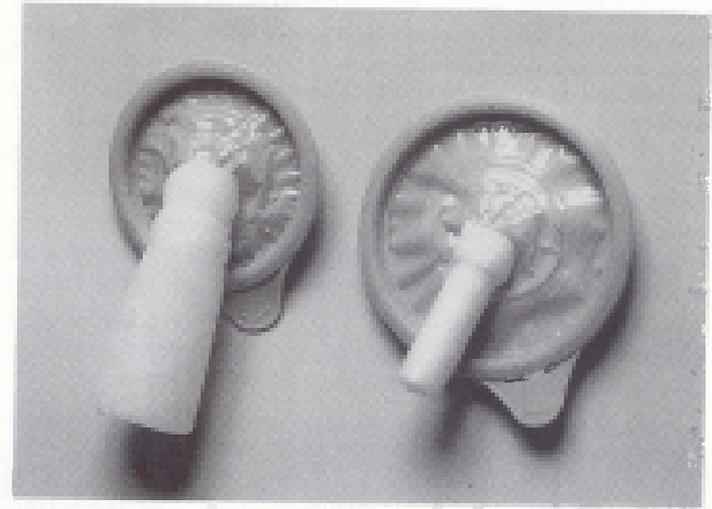


Fig 1.8 'Plug' system – developed in the 1980s and 1990s

Another development during this time was the first colostomy pouch, which was designed to be 'toilet-flushable'. The flushable pouch was welcomed with great enthusiasm by colostomists as it seemed to offer a solution to pouch disposal problems, especially when away from home. Unfortunately a few reports of problems and embarrassment caused by blocked pipes and drains, meant that initial enthusiasm waned and patients were reluctant to risk flushing them away. In the early 1990s a company introduced a more successful product which is a colostomy pouch with a 'toilet disposable' liner. The user removes the liner from the outer pouch and flushes it away in the toilet where it biodegrades in the sewage system.

Before the arrival of stoma care nurses in the UK in the late 1960s, patients had looked to surgeons, appliance manufacturers and self-help groups for support, information and advice. Stoma care nurses brought about tremendous improvements in the quality of life of their patients. Among many other things, they encouraged surgeons to improve their techniques and took over the stinging of stomas, trying to ensure that the position of the stoma made it as easy as possible for the patient to manage the appliance. At the same time they were taking part in product trials and evaluations and continually pressing manufacturers to make further improvements and additions to the range of products available.

At the same time as the pouches were being improved, more effective skin barriers were introduced which eventually superseded karaya. These barriers were also developed from substances used in dentistry and further reduced the instances of sore skin. We refer to these skin barriers as hydrocolloid adhesives and they are made of carboxymethylcellulose, polyisobutylene, pectin and gelatin – a combination of synthetic and natural materials. They should be strong enough to keep a fitted appliance attached to the skin without leaking, even during physical activity and, at the same time, they should protect and maintain the skin area around the stoma. Since the late 1960s manufacturers have continued to research and develop barriers, and modern versions are more flexible, comfortable and durable than their predecessors.

In the 1960s another giant step forward was taken when the usual polythene pouches were superseded by a thin laminated plastic pouch which was many times more odourproof than its predecessors. Modern stoma appliances are made from several layers of film, each of which imparts different properties to the pouch attempting to ensure that it is odourproof, low noise, soft feel and environmentally friendly. They usually have a layer of soft, water-resistant material on both the front and the back, which makes them more comfortable, reduces noise and improves the appearance of the pouch.

Dr Rupert Turnbull of the Cleveland Clinic appreciated that its ability to adhere to mucous membranes, such as the inside of the mouth, might prove useful for stoma patients in forming a barrier around the stoma to prevent skin excoriation (Osborn Quarterly, 1981). Karaya has been used in a variety of forms to protect peristomal skin; it can be sprinkled on in powder form, formed into a separate ring or washer to act as an extra protective barrier, or as an integral part of the appliance itself. For many ostomists karaya brought more effective, longer lasting protection and helped to reduce the amount of skin excoriation.

Modern appliances

Modern appliances are divided into three main groups: drainable, closed and urostomy. Each of these groups of products is available in one-piece and two-piece versions.

- ▶ Drainable pouches are used in the immediate postoperative period and where the faecal output is liquid or semiformed. All ileostomists wear a drainable pouch and some colostomists with a more fluid output need them. They can be emptied via the outlet, which is then sealed with a plastic clip or flexible tie.
- ▶ Closed pouches are worn by colostomists with well-formed faeces and are discarded after use.
- ▶ Urostomy pouches incorporate a non-return valve to prevent reflux of urine onto the stoma, thus reducing the risk of infection. They have a tap for emptying and can be connected to a night drainage system.

