# Contents

CHAPTER

3

# Sacroiliac Joint Pain Syndrome: Anatomy, Diagnosis, and Treatment—Surgical Laser Thermoneurectomy

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## Introduction

- The *chronic low back pain* can be difficult to localize and diagnosed clinically
- Primary function of the *sacroiliac joint (SIJ)* is lending *pelvic* and *lower extremity stability connecting* to *upper body* stability
- SIJ dysfunction can be *caused by* various pathology, including *major lumbar spinal surgery/fusion*

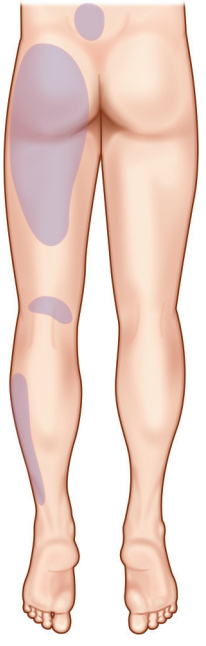

**Fig. 3.1** Usual pain pattern seen

- *SIJ pain* contributes up to *25-40% of patients with low back pain* from various causes including minor trauma
- *39%* of patients with *SIJ pain* found to *have low back pain*
- Due to *post-lumbar fusion*-related biomechanical changes which lead to *SIJ* dysfunction/*pain (about 1/3 post fusion patient)*
- SIJ pain can radiate to *the low back, buttocks, abdomen, groin, or legs (Fig. 3.1)*

## Anatomy of SI Joint with Nutation

- The *pelvis consists* of the two *ilia* and the *sacrum*
- The *SIJ* is the *largest axial joint* in the body (*17.5 cm*$^2$)
- The anterior side of the joint is lined with thick hyaline cartilage (Fig. 3.2)

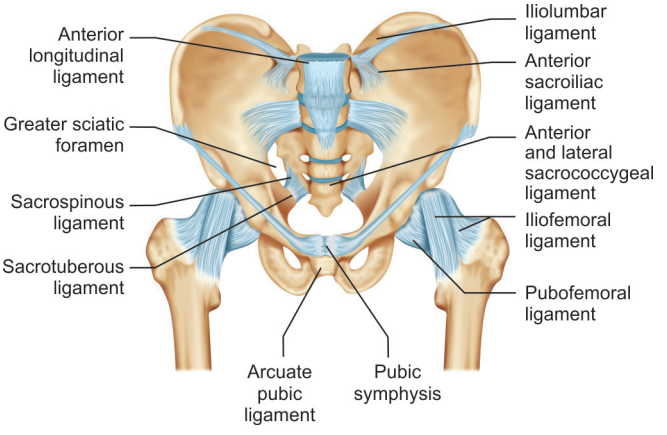


**Fig. 3.2** Anterior view of articulations and ligaments of sacroiliac joint and surrounding structures

- The posterior iliac side of the joint is lined with fibrocartilage (Fig. 3.3)
- *Anterior third—true synovial joint*
- The *rest* of the junction is a set of *ligamentous connections.*

## Articular Surface of SI Joint

Figures 3.4 and 3.5 illustrate schematically the articular surface of SI joints. Figure 3.5 shows nodding movements of SIJ.

