NATIONAL INSTITUTE FOR HEALTH AND CARE EXCELLENCE

INTERVENTIONAL PROCEDURES PROGRAMME

Interventional procedure overview of radially emitting laser fibre treatment of an anal fistula

An anal fistula is a narrow tunnel that forms between the end of the bowel and the skin near the anus. It may cause pain or discomfort, and leak blood or pus. In this procedure, a fibre containing a laser is put into the fistula. Laser energy is emitted all around the fibre (radially) and the fibre is then gradually withdrawn. The aim is that the laser energy will destroy and seal off the fistula.

Contents

Introduction

The National Institute for Health and Care Excellence (NICE) prepared this interventional procedure overview to help members of the interventional procedures advisory committee (IPAC) make recommendations about the safety and efficacy of an interventional procedure. It is based on a rapid review of the medical literature and specialist opinion. It should not be regarded as a definitive assessment of the procedure.

Date prepared

This overview was prepared in July 2018 and updated in November 2018.

Procedure name

Radially emitting laser fibre treatment of an anal fistula

Specialist societies

- Association of Coloproctology of Great Britain and Ireland
- British Society of Gastroenterology
- Royal Society of Medicine Coloproctology Section
- Royal College of Surgeons of England
- Royal College of Surgeons of Edinburgh
- Royal College of Physicians and Surgeons of Glasgow.

Description of the procedure

Indications and current treatment

An anal fistula is an abnormal tract between the anal canal and the skin around the anus. It may cause symptoms such as pain or discomfort in the anal area, and leakage of blood or pus. It usually results from previous anal abscesses (cryptoglandular), and can be associated with other conditions such as inflammatory bowel disease and cancer.

Anal fistulas can be classified according to their relationship with the external sphincter. Intersphincteric fistulas are the most common type and cross only the internal sphincter. Trans-sphincteric fistulas pass through the internal and external sphincter.

Treatment of anal fistulas commonly involves surgery. The type of surgery depends on the location and complexity of the fistula. For intersphincteric and low trans-sphincteric anal fistulas, the most common treatment is a fistulotomy or laying open of the fistula track. For deeper fistulas that involve more muscle, and for recurrent fistulas, a seton (a piece of suture material or rubber sling) may be used, either alone or with fistulotomy. Setons can be loose (designed to drain the sepsis but not for cure), or snug or tight (designed to cut through the muscles in a slow controlled fashion). Fistulas that cross the external sphincter at a high level are sometimes treated with a mucosal advancement flap or other procedures to close the internal opening. Another less commonly used option for treating anal fistula is to fill the track with either a plug or paste. For example, 1 type of filler is fibrin glue (a solution of fibrinogen and thrombin).

What the procedure involves

Radially emitting laser fibre treatment of an anal fistula can be done with the patient under regional or general anaesthesia. With the patient in lithotomy position, the external and internal openings of the fistula tract are identified. The fistula is then catheterised using a probe and cleaned by irrigation. Under ultrasound guidance, a radially emitting laser fibre is advanced from the external to internal orifice, activated and gradually withdrawn at about 1 mm/second. The aim is to cause destruction and sealing of the fistula tract, allowing primary closure. The procedure may be used with techniques that close the internal orifice of the tract such as an advancement flap.

Outcome measures

In the Parks' classification, anal fistulas are classified according to the relationship between the primary fistula track and the anal sphincter muscles into:

- superficial fistula –beneath the internal and external anal sphincters
- intersphincteric fistula – between the internal and external anal sphincter muscles in the intersphincteric space
- trans-sphincteric fistula – crossing both the external and internal anal sphincters
- suprasphincteric fistula – travels outside the internal and external sphincters over the top of the puborectalis muscle and penetrates the levator muscle before tracking down to the skin

- extrasphincteric fistula – outside the external anal sphincter and penetrates the levator muscle into the rectum.

Efficacy summary

Primary healing rate (healing after the first laser treatment)

The primary healing rates after the first laser procedure were 64% (75/117)[1], 82% (41/50)[3], 71% (32/45)[4], 71% (25/35)[5], 82% (9/11)[6] and 89% (24/27)[7] in 6 of the case series included in table 2.

In a further case series of 103 patients the description of healing was classified as follows: 40% (41/103) of patients had a complete healing; 19% (20/103) had slight drainage with minimal symptoms; 37% (38/103) had persistent symptomatic drainage; and 4% (4/103) had painful symptomatic drainage after the procedure.[2]

Secondary healing rate after a consecutive laser procedure

The secondary healing rates after a consecutive laser procedure were 60% (3/5)[1], 14% (1/7)[2], and 50% (1/2)[4] in 3 case series in which these rates were reported.

Recurrence rate

In the case series of 45 patients, the recurrence rate was 4% (2/45) at a median follow-up of 30 months. The recurrences happened at 6 months and 9 months after the procedure.[4]

In the case series of 35 patients, the recurrence rate was 6% (2/35) at a median follow-up of 20 months. The recurrences occurred at 3 months and 6 months. Both were successfully treated with a lay-open procedure.[5]

In the case series of 27 patients, the recurrence rate was 11% (3/27) at a mean follow-up of 22 months. The recurrences occurred at 4 months in 1 patient and at 6 months in the other 2 patients. One of the patients who had a recurrence had an extrasphincteric fistula and had a second laser procedure 6 months after the first one. At 14-month follow-up, the fistula appeared to have healed. The other 2 patients (with suprasphincteric fistulas) were treated with a loose seton stitch.[7]