One-piece appliances are the most simple to use being lightweight and discreet (Fig 1.9). The pouch incorporates an adhesive flange to secure it to the skin and after use it is removed and replaced by a new one.

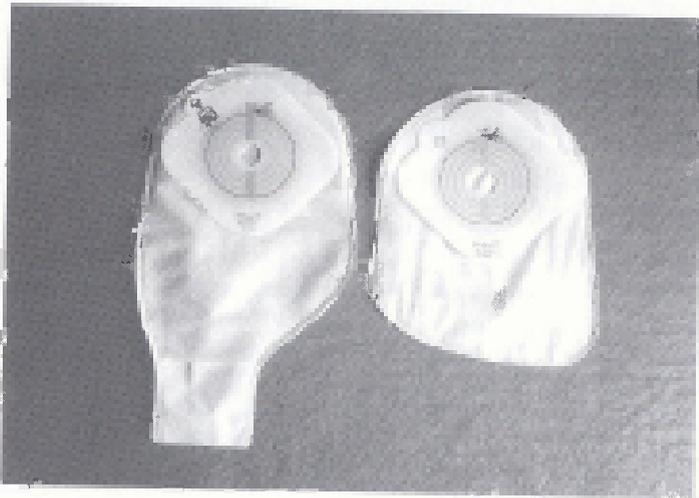


Fig 1.9 One-piece appliances (1990s)

Two-piece appliances (Fig 1.10) have a separate adhesive flange or base plate, which is attached to the skin, and the pouch is then clipped into

position on the flange. The pouch is replaced after use but the flange may stay in position for several days. Two-piece appliances reduce the risk of skin excoriation caused by frequent removal of adhesive, and they offer the patient the flexibility of being able to change the capacity of the pouch while keeping the flange *in situ*.

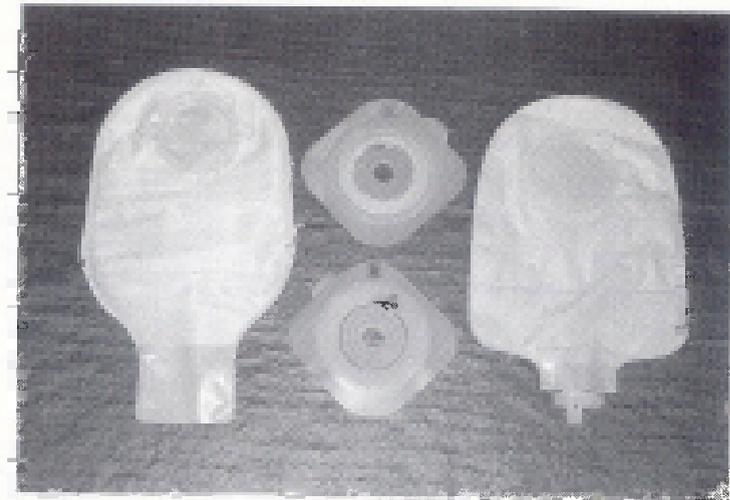


Fig 1.10 Two-piece appliances (1990s)

Pouches are available in both clear and opaque versions. Clear pouches are usually used in the immediate postoperative period or by patients who, perhaps because of poor eyesight, need to feel confident that they have fitted their pouch correctly. Opaque pouches conceal the contents and are more acceptable to the majority of patients.

Patients often experience problems because of flatus, or wind, which can create embarrassment by causing their pouches to 'balloon'. This ballooning can disrupt sleep and can increase the risk of leakage. Closed pouches have long had integral charcoal filters, which allow flatus to be released while absorbing any odour. In the late 1990s modern technology has enabled this solution to be available to ileostomists. Some pouches include a filtration system, which allows the filter to remain effective by protecting it from the more fluid faecal output of the ileostomist.

There is a wide range of accessory products available to patients including pastes, wafers, protective rings, seals and wipes, deodorant sprays,



powders and drops, corsets, belts and girdles. These should only be recommended if essential to the patient's stoma care as it is beneficial that the stoma be managed as simply as possible without any unnecessary procedures.

The choice of appliance for a patient is determined by the type of stoma, the faecal output, the site of the stoma, the patient's physical or mental capabilities, the skin condition and sensitivity and last, but by no means least, the patient's choice.

CONCLUSION

This chapter has described the incredible developments in surgery and amazing expansion in the range and quality of appliances available. Tomorrow promises to bring even more improvements and an even better quality of life for those who have a stoma. We owe a great debt to those who have gone before.