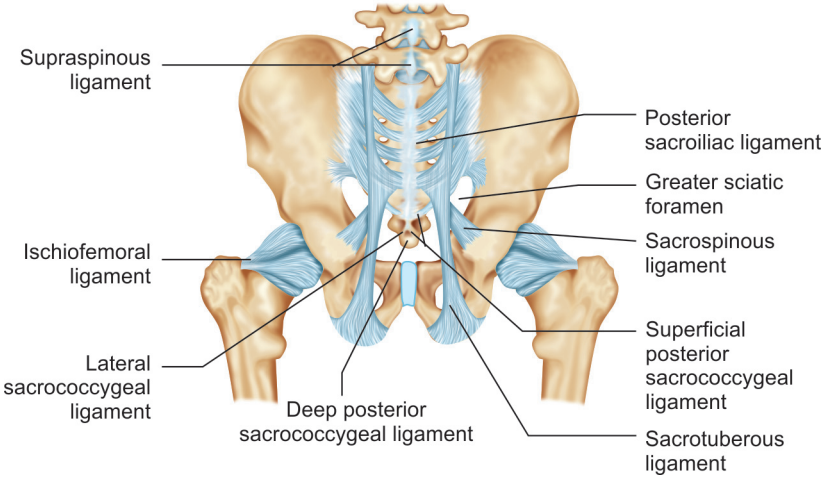


**Fig. 3.3** Posterior view of articulations and ligaments of sacroiliac joint and surrounding structures

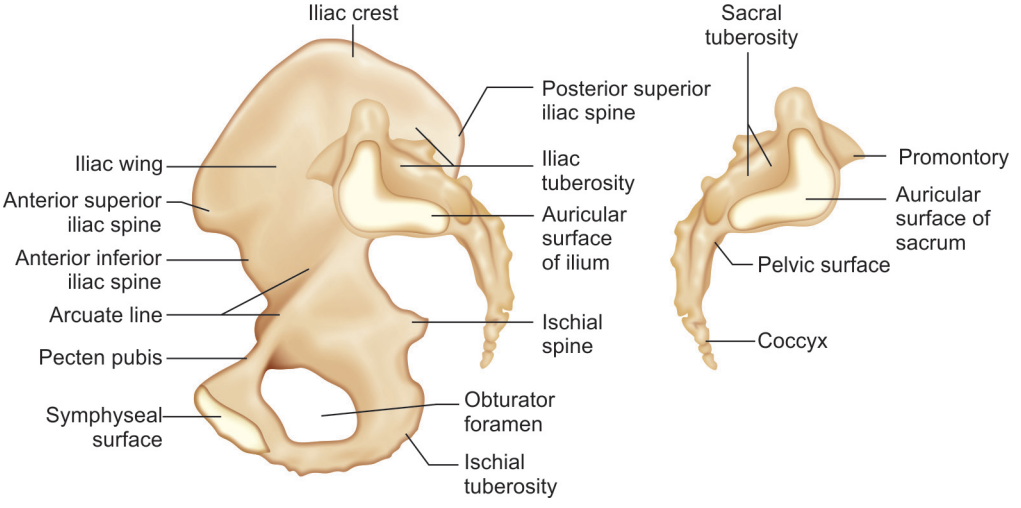


**Fig. 3.4** Articular surface of sacroiliac joint

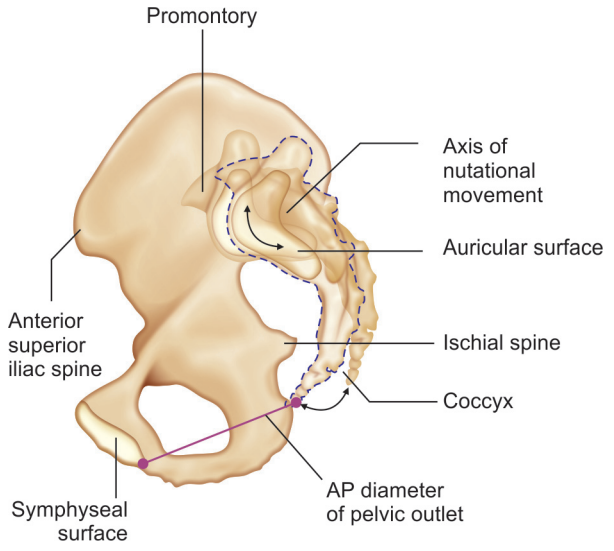


**Fig. 3.5** Nutation or rocking, swaying, or nodding motion of SIJ

# Pathoanatomy and Pathophysiology

## Pathoanatomy

- *Between the sacral and ileum* is a *true SIJ* (Fig. 3.7)
- The biomechanics of SI joint is then a medially directed force six times greater than the lumbar spine but only half the torsion and 1/20th of axial compression load
- The *joint transmits* all the *forces* of the upper body *to the pelvis through the SIJ down to the legs* (Fig. 3.8)
- Currently there is *no standard* SIJ treatment algorithm.

## Factors Predisposing SIJ Injury

- Capsular and synovial disruption
- Capsular and ligamentous tension
- Hypomobility or hypermobility

# Innervation of SI Joint

- The *innervation of the SIJ* is extremely complex, mostly believed to be as follows (Fig. 3.6):
  - *Posterior innervation* from medial branches of dorsal rami of spinal nerves, L4, L5, S1–3
  - *Anterior innervation*: The L4–S2 ventral rami.

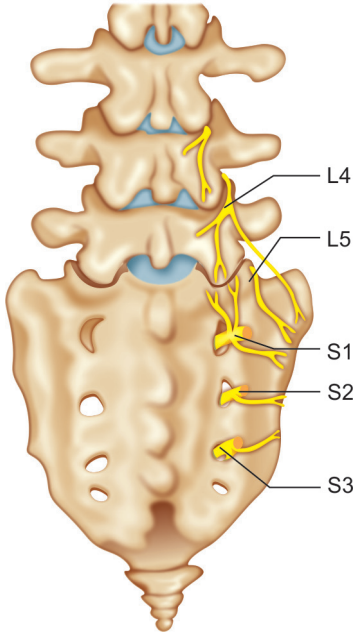


**Fig. 3.6** Posterior innervation of sacroiliac joint

**Fig. 3. 7** CT scan of sacroiliac joint from front

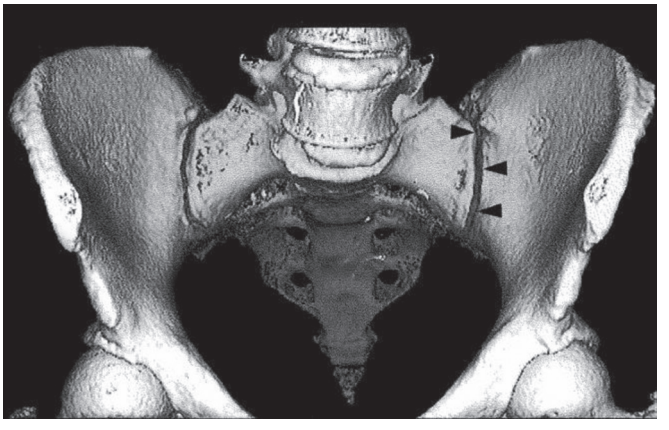

**Fig. 3.8** CT scan of sacroiliac joint—posterior view

- Extraneous compression or sharing forces of the joint
- Abnormal joint mechanism
- Microfracture or macrofracture
- Chondromalacia
- Soft tissue injury
- Inflammation
- Joint laxity
- Degenerative joint disease
- History of minor direct trauma with a fall onto the buttocks.

# Sacroiliac Joint Dysfunction Syndrome

## Causes

- *Often major lumbar spinal surgery and spinal fusion can cause* SIJ dysfunction
- *Various minor traumatic injury to SIJ can initiate SIJ pain* after minor traumatic event, such as *falling onto the buttocks or a slip while pushing* a heavy object
- It is *aggravated* by transitional activities, *such as climbing stairs, getting up from chairs* and getting out of a car (Figs 3.9 and 3.10)
- Aggravated by activities requiring *unequal loading* through the lower extremities or pelvis
- *Pathology of surrounding structures*
- *Capsular* and *ligamentous tension related to* hypomobility or hypermobility, shearing forces, abnormal joint mechanics, fractures, *soft tissue trauma,* inflammation.