Procedure failure rate

In the case series of 45 patients, the procedure failure rate was 24% (11/45) at a median follow-up of 30 months.[4]

In the case series of 35 patients, the procedure failure rate (defined as no evidence of closure of the external opening at 3-month follow-up) was 23% (8/35).[5]

Return to daily activities

In the case series of 50 patients, the median number of days needed to return to normal activities after the procedure was 7 (range 5 to 17 days).[3]

Healing time

In the case series of 45 patients, the median healing time was 5 weeks (range 3 to 8 weeks).[4]

Patient satisfaction

In the case series of 27 patients, the patient satisfaction assessed with a Likert scale (scores from 1 [very unsatisfied] to 5 [very satisfied]) was 4.62±1.07 at 1 year after the procedure.[7]

Safety summary

Incontinence

Minor soiling was reported in 6% (7/117) of patients who had the laser procedure in the case series of 117 patients (3 patients after primary laser procedure and 4 patients after a repeated second fistula surgery). In the same study, minor incontinence of mucus and gas was reported in 2% (2/117) of patients.[1]

Type 1–2 incontinence (soiling) was reported in 1 patient in the case series of 11 patients. This lasted for 6 months and was successfully treated by rubber band ligation of hypertrophic prolapsed mucosa.[6]

Pain

Temporary pain and anismus were reported in 18% (8/45) of patients after the procedure in the case series of 45 patients. The median intensity of pain (measured with a visual analogue scale [VAS] from 0 [no pain] to 10 [worst possible pain]) was 3 after the procedure.[4]

Pain scores of less than 5 for more than 7 days on a VAS were reported in 11% (4/35) of patients during the 12-month follow-up in the case series of 35 patients. Pain scores of more than 5 for more than 7 days on a VAS were also reported in 11% (4/35) of patients (3 of the 4 patients had been treated with a 980-nm diode laser). In the same study, 23% (8/35) of patients had postoperative discomfort

and pain (mainly because of anismus and temporary constipation), which were treated with minor analgesics.[5]

Anismus

Anismus within 7 days of the procedure was reported in 17% (6/35) of patients in the case series of 35 patients.[5]

Bleeding

Moderate bleeding was reported in 6% (3/45) of patients after the procedure in the case series of 45 patients.[4]

Bleeding was reported in 3% (1/35) of patients during the 12-month follow-up in the case series of 35 patients.[5]

Abscess

A late abscess was reported in 1 patient after the procedure in the case series of 117 patients.[1]

Urinary retention

Urinary retention was reported in 6% (2/35) of patients during the 12-month follow-up in the case series of 35 patients.[5]

Anecdotal and theoretical adverse events

In addition to safety outcomes reported in the literature, specialist advisers are asked about anecdotal adverse events (events which they have heard about) and about theoretical adverse events (events which they think might possibly occur, even if they have never happened). For this procedure, specialist advisers listed the following anecdotal adverse event: abscess formation. They considered that the following was a theoretical adverse event: long-term failure.

The evidence assessed

Rapid review of literature

The medical literature was searched to identify studies and reviews relevant to radially emitting laser fibre treatment of an anal fistula. The following databases were searched, covering the period from their start to 27 November 2018: MEDLINE, PREMEDLINE, EMBASE, Cochrane Library and other databases. Trial registries and the internet were also searched. No language restriction was applied to the searches (see the literature search strategy). Relevant published

studies identified during consultation or resolution that are published after this date may also be considered for inclusion.

The following selection criteria (table 1) were applied to the abstracts identified by the literature search. Where selection criteria could not be determined from the abstracts the full paper was retrieved.

Table 1 Inclusion criteria for identification of relevant studies

Characteristic	Criteria
Publication type	Clinical studies were included. Emphasis was placed on identifying good quality studies. Abstracts were excluded when no clinical outcomes were reported, or when the paper was a review, editorial, or a laboratory or animal study. Conference abstracts were also excluded because of the difficulty of appraising study methodology, unless they reported specific adverse events that were not available in the published literature.
Patient	Patients with an anal fistula.
Intervention/test	Radially emitting laser fibre treatment.
Outcome	Articles were retrieved if the abstract contained information relevant to the safety and/or efficacy.
Language	Non-English-language articles were excluded unless they were thought to add substantively to the English-language evidence base.

List of studies included in the IP overview

This IP overview is based on 388 patients from 7 case series.

Other studies that were considered to be relevant to the procedure but were not included in the main extraction table (table 2) are listed in the appendix.

Table 2 Summary of key efficacy and safety findings on radially emitting laser fibre treatment of an anal fistula

Study 1 Wilhelm A (2017)

Details

Study type	**Case series**
Country	Germany (single centre)
Recruitment period	2009–14
Study population and number	n=**117** patients with high anal fistulas
Age and sex	Mean 46 years; 70% (82/117) male
Patient selection criteria	Inclusion criteria; patients with anal fistula Exclusion criteria: very superficial fistulas when fistulotomy could be done without compromising sphincter function and malignant fistulas.
Technique	Laser ablation with the FiLaC device (Biolitec) and definitive flap closure of the internal fistula opening. Before the procedure, all patients had a mechanical bowel preparation and antibiotics. After the procedure, all patients had stool softeners for a 2-week period. Patients were discharged 2 or 3 days after the procedure.
Follow-up	**Median 25 months (range 6 to 60 months)**
Conflict of interest/source of funding	Doctor Arne Wilhelm has received travelling grants and speaker honoraria from Biolitec AG, Germany, and THD Spa, Italy.