REFERENCES

- Bricker, E.M. (1950) Bladder substitution after pelvic evisceration. *Surgical Clinics of North America*; 30, 1511-1521.
- Brooke, B.N. (1952) The management of an ileostomy including its complications. *Lancet*, ii, 102-104.
- Brown, J.Y. (1913) The value of complete physiological rest of the large bowel in the treatment of certain ulcerative and obstructive lesions of this organ with description, operative technique and report of cases. *Surgery, Gynaecology and Obstetrics*; 16, 610-613.
- Celsus. *De Medicina*, English trans. by Spencer, W.G. (1935) London: Heinemann. Cambridge, Mass.: Harvard University Press; 3, 385. Book VII Section 16.
- Cheselden, W. (1756) *The anatomy of the human body*. 7th Edition. London: Hitch and Dodsley.
- Coffey, R.C. (1911) Physiological implantation of the severed ureter or common bile duct into the intestine. *Journal of American Medical Association*; 56, 397-403.
- Cromar, C.D.L. (1968) The evolution of colostomy. *Diseases of the Colon and Rectum*; 11, 256-280; 367-390; 423-446.

- Dragstedt, L.R., Dack, G.M., Kirsner, J.B. (1941) Chronic ulcerative colitis. *Annals of Surgery*; 114, 653-662.
- Dubois, A. Reported by Allan (1797) *Recueil Périodique de la Société de Médecine de Paris*; 3, 125. (Reprinted in Amussat (1839), p 88.)
- Duret, C. (1798) Observations et réflexions sur une imperforation de l'anus. *Recueil Périodique de la Société de Médecine de Paris*; 3, 46. (Reprinted in Amussat (1839) pp. 95-99.)
- Gross, S.D. (1866) *A System of Surgery*, Vol. 2. Philadelphia: Blanchard and Lea.
- Heister, L. (1743) *A General System of Surgery in Three Parts*. London: Innys, Davis, Clark, Mamby and Whiston. (Original German edition, 1718.)
- Ileostomy Association Midlands Divisions, (1981) Newell, A., Pearson, B (eds.) *The first twenty-five years 1956-1981*.
- Kock, N.G. (1969) Intra-abdominal reservoir in patients with permanent ileostomy. *Archives of Surgery*; 99, 223-231.
- Larrey, D.J. (1823) *Some observations on wounds of the intestines*. Surgical Essays. Baltimore: Maxwell.
- Le Dran, (1781) *The Operations in Surgery*. Translated by Gataker, 5th Edition. London: Dodsley and Law. (Original French edition, 1742.)
- Littre (1710) Diverses observations anatomiques. II. *Histoire de l'Académie Royale des Sciences Paris*. 36-37 (Edition published in 1732.)
- Miller, G.G., Gardner, C.McG., Ripstein, C.B. (1949) Primary resection of the colon in ulcerative colitis. *Canadian Medical Association Journal*; 60, 584-585.
- Mitrofanoff, P. (1980) Cystostomies continente trans-appendiculaire dans le traitement des vessies neurologiques. *Chirurgie Pédiatrique*; 21: 297.
- Ostomy Quarterly, Ileostomy Association Midlands Divisions, (1981) Newell, A., Pearson, B (eds.) *The first twenty-five years 1956-1981*.
- Parks, A.G., Nicholls, R.J., Belleveau, P. (1980) Proctocolectomy with ileal reservoir and anastomosis. *British Journal of Surgery*; 67, 533-538.
- Paul and von Miculicz, (1903) Small contributions to surgery of the intestinal tract. *Boston Medical and Surgical Journal* 1903; 148, 608-611.
- Pring, D. (1821) History of a case of the successful formation of an artificial anus in an adult, with an account of an analogous operation in two cases by G. Freer of Birmingham. *London Medical and Physical Journal*; 45, 1-15.

Richardson, R.G. (1973) *The Abominable Stoma: A Historical Survey of the Artificial Anus*. Queenborough, Abbot Laboratories.

Simon, J. (1855) Congenital imperfection of the urinary organs treated by operation. *Transactions of the Pathological Society, London*; **6**, 256–258.

Todd, I.P. (1978) *Intestinal Stomas*. London: Heinemann.

FURTHER READING

Allison, M. (1998) *An Interactive Guide to Stoma Care Nursing*. CD-ROM, City University, St Bartholomew's School of Nursing and Midwifery.

Black, P.K. (1994) History and evolution of stomas. *British Journal of Nursing*; **3**: 1.

Black, P.K. (1999) New developments in stoma appliances and care. *Nurse Prescriber/Community Nurse*; March 1999.

Elcoat, C. (1986) *Stoma Care Nursing*. London: Baillière Tindall.