# How to Diagnose SIJ Dysfunction?

## Diagnostic Criteria for SIJ Syndrome

- **Pain in** the region of *SIJ* with possible radiation to the groin, medial buttock and posterior thigh
- *Reproduction of pain* by physical examination technique that stresses the joint—refer to physical signs and *common tests*
- *Elimination of pain with intra-articular injection* of local anesthetics and *nerve blocks*
- An ostentatiously morphological normal joint without demonstration of pathopneumonic radiographic abnormality
- *Point specific tenderness* over the *sacral sulcus* as well as the *posterior superior iliac spine.*

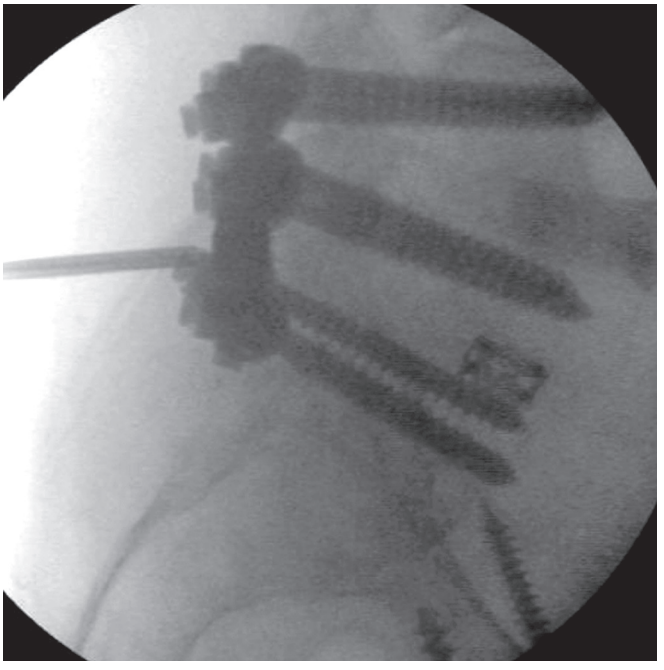

**Fig. 3.9** X-rays of lumbar fusion—Lateral view

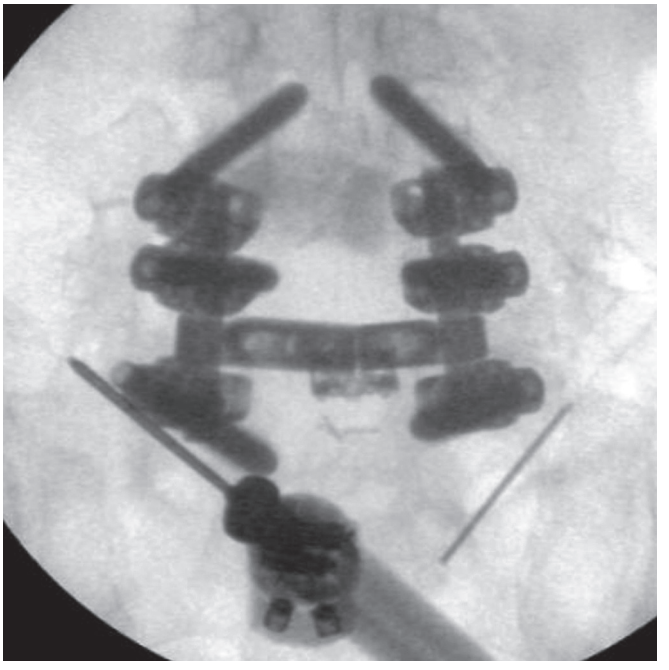

**Fig. 3.10** X-rays of lumbar fusion—anteroposterior view

# Common Tests

## Common Confirmatory Tests and Signs of SIJ Dysfunction

- *Fortin finger test*—patients one finger pointing to the area pain
- Positive result at the site within 1 cm of inferior medial to the *posterior superior iliac spine (PSIS)*
- *Gaenslen test* (Fig. 3.11)
- *Patrick test* (Fig. 3.12)
- *Yeoman test* (Fig. 3.13).

# Options for Treatment

## Primary Indication for Treatment of SIJ Pain Syndrome

- If *conservative* medications, physical therapy, exercise and acupuncture *fail then*,