Analysis

Follow-up issues: Follow-up was done on the 4th and 10th postoperative days and at 6 weeks, 3 months, 6 months and 1 year thereafter. Further follow-up was done at yearly intervals, and patients were told to return to the clinic in the interim if symptoms recurred.

Study design issues:

- The same surgeon treated all the patients.
- After treatment failure, there was selective management at the discretion of the surgeon, which included repeat laser treatment, fistula excision with partial sphincter reconstruction (if <30% of the sphincter complex was involved) or complete fistula excision with major sphincter reconstruction (if >30% of the sphincter complex was involved).

Study population issues:

- In the cohort, 104 fistulas (89%) were cryptoglandular in origin and 13 (11%) were Crohn's related. One hundred and 13 patients (96.6%) had previously had surgery including abscess drainage and prior fistula operations. The mean number of operations before FiLaC treatment was 2.4 (±1.7) with a range of 1–9 previous operations.
- Seven patients (6.0%) had immediate definitive laser treatment without prior abscess drainage and 11 (9.4%) had FiLaC treatment without using a seton after abscess drainage done elsewhere. A seton was placed in 99 patients (84.6%) with a mean period between seton insertion and definitive fistula treatment of 16.1 (±29.2) weeks.
- Sixteen patients (14%) had a persistent fistula after previous fistula repair before laser treatment. Of this group, 6 (46.0%) had 2 previous attempts to repair the fistula.

Key efficacy and safety findings

<table>
<tr><th>Efficacy</th><th>Safety</th></tr>
<tr><td>
Number of patients analysed: 117

Primary healing rate (healing after the first laser treatment): 64% (75/117)

74% (31/42) of patients for whom the procedure failed had a second operation. In these 42 patients for whom the procedure failed, conversion from a high to a low fistula was seen in half (21/42) of the patients.

Secondary healing rate (healing after a consecutive procedure after initial laser treatment failure): 88% (103/117)

Secondary healing rate per type of consecutive procedure
<table>
<tr><th>Reoperation</th><th>Secondary healing rate</th></tr>
<tr><td>Repeat FiLaC procedure</td><td>60% (3/5)</td></tr>
<tr><td>Excision and partial sphincter reconstruction</td><td>100% (16/16)</td></tr>
<tr><td>Excision and major sphincter reconstruction</td><td>100% (7/7)</td></tr>
<tr><td>Gore plug</td><td>0 (0/1)</td></tr>
<tr><td>Lay-open fistulotomy</td><td>100% (2/2)</td></tr>
</table>
The only statistically significant determinant of treatment success was disease severity. A 1.63-fold increase in primary success rate was seen for Parks—St. Marks type 1 as compared with type 2 fistulas, used as the reference group (95% CI 1.39, to 1.93).
</td><td>

No incontinence to solid and liquid stool was reported.
Minor soiling: 6% (7/117) [3 patients after primary FiLaC procedure and 4 patients after a repeated second fistula surgery]
Minor incontinence to mucus and gas: 2% (2/117)
Late abscess: 1% (1/117)
Death from an unrelated cancer: 1% (1/117)

</td></tr>
<tr><td colspan="2">Abbreviations used: CI, confidence interval; FiLaC, fistula laser closing.</td></tr>
</table>

Study 2 Terzi M C (2018)

Details

Study type	**Retrospective case series**
Country	Turkey (Single centre)
Recruitment period	2012-16
Study population and number	n=**103** consecutive patients with primary or recurrent perianal fistula
Age and sex	Median 43 years; 80% (82/103) male
Patient selection criteria	Inclusion criteria: patients with a perianal fistula who agreed to the FiLaC procedure and to pay the cost of the treatment. The perianal fistulas treated included superficial, recurrent, and multiple or branching fistulas. Exclusion criteria: Patients in whom an abscess was found during an attempt to use FiLaC. Other exclusion criteria were anovaginal fistulas, inflammatory bowel disease, malignancy and perianal tuberculosis.
Technique	Laser closure procedure using a 12-watt laser emitting at a wavelength of 1470 nm (FiLaC device). No additional surgical techniques, such as closure of the internal orifice with a purse string suture or an advancement flap were used. A loose seton procedure was not used as a bridge to laser therapy. All patients had 1 enema just before the surgery, and no antibiotic prophylaxis was used.
Follow-up	**Median 28 months (range 2 to 50 months)**
Conflict of interest/source of funding	None reported

Analysis

Follow-up issues: The first follow-up examination happened at the end of the first month, and all of the patients were re-examined between June 2016 and August 2016.

Study design issues:

- Fistulas were classified according to the Park classification, and healing was evaluated based on the perianal fistula disease severity score.
- There was no formal prospective continence assessment.

Study population issues:

- Fifty-three patients (52%) had previous perianal fistula repair surgery.
- Based on the Park classification, 56 patients (54%) had intersphincteric fistula, 29 (28%) had trans-sphincteric fistula, 11 (11%) had suprasphincteric or extrasphincteric fistula, and 7 (7%) had superficial perianal fistula.