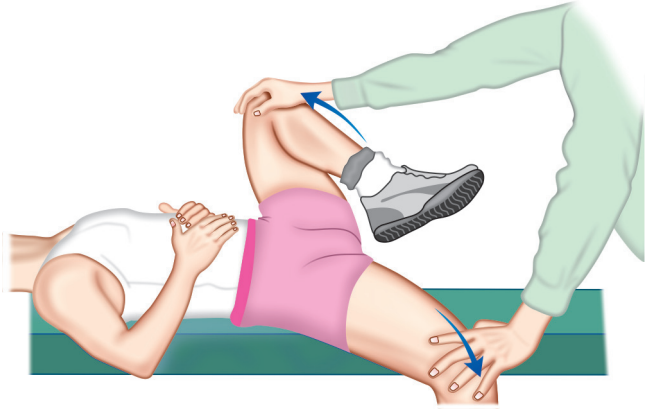

**Fig. 3.11** Gaenslen test

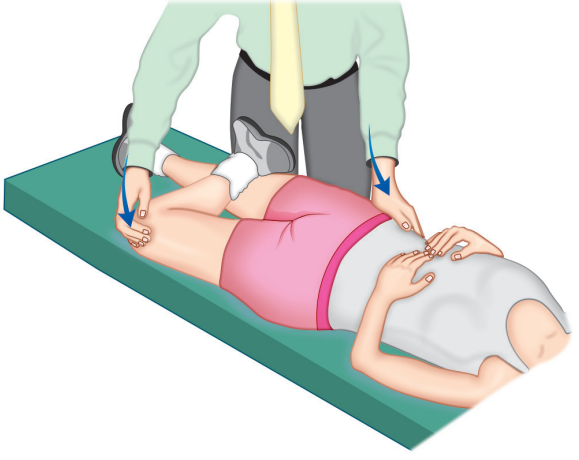

**Fig. 3.12** Patrick test

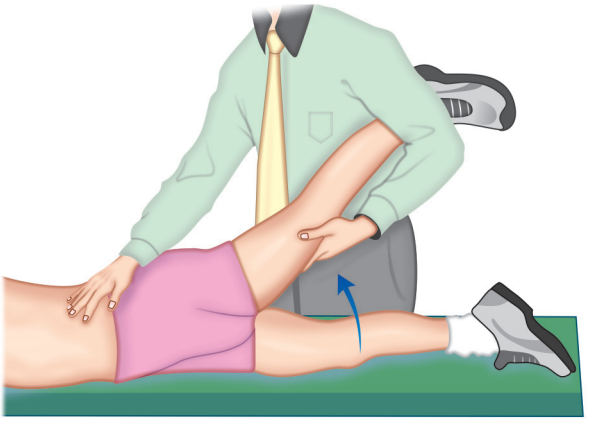

**Fig. 3.13** Yeoman test

- *SIJ injections intra-articular and extraarticular*
  - Injection anesthetic medication into the joint confirms whether or not the pain came from the joint
  - The local anesthesia and cortisone can help break a pain cycle or possibly facilitate a rehabilitation exercise program
- If *above fails* and SIJ pain continues to be intractable then,
- *Nerve blocks L4 to S3* are to be performed, if successful then,
- *Laser thermal neurectomy/rhizotomy* for denervation, including endoscopic *microdecompression* and laser neurolysis.

# Surgical Procedure/Technique

## SIJ Injection and Nerve Blocks

- In the *prone position*
- Under *local anesthesia* with mild IV *sedation*, 22 gauge needle is inserted into the joint under fluoroscopic guidance (Fig. 3.14)
- *Contrast material* (isovue) is injected intra-arctiularly to confirm
- A mixture of *local anesthetics* and *steroids* is injected
- After the injection some *may benefit* by wearing a support belt.

# Surgical Laser Thermoneurectomy (LTN) of SIJ

## Surgical Technique

- In *prone position*
- The *C-arm fluoroscopic unit* is angled towards the visualized line of the posterior aspect of SIJ

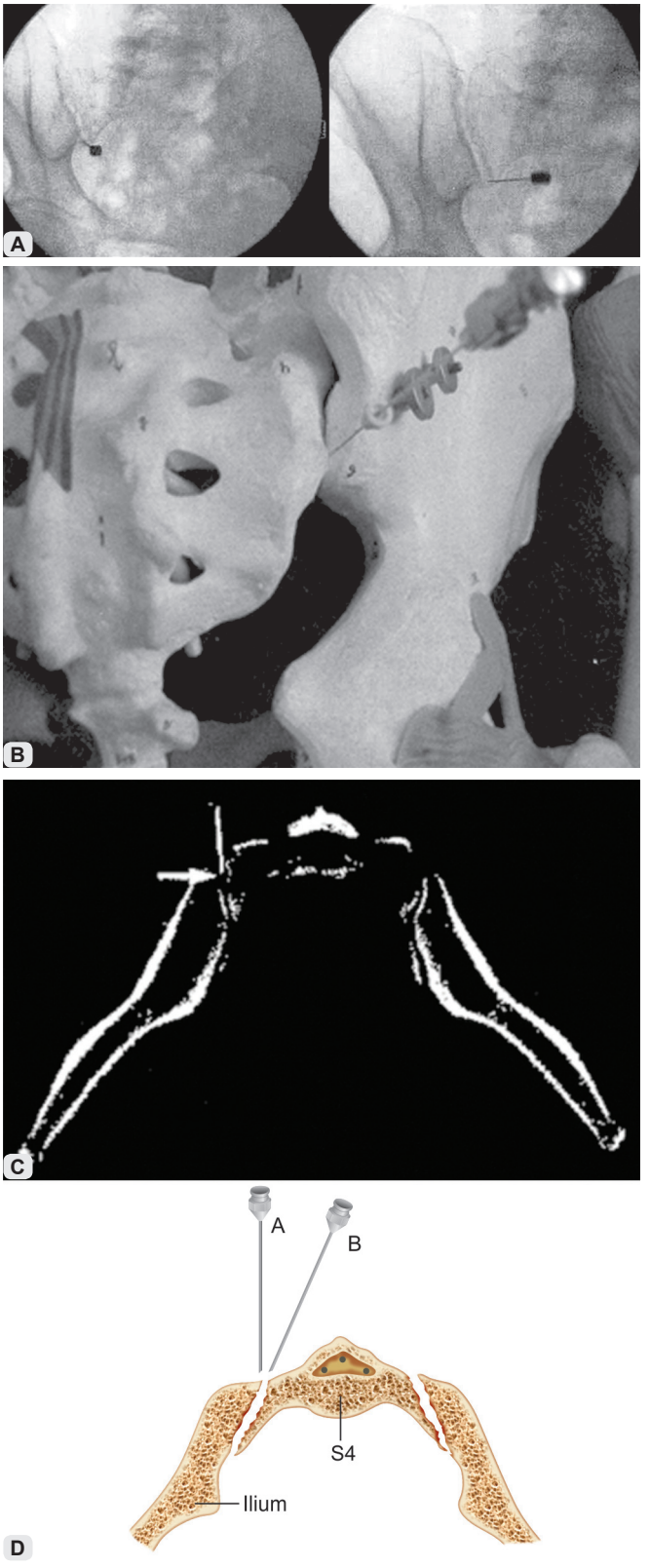


**Fig. 3.14** 'C'-arm picture, anatomical correlation of sacroiliac block

- The *tube is angled caudally and obliquely* (*15–20 degrees from the opposite side* of the body) from the side opposite to t*he SIJ to be denervated* with visualization of posterior SIJ line
- *LTN target* 5 mm to the sacral neural foramen, superiorly and laterally along the foramen for sacral neurectomy of S1, S2, S3 in addition to L4 and L5 medial branch neurectomy for SIJ denervation (Fig. 3.15)
- *Two successful SIJ nerve blocks* are *required before LTN/* rhizotomy.