Key efficacy and safety findings

Efficacy

Number of patients analysed: **103**

FiLaC evaluated based on perianal fistula disease severity score

Perianal fistula disease severity score	Total	Low/simple perianal fistula	High/complex perianal fistula	No previous anal fistula surgery	Previous anal fistula surgery
Complete healing	40% (41/103)	39% (24/61)	40% (17/42)	40% (20/50)	40% (21/53)
Slight drainage with minimal symptoms	19% (20/103)	20% (12/61)	19% (8/42)	12% (6/50)	26% (14/53)
Persistent symptomatic drainage	37% (38/103)	39% (24/61)	33% (14/42)	42% (21/50)	32% (17/53)
Painful symptomatic drainage	4% (4/103)	2% (1/61)	7% (3/42)	6% (3/50)	2% (1/53)

FiLaC evaluated based on Parks' classification

Variable	Superficial	Intersphincteric	Trans-sphincteric	Suprasphincteric/ extrasphincteric
Complete healing	43% (3/7)	39% (22/56)	34% (10/29)	55% (6/11)
Slight drainage with minimal symptoms	0	21% (12/56)	21% (7/29)	9% (1/11)
Persistent symptomatic drainage	57% (4/7)	38% (21/56)	31% (9/29)	36% (4/11)
Painful symptomatic drainage	0	2% (1/56)	10% (3/29)	0

There was no significant difference in overall healing results irrespective of patient Park classification or their history of previous fistula surgery. There was also no significant difference in complete healing rates between high/complex and low/simple fistulas (40% versus 39%; p=0.56, $\chi 2$ test; table 2).

Reoperation: 27% (28/103)

- With a conventional surgical technique: 21/28
- With laser treatment again: 7/28 (complete healing was observed in 1 patient, symptoms were reduced in 2 patients, and no benefit was obtained in 4 patients)
- Secondary healing rates after a consecutive laser procedure: 14% (1/7)

Safety

There were no perioperative complications or morbidity.

No patients had major incontinence (solid or liquid stool or gas).

Abbreviations used: FiLaC, fistula laser closing.

Study 3 Ozturk E (2014)

Details

Study type	**Retrospective case series**
Country	Turkey (single centre)
Recruitment period	Not reported
Study population and number	n=**50** patients with anal fistula
Age and sex	Median 41 years; 74% (37/50) male
Patient selection criteria	• During the first phase of the study (20 first patients), all patients who were admitted with fistula in-ano and who did not have a history of prior surgical treatment for fistula-in-ano were included in the study. Patients with a history of surgical treatment for fistula in- ano or a proven history of inflammatory bowel disease were excluded. • During the second phase of the study, therefore, patients were selected after having pelvic MRI to exclude those with abscesses before the surgery. In those patients, a loose nylon seton was placed, and the procedure was delayed for 3–4 weeks. During the second phase, patients paid 500 Euros to be treated with the laser probe, and the generator was provided by the company on a patient-by-patient basis.
Technique	A 15-watt laser probe (FiLaC [Biolitec]) emitting at a wavelength of 1470 nm and producing 100–120 joules/cm of energy was used. Patients were discharged on the day of the surgery or the next day. When there was pus during curettage of the tract, patients were prescribed oral antibiotics for a week.
Follow-up	**Median 1 year (range 2 to 18 months)**
Conflict of interest/source of funding	The first 20 laser probes used in this study were provided by Biolitec AG.

Analysis

Follow-up issues: For patients who could return to the clinic in person, routine patient interviews and examinations were done at 3-week intervals. For patients who were unable to return, phone interviews were held. 24% (12/50) of patients were interviewed at the clinic, and the others were interviewed by phone.

Study design issues:

- The outcomes assessed were success rate, complications, pain scores and time to return to normal daily activities.

Study population issues: 10 patients had inter-sphincteric fistulas, 34 had low trans-sphincteric fistulas and 6 had high trans-sphincteric fistulas.

Key efficacy and safety findings

Efficacy	Safety
Number of patients analysed: **50** **Success rate** (cessation of either the discharge or the patient's complaints): 82% (41/50) • The procedure failed to close the fistula tract in 14% (7/50) of patients. One patient had a high trans-sphincteric fistula, 4 had trans-sphincteric fistulas and 2 had intersphincteric fistulas. • 2 patients had anal fistulas at different locations than those treated with the procedure (one patient after 3 months, 1 patient after 5 months). • The rate of persistent fistula was 25% (5/20) in the first phase and 7% (2/30) in the second phase. • When the procedure failed, it usually happened during the first one or 2 weeks after surgery. No recurrence at the original fistula site occurred during the follow-up period. • The loose seton technique was used when the procedure failed. The patient with high Trans-sphincteric fistula had a mucosal advancement flap. The remaining 8 patients had a fistulotomy. All of these patients had symptom relief. **Return to daily activities**: median 7 days (range 5 to 17 days)	No patients needed opiates after the procedure.
Abbreviations used: FiLaC, fistula laser closing.	

Study 4 Giamundo P (2015)

Details

Study type	**Retrospective case series**
Country	Italy (single centre)
Recruitment period	2010-14
Study population and number	n=**45** patients with an anal fistula
Age and sex	Median 46 years; 47% (21/45) male
Patient selection criteria	The first group of patients treated in the centre where the study took place was excluded because a different laser energy of 15 W at a different wavelength (980 nm) was used. The procedure was postponed if there was a persistent undrained abscess or previously undetected secondary tracts. Patients were prescribed antibiotics for 5 days, a high fibre diet, sitz baths and analgesics if needed after the procedure.
Technique	FiLaC was done with a diode laser of 12 W at a wavelength of 1470 nm (Biolitec) by a radial fibre.
Follow-up	**Median 30 months (range 6 to 46 months)**
Conflict of interest/source of funding	The main author is ''surgical trainer'' for Biolitec. There is no conflict of interest for the remaining authors.

Analysis

Follow-up issues:

- Follow-up was scheduled at 1 week, 3 months and 12 months after surgery. Telephone interviews were used to assess for any recurrence of symptoms at follow-ups longer than 12 months.
- 84% (38/45) of patients had a follow-up of more than 1 year.