## Surgical Procedure/Technique

*Fluoroscopic technique*

- The spine is in the *prone position*
- The fluoroscopic beam *aligns the anterior and posterior sacral foramina*
- A photograph of a sacrum from the anterior aspect
- The anterior and posterior foramina align
- *A/P fluoroscopic image* of the sacrum with *alignment of the anterior and the posterior foramina* (Fig. 3.16).

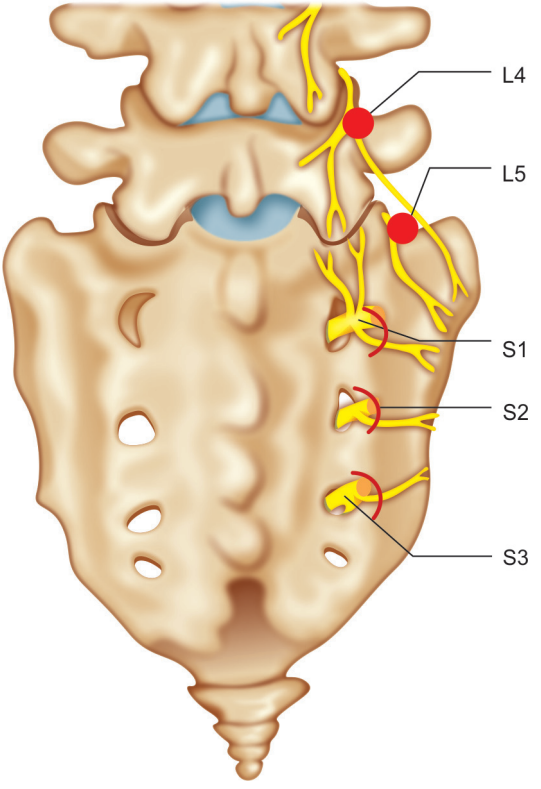


**Fig. 3.15** Surgical laser thermoneurectomy targets of S1–S3, lateral branches, and L4–L5 MBR innervating sacroiliac joint

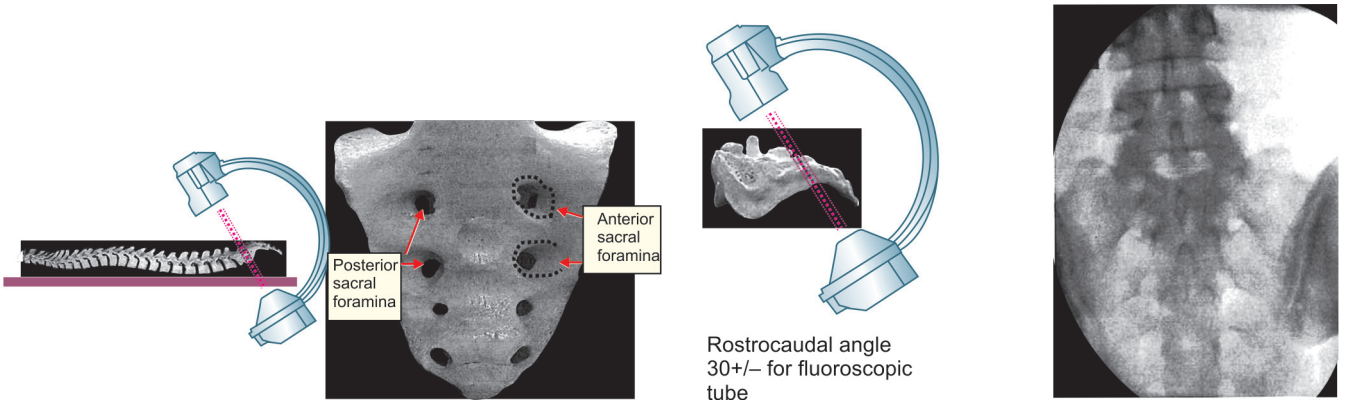


**Fig. 3.16** 'C'-arm correlation technique

## LTN Surgical Technique: Tissue Modulation Technology

Application of *tissue modulation technology* with microdecompression and LTN (laser) and even radiofrequency (Fig. 3.17).

- *Holmium YAG laser* equipment and side firing laser probe are utilized for *LTN* at lower level laser energy for ablation


**Fig. 3.17** (A) Trimedyne holmium YAG laser generator; (B) Right angle (side firing) laser probe

### *The Technique*

- The red spots and red curved line are the targets (medial branch of posterior roots of L4, L5, S1, S2, S3) for LTN (refer to Fig. 3.15)
- This procedure of laser *denervation* can be successfully performed with *Holmium YAG laser* system at 125 joules (5 watts, 10 hertz) for each site/nerve
- During the *LTN, continuous cold saline irrigation* to *dissipate* the *heat* generated by laser application, caused by the LTN/rhizotomy.

## LTN Surgical Equipment

LTN surgical equipments are shown in Figure 3.18.