Study design issues:

- The aim of the study was to report long-term outcomes of the laser procedure.
- Patients fistulas were considered healed when symptoms completely disappeared without additional interventions. Fistulas were assessed by MRI or endorectal ultrasound to exclude recurrences if they had long-lasting discomfort or sporadic anal discharge after the procedure.
- All the procedure were done by the same surgeon.

Study population issues:

- 78% (35/45) of patients had a history of previous fistula surgery.
- 53% (24/45) of patients had a loose seton placed for a median of 10 weeks before the procedure.
- 1 patient chose to have a local anaesthesia instead of general or epidural anaesthesia.
- Previous surgery included mucosal advancement flaps (n=3), fistulectomy (n=2), fistulotomy (n=3) and fibrin glue/ fistula plug (n=3).
- The types of fistula treated were: intersphincteric (15% [7/45]), low trans-sphincteric (15% [7/45]), mid trans-sphincteric (42% [19/45]), high trans-sphincteric (22% [10/45]), suprasphincteric (42% [19/45]).

Other issues: Patient overlaps with the Giamundo (2014) study are likely.

Key efficacy and safety findings

<table>
<tr><th>Efficacy</th><th>Safety</th></tr>
<tr><td>Number of patients analysed: 45

Median operative time: 20 minutes (range 6 to 35 minutes).

Primary healing rate at a median follow-up of 30 months: 71% (32/45)
Primary healing rate in the 27 patients followed for more than 12 months: 71%
Recurrence rate at a median follow-up of 30 months: 4% (2/45)
The recurrences happened 6 and 9 months after the procedure.
Failure rate at a median follow-up of 30 months: 24% (11/45)

Median healing time: 5 weeks (range 3 to 8 weeks)

85 % (11/13) of the failures were early failures (persistent symptoms)

The best healing rate was observed in patients who had previously been treated with loose seton (79% [19/24] compared with 62% (13/21) without seton, p=NS).

Reoperations after failure or recurrence
• Repeat FiLaC: 15% (2/13) (1 with success)
• Fistulotomy: 23% (3/13)
• Internal mucosal flap + curettage: 38% (5/13)
• Extrasphincteric fistulectomy + curettage: 23% (3/13)</td><td>There were no intraoperative complications.

Postoperative complications
<table><tr><td>Temporary pain and anismus</td><td>18 % (8/45)</td></tr><tr><td>Moderate bleeding</td><td>6% (3/45)</td></tr></table>
Median intensity of postoperative pain: 3/10

No significant changes in continence were reported after the procedure.</td></tr>
<tr><td colspan="2">Abbreviations used: FiLaC, fistula laser closing; NS, not statistically significant.</td></tr>
</table>

Study 5 Giamundo P (2014)

Details

Study type	**Case series**
Country	Italy (single centre)
Recruitment period	2009-13
Study population and number	n=**35** patients with an anal fistula
Age and sex	Median 48 years; 57% (20/35) male
Patient selection criteria	Inclusion criteria: a mid or a high trans-sphincteric fistula; an anterior intersphincteric or a low trans-sphincteric fistula in a woman with preoperative low sphincter anal tone or some degree of faecal incontinence; a fistula previously treated by seton placement; and a Crohn's-related fistula. Exclusion criteria: a superficial fistula that could be treated by fistulotomy without compromising anal sphincter function and any fistula related to malignancy.
Technique	Patients were prescribed antibiotic prophylaxis. For the first 8 patients, a diode laser (Biolitec), delivering energy at 980 nm, was employed. At this wavelength, a power of 13 W was necessary to seal the fistula track. In the remaining 27 patients, a diode laser at 1470 nm (Biolitec) was used. In this case, laser energy of 10 W was sufficient to seal the fistula track. All patients were admitted overnight and were discharged the day after the operation. Fistula tracks were primarily sealed by laser energy with no additional procedures.
Follow-up	**Median 20 months (range 3 to 36 months)**
Conflict of interest/source of funding	The main author is ''surgical trainer'' for Biolitec. There is no conflict of interest for the remaining authors.

Analysis

Follow-up issues:

- Intraoperative endoanal ultrasound was performed in most patients to confirm closure of the fistula track when the laser treatment was complete. Anal manometry was used in patients with preoperative symptoms of a continence disturbance or with low anal tone on digital examination. In cases of postoperative discomfort or sporadic anal discharge despite apparent successful closure of the external opening, fistulas were assessed by endorectal ultrasound or MRI to exclude recurrence.
- Follow-up was scheduled in the outpatient clinic at 1 and 2 weeks and 1, 3, 6 and 12 months postoperatively.
- Follow-up of longer than 12 months was conducted by telephone interview.
- No patient was lost to follow-up.
- 71% (25/35) of patients had a follow-up of at least 12 months.

Study design issues:

- The primary end-point was cure of the disease and evaluation of morbidity. The secondary end-point was an assessment of the degree of postoperative continence using the Cleveland Clinic Florida (CCF) Fecal Incontinence Score.

Study population issues:

- The aetiology of the fistula was cryptoglandular in 33 patients and Crohn's disease-related in 2 patients.
- One patient had a local anaesthesia.
- The external fistula opening was dissected off the external sphincter muscle in 5 patients. In the remaining patients no dissection was necessary.
- 71% (25/35) of patients had treatment for a recurrent fistula.
- Three patients had secondary tracks: 2 were treated by lay-open procedure and the third was treated by a fistulectomy.
- The types of fistula treated were: intersphincteric (23% [8/35]), low trans-sphincteric (23% [8/35]), mid trans-sphincteric (34% [12/35]), high trans-sphincteric (17% [6/35]), suprasphincteric (3% [1/35]).