## Surgical Procedure/Technique

- Patient *positioning and localization*
  - In *prone* position on 1–2 pillows
  - Localization – *skin marking* for *portal of entry* and placement of needle under *fluoroscopic guidance* (Figs 3.19 to 3.29).

## Postoperative Care

- *Ambulatory* usually in about 30 minutes and discharged subsequently
- May *shower* the following day
- Ice pack is helpful
- *Mild analgesics* and muscle relaxant are needed at times
- *Progressive exercises and able to start PT* the following day (Figs 3.30 and 3.31)
- Rehabilitation complements MISS and motion preservation (Fig. 3.32)
- *Return to work* in 3 days as tolerated (not for heavy work)

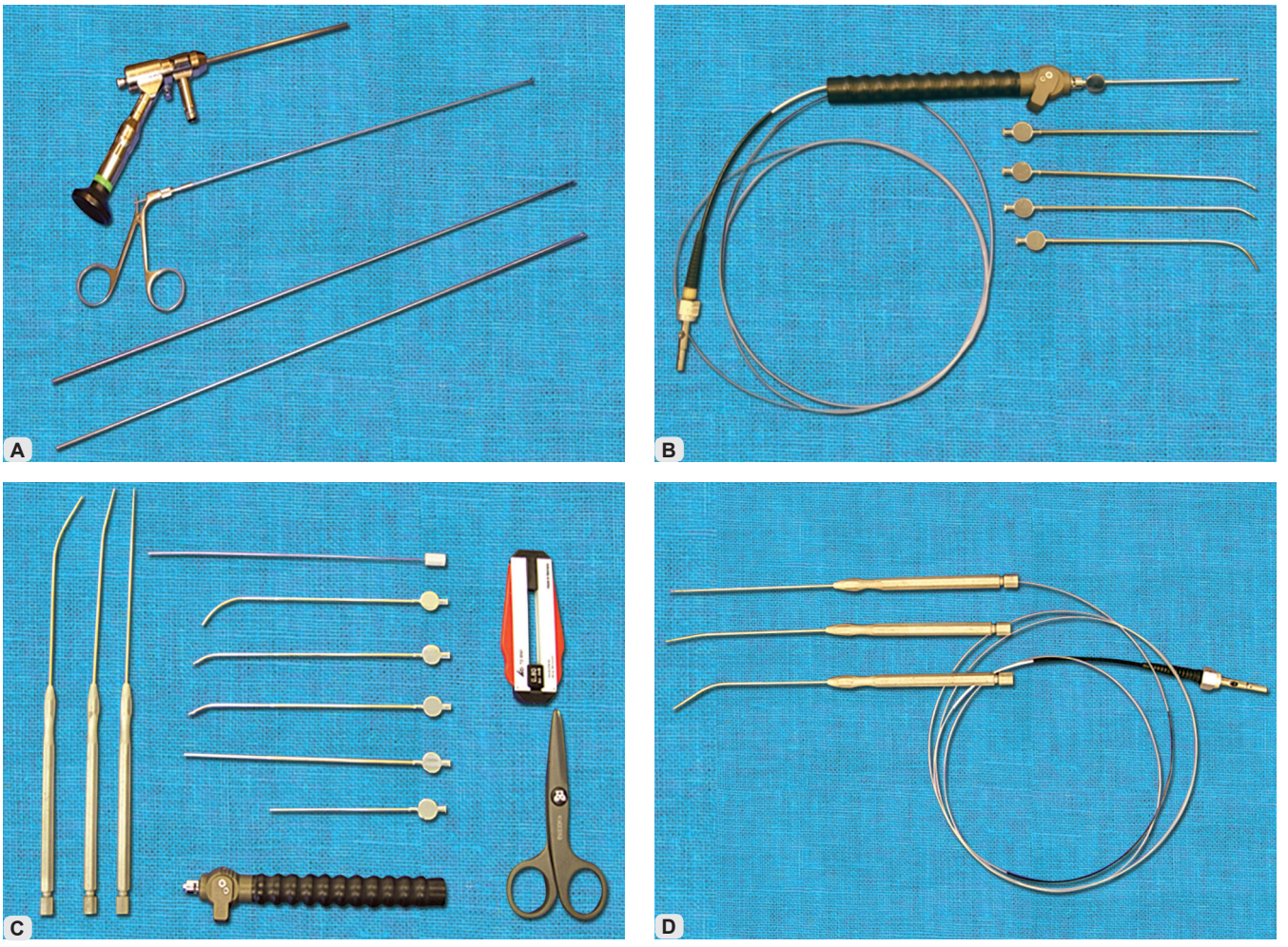


**Fig. 3.18** LTN surgical equipment

**Fig. 3.19** Skin markings for portal entry and needle insertion

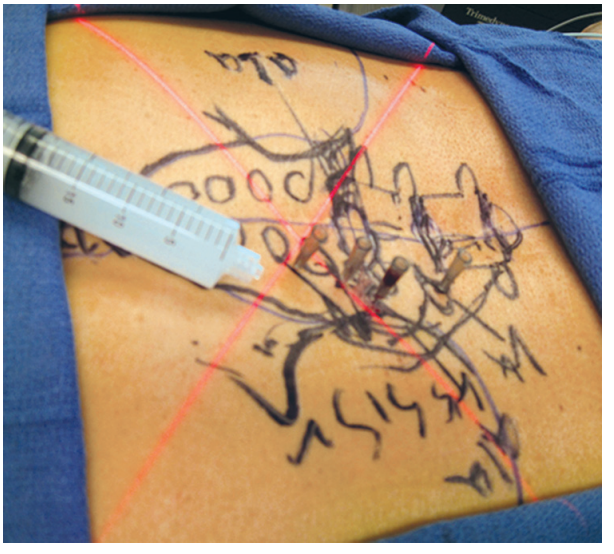

**Fig. 3.20** Placement of needle

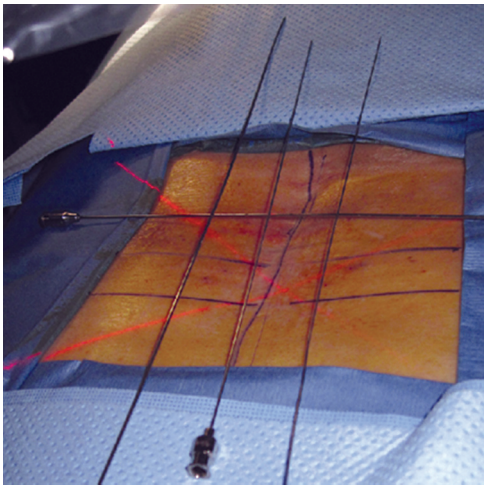

**Fig. 3.21** Identifying sacral neural foramen under fluoroscopy

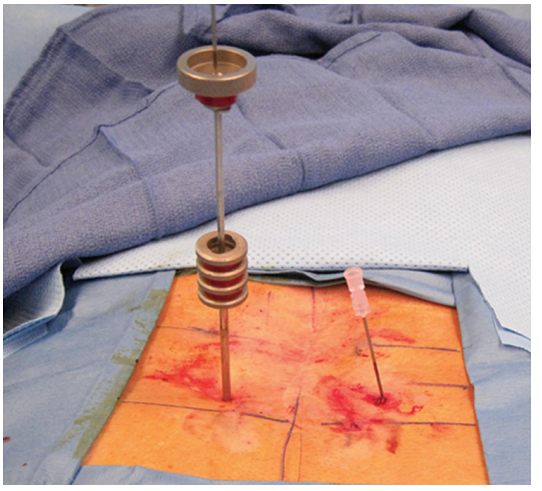