Other issues: Patient overlaps with the Giamundo (2015) study are likely.

Key efficacy and safety findings

<table>
<tr><th>Efficacy</th><th>Safety</th></tr>
<tr><td>Number of patients analysed: 35

Median operation time: 20 minutes (range 6 to 35 minutes)

Primary healing rate (median follow-up of 20 months): 71% (25/35)
Failure rate: 23% (8/35)
Recurrence rate: 6% (2/35) – Recurrences occurred at 3 and 6 months. Both were successfully treated by a lay-open procedure.

The patient was considered as cured on closure of the external opening in the absence of drainage, pain or perianal swelling. Treatment was deemed to have failed treatment if there was no evidence of closure of the external opening at the 3-month follow-up.

In the 8 patients whose procedure was considered to have failed, discomfort and discharge from the original external orifice did not resolve postoperatively. Five patients had treatment with an endoanal mucosal flap and 3 were waiting for another laser therapy procedure after having a new seton inserted.</td><td>No intraoperative complications were reported.
No patient reported incontinence after the procedure.
The mean ±SD preoperative CCF-FI score was 2.9 ± 2.5 and the mean ±SD postoperative CCF-FI score was 3.1 ± 2.8 (p=0.86; Student’s t-test).

Complications reported during the 12-month follow-up
<table><tr><td>Urinary retention</td><td>6% (2/35)</td></tr><tr><td>Bleeding</td><td>3% (1/35)</td></tr><tr><td>Pain (VAS score of <5 for more than 7 days)</td><td>11% (4/35)</td></tr><tr><td>Pain (VAS score of >5 for more than 7 days)</td><td>11% (4/35)*</td></tr><tr><td>Anismus (7 days)</td><td>17% (6/35)†</td></tr></table>*Three patients had treatment with a 980-nm diode laser.
†Five patients had treatment with a 980-nm diode laser.

23% (8/35) of patients had postoperative discomfort and pain (mainly because of anismus and temporary constipation), and had minor analgesics.</td></tr>
<tr><td colspan="2">Abbreviations used: CCF-FI, Cleveland Clinic Florida Fecal Incontinence; SD, standard deviation; VAS, visual analogue scale.</td></tr>
</table>

Study 6 Wilhelm A (2011)

Details

Study type	**Case series (pilot study)**
Country	Germany
Recruitment period	Not reported
Study population and number	n=**11** patients with cryptoglandular anal fistula
Age and sex	Median 51 years; 73% (8/11) male
Patient selection criteria	Only cryptoglandular fistulas were analysed and patients with inflammatory bowel disease-related fistulas were excluded from analysis.
Technique	In a primary operation, all patients had drainage of the perianal abscess, removal of possible side tracks, identification of the internal opening and seton drainage of the principal fistula track using a 2 mm silicone vessel loop. All patients had a mechanical bowel preparation and had antibiotics prescribed for 5 days. An advancement flap, a mucosal or an anodermal flap were used for closure of the internal opening. Laser energy was applied homogeneously at a wavelength of 1,470 nm and 13 watt using the FiLaC device. Patients were allowed to eat and drink liquids from day 1 to day 3. From that day on they were placed on a normal diet and were discharged by day 5 after clinical and proctoscopic examination
Follow-up	**Median 7.4 months (range 2 to 11 months)**
Conflict of interest/source of funding	The laser equipment was the FiLaC device by Biolitec. The author did not have a financial relationship to Biolitec.

Analysis

Study population issues:

- The types of fistula treated were 2 type 4, 3 type 3, 5 type 2 and 1 type 1 fistulas in accordance with the Parks' fistula classification.
- All patients had previous surgery for a perianal abscess and fistula with a maximum of 6 prior surgeries before referral (mean ± SD of 3.1 ± 1.6).

Key efficacy and safety findings

Efficacy	Safety
Number of patients analysed: **11** **Primary healing rate**: 82% (9/11) One fistula persisted in a patient with a type 4 extrasphincteric fistula and in a second patient with a transphincteric fistula after complicated drainage of a horseshoe abscess.	One minor form of **type 1–2 incontinence (soiling**) was reported. This lasted for 6 months and was successfully treated by rubber band ligation of hypertrophic prolapsed mucosa. No major or minor complications were noted during follow-up.
Abbreviations used: FiLaC, fistula laser closing.	

Study 7 Donmez T (2017)

Details

Study type	**Retrospective case series**
Country	Turkey
Recruitment period	2013-14
Study population and number	n=**27** patients with an anal fistula
Age and sex	Mean 36 years; 85% (23/27) male
Patient selection criteria	Patients with an anal fistula. The fistulas were classified according to the Parks classification system. All patients were evaluated preoperatively with clinical examination and proctosigmoidoscopy and were classified using contrast-enhanced pelvic MRI.
Technique	A 15-watt FiLaC laser probe with a wavelength of 1470 nm and a power of 100-120 joules/cm, was used. Before the procedure, all patients had a mechanical bowel preparation with fleet oral soda and fleet enema and had antibiotics intravenously. They had 2 more doses of intravenous antibiotics after the procedure over 24 hours and oral antibiotics for 1 week. The procedure was done under spinal anaesthesia. The internal and external openings of the fistula were not sutured and no ointments or topical medications were used. Patients were discharged after 1 or 2 days.
Follow-up	**Mean 22 months (range 17 to 26 months)**
Conflict of interest/source of funding	None

Analysis

Follow-up issues:

- The patients were called for weekly follow-up for the first month after discharge. After one month, patients were followed at 3-month intervals for the first year. After 1 year, follow-up was done over the phone at 3-month intervals.
- Patients completed a patient satisfaction questionnaire 1 year after the procedure.

Study population issues:

- The types of fistula treated were: intersphincteric (52% [14/27]), trans-sphincteric (26% [7/27]), suprasphincteric (19% [5/27]) and extrasphincteric (4% [1/27]).
- 19% (5/27) of patients had a seton stitch before the procedure.

Key efficacy and safety findings

Efficacy	Safety
Number of patients analysed: **27** Mean procedure time: 18.37±5.27 minutes **Primary healing rate**: 89% (24/27) **Recurrence rate:** 11% (3/27) – Recurrences occurred at 4 months in 1 patient and at 6 months in another 2 patients. Of the patients with failed FiLaC procedures, one had an extrasphincteric fistula and 2 had suprasphincteric fistulas. For the patient with the extrasphincteric fistula, the fistula transformed into a trans-sphincteric fistula after the first laser treatment. The patient had a second session of laser 6 months after the first one. At 14-month follow-up, the fistula appeared to have healed. The other 2 patients had suprasphincteric fistulas and did not consent to a second session of laser application. A loose seton stitch was used for these patients. Follow-up and treatment of these 2 patients is ongoing. **Patient satisfaction 1 year after the procedure**: 4.62±1.07 Patient satisfaction was assessed according to the Likert scale (1: very unsatisfied, 2: unsatisfied, 3: neutral, 4: satisfied, 5: very satisfied).	No intraoperative complications were reported. None of the patients needed opioid drugs. All patients were able to drive or walk the day after the procedure.
Abbreviations used: FiLaC, fistula laser closing	

Validity and generalisability of the studies

- Only case series were included in Table 2.
- The same device (FiLaC) was used in all the studies.
- The longest follow-up was a median of 30 months and the maximum number of patients included in a study was 117.
- Studies were a CO_2 laser was used were not included as they were considered out of remit.
- There might be some degree of patient overlap between the Giamundo (2014) and the Giamundo (2015) studies.
- One study included only patients with cryptoglandular anal fistulas (Wilhelm 2011).
- In some studies, a seton procedure was used before the laser procedure and in some studies, the laser procedure was used in conjunction with techniques that close the internal orifice such as an advancement flap.
- The laser probe did not have the same power and emission in all the studies.

Existing assessments of this procedure

- The German S3 guidelines: anal abscess and fistula (second revised version)[8] were published in 2017. They stated:

"*New technical developments*

Laser application

Coagulation of fistula by a laser probe (FiLaC, Biolitec), partly combined with a flap technique, has been introduced as a new method. Current studies showed success rates of 71 to 82% without noteworthy impact on continence. Further conclusions cannot be drawn due to the current data."

- The Association of Coloproctology of Great Britain and Ireland published a position statement on the treatment of anal fistula[9] in 2018. It says:

"At present, laser ablation of a fistula track is in its infancy, with evidence supporting its use confined to a few case series (Level II/III evidence). The best technique has not been established: for instance, is surgical closure of the

internal opening necessary prior to laser ablation? Further larger studies, especially randomized trials against other sphincter-preserving techniques, are required to establish its role in treatment of anal fistulas."

Related NICE guidance

Below is a list of NICE guidance related to this procedure.

Interventional procedures

- Closure of anorectal fistula using a suturable bioprosthetic plug. NICE interventional procedures guidance 410 (2011). This guidance is currently under review and is expected to be updated in 2019. For more information, see https://www.nice.org.uk/guidance/ipg410.

Additional information considered by IPAC

Specialist advisers' opinions

Specialist advice was sought from consultants who have been nominated or ratified by their Specialist Society or Royal College. The advice received is their individual opinion and is not intended to represent the view of the society. The advice provided by specialist advisers, in the form of the completed questionnaires, is normally published in full on the NICE website during public consultation, except in circumstances but not limited to, where comments are considered voluminous, or publication would be unlawful or inappropriate. Two specialist adviser questionnaires for radially emitting laser fibre treatment of an anal fistula were submitted and can be found on the NICE website.

Patient commentators' opinions

NICE's Public Involvement Programme sent questionnaires to NHS trusts for distribution to patients who had the procedure (or their carers). NICE received 1 completed questionnaire.

The patient commentator's views on the procedure were consistent with the published evidence and the opinions of the specialist advisers. See the patient commentary summary for more information.

Company engagement

A structured information request was sent to 3 companies who manufacture a potentially relevant device for use in this procedure. NICE did not receive any completed submission.