**Fig. 3.24** Establishing working channel for microdecompression laser probe insertion

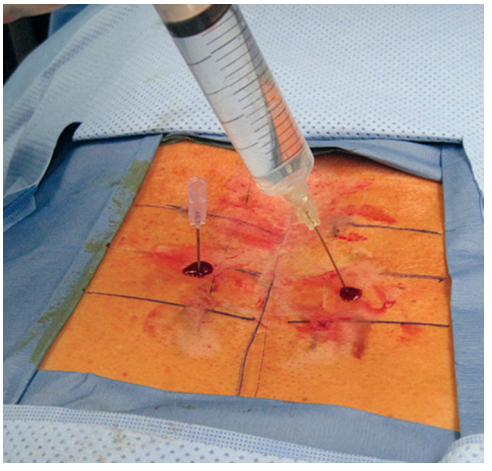

**Fig. 3.22** Injection of local anesthetics before denervation

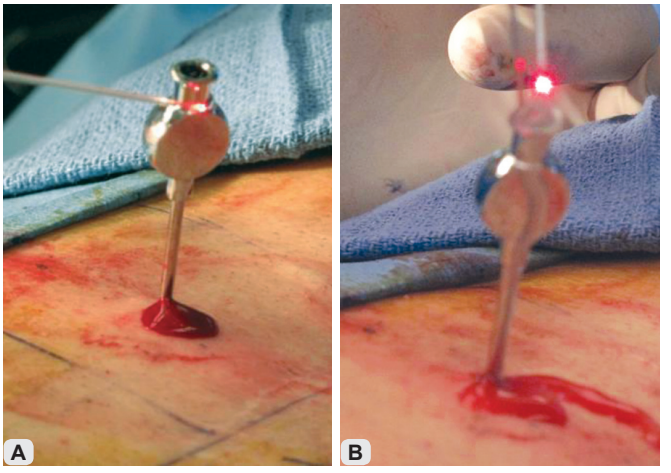


**Fig. 3.25** Introduction of working probe channel

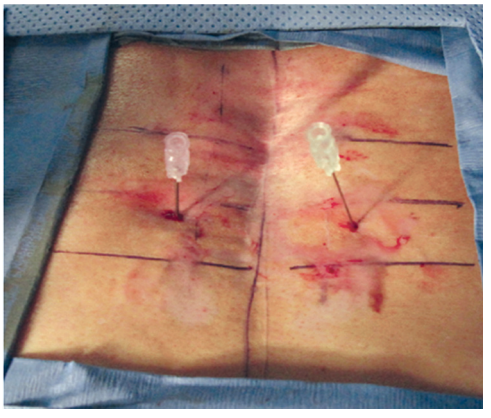

**Fig. 3.23** Needle localization for denervation along the neural foramen

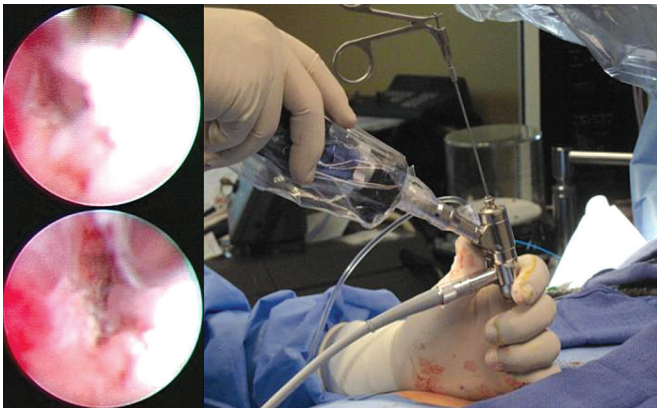

**Fig. 3.26** Mechanical endoscopic microdecompression LTN of the L5 medial branch of dorsal root rami

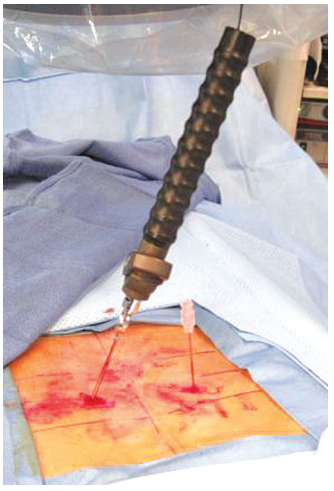

**Fig. 3.27** LTN with laser probe in place

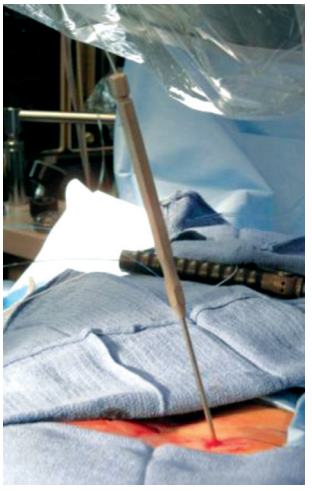

**Fig. 3.28** Laser thermoneurectomy

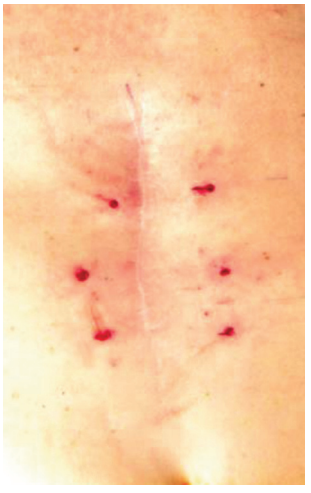

**Fig. 3.29** Small surgical wound post LTN

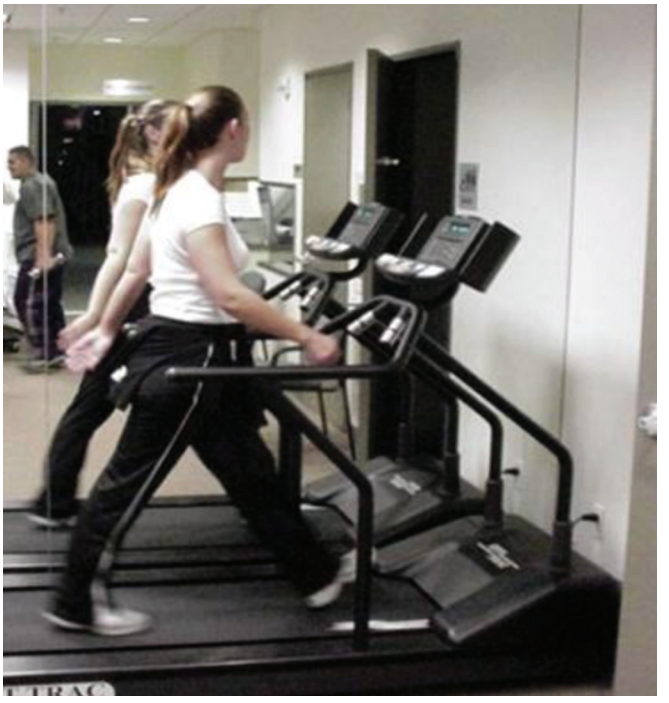

**Fig. 3.30**

**Fig. 3.31**

**Figs 3.30 and 3.31** Gym for the treatment of the patient

## Surgical Outcome for Laser Thermoneurectomy

- In *34 patients*, average follow-up *24 months* (12 months)
- Overall result: 31 (*91.2%*) patients with *good to excellent results*, fair results 3 (8.8%)
- *Response to treatment* evaluated by using: MacNab, modified Mac Nab criteria, ODI, VAS, patient satisfaction scoring, pain diagram and/or patient target achievement score (PTA)
- *Average satisfaction score* – 32 (*94%* ) patients
- 3 (8.8%) patients had some mild residual pain
- *Intraoperative and postoperative complication: 0%*
- Preliminary report (Fig. 3.33).

# Conclusion

- *Intractable SIJ pain* can be treated *conservatively* with medication, PT, ice, heat, injection and even with *local nerve blocks with some relief*
- *If failure* of conservative treatment and SIJ pain syndrome continues
- It *can be successfully treated with outpatient SIJ nerve blocks and subsequent laser thermoneurectomy (LTN)* with endoscopic rhizotomy/decompression

**Fig. 3.32** Swimming pool for physiotherapy

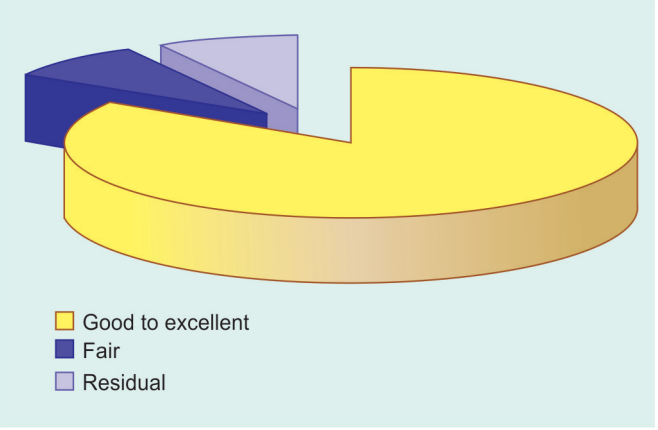


**Fig. 3.33** Outcome of surgical LTN

- LTN with microdecompression *of L4–S3 SIJ* appears to be a *safe* and *efficacious outpatient surgical procedure*
- It provides *economical savings and speedy recovery*

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