Issues for consideration by IPAC

Ongoing studies:

NCT03017898 - Treatment of anal fistula with laser coagulation, Germany, case series, n=52, FU=12 months, Start date: March 2017, Expected study completion date: May 2020 [recruiting]

NTR6892 Use of laser in the treatment of perianal fistulas, Germany, case series, n=100, FU=3 months, Start date: January 2018, Expected completion date: January 2021

ChiCTR-IOR-17012085 FiLaC combing with QingRe-Lishi Recipe for treating complex anal fistula: A multi-centre randomized controlled clinical research, China, RCT, n=240, FU=not reported, Start date: July 2017, Expected completion date: not reported [recruitment status: pending]

References

1. Wilhelm A, Fiebig A, and Krawczak M (2017) Five years of experience with the FiLaCTM laser for fistula-in-ano management: long-term follow-up from a single institution. Techniques in Coloproctology 21(4), 269-276
2. Terzi M C, Agalar C, Habip S et al. (2018) Closing Perianal Fistulas Using a Laser: Long-Term Results in 103 Patients. Diseases of the Colon & Rectum 61(5), 599-603
3. Ozturk E, and Gulcu B (2014) Laser ablation of fistula tract: a sphincter-preserving method for treating fistula-in-ano. Diseases of the Colon & Rectum 57(3), 360-4
4. Giamundo P, Esercizio L, Geraci M et al. (2015) Fistula-tract Laser Closure (FiLaCTM): long-term results and new operative strategies. Techniques in Coloproctology 19(8), 449-53
5. Giamundo P, Geraci M, Tibaldi L et al. (2014) Closure of fistula-in-ano with laser - FiLaCTM: An effective novel sphincter-saving procedure for complex disease. Colorectal Disease 16(2), 110-115
6. Wilhelm A (2011) A new technique for sphincter-preserving anal fistula repair using a novel radial emitting laser probe. Techniques in Coloproctology 15(4), 445-9
7. Donmez T and Hatipoglu E (2017) Closure of fistula tract with filac laser as a sphincter-preserving method in anal fistula treatment. Turkish Journal of Colorectal Disease 27 142-7
8. Ommer A, Herold A, Berg E et al. (2017) German S3 guidelines: anal abscess and fistula (second revised version). Langenbeck's Archives of Surgery 402(2), 191-201
9. Williams G, Williams A, Tozer P et al. (2018) The treatment of anal fistula: second ACPGBI Position Statement - 2018. Colorectal Disease 20 Suppl 3:5-31

Literature search strategy

Databases	Date searched	Version/files
Cochrane Database of Systematic Reviews – CDSR (Cochrane)	27/11/2018	Issue 11 of 12, November 2018
Cochrane Central Database of Controlled Trials – CENTRAL (Cochrane)	27/11/2018	Issue 11 of 12, November 2018
HTA database (CRD website)	27/11/2018	n/a
MEDLINE (Ovid)	27/11/2018	1946 to November 21, 2018
MEDLINE In-Process (Ovid) & MEDLINE Epubs ahead of print (Ovid)	27/11/2018	November 21, 2018
EMBASE (Ovid)	27/11/2018	1974 to 2018 Week 47

Trial sources searched

- Clinicaltrials.gov
- ISRCTN
- WHO International Clinical Trials Registry

Websites searched

- National Institute for Health and Care Excellence (NICE)
- NHS England
- Food and Drug Administration (FDA) - MAUDE database
- Australian Safety and Efficacy Register of New Interventional Procedures – Surgical (ASERNIP – S)
- Australia and New Zealand Horizon Scanning Network (ANZHSN)
- EuroScan
- General internet search

The following search strategy was used to identify papers in MEDLINE. A similar strategy was used to identify papers in other databases.

1 Rectal Fistula/ or Anal Canal/su

2 ((Anal or anus or rectal or rectum or transphincteric or intersphincteric or ano-rectal or anorectal or plural or peri-anal or perianal or multiple or recurr* or high or horse shoe) adj4 fistula*).tw.

3 (fistula-in-ano or fistula in ano).tw.

4 (fistula tract or fistula-tract).tw.

5 or/1-4

6 Lasers/

7 Laser Therapy/

8 ((laser* or Light* or Photo*) adj4 (treat* or intervent* or therap* or close or closure or ablat* or seal*)).tw.

9 ((fistula tract or fistula-tract or fistula*) adj4 laser* closure).tw.

10 *Digestive System Surgical Procedures/

11 (filac* or lasotronix or alfa or elite or neolaser).mp.

12 or/6-11

13 5 and 12

14 animals/ not humans/

15 13 not 14

16 limit 15 to English language

Appendix

The following table outlines the studies that are considered potentially relevant to the IP overview but were not included in the main data extraction table (table 2). It is by no means an exhaustive list of potentially relevant studies.

Article	Number of patients/follow-up	Direction of conclusions	Reasons for non-inclusion in table 2
Adegbola S O, Sahnan K, Pellino G et al. (2017) Short-term efficacy and safety of 3 novel sphincter-sparing techniques for anal fistulas: a systematic review. Techniques in Coloproctology 21(10), 775-782	Systematic review n=3 case series for FiLaC Search done from 2006 to 31 April 2017	All 3 techniques appear to be safe and feasible options in the management of anal fistulas, and short-term healing rates are acceptable with no sustained effect on continence. There is, however, a paucity of robust data with long-term outcomes. These techniques are thus welcome additions; however, their long-term place in the colorectal surgeon's armamentarium, whether diagnostic or therapeutic, remains uncertain.	The 3 case series are already included in Table 2.
Narang S K, Keogh K, Alam N et al. (2017) A systematic review of new treatments for cryptoglandular fistula in ano. Surgeon Journal of the Royal Colleges of Surgeons of Edinburgh & Ireland 15(1), 30-39	Systematic review n=2 case series for the FiLaC procedure Search date: 1 January 2007 to 31 December 2014	This systematic review has demonstrated that whilst there have been technological advances to treat complex cryptoglandular fistula in ano, these are in an early stage of evolution and although early results were promising they are difficult to reproduce. Longer follow-up data are not currently available and these treatments should not be introduced without further evidence.	Both case series are already included in Table 2.