



SCIATIC FUNCTIONAL INDEX CHAMBER (SFI CHAMBER)

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ABSTRACT:

The Sciatic Functional Index (SFI) chamber is a specialized experimental apparatus used to evaluate functional recovery following sciatic nerve injury in animal models, primarily rodents. It plays a crucial role in neuropharmacology and nerve regeneration studies by enabling quantitative assessment of motor function. The SFI is derived from footprint analysis, where parameters such as print length (PL), toe spread (TS), and intermediary toe spread (IT) are measured from both injured and normal limbs.

The chamber typically consists of a confined walking track with a darkened goal box that encourages the animal to walk in a straight path. The hind paws are coated with ink or dye, allowing clear footprints to be recorded on paper or digital surfaces. These footprints are then analyzed using established mathematical formulas to calculate the SFI, which ranges from 0 (normal function) to -100 (complete impairment).

This method provides a non-invasive, reliable, and reproducible means of assessing peripheral nerve function and recovery over time. It is widely used to evaluate the efficacy of pharmacological agents, surgical interventions, and regenerative therapies in preclinical studies. Despite its advantages, factors such as animal behavior variability and measurement errors can influence results, requiring careful experimental design.

Overall, the SFI chamber remains a valuable tool in experimental neuropharmacology for assessing functional outcomes in sciatic nerve injury models.

KEYWORDS:

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INTRODUCTION

The Sciatic Functional Index (SFI) chamber is an experimental setup used in neuro pharmacology and biomedical research to evaluate the function of the sciatic nerve after injury. The sciatic nerve is one of the largest nerves in the body and plays an important role in controlling movement and sensation in the hind limbs. Damage to this nerve can affect walking ability and muscle control.

The SFI chamber, also called a walking track chamber, is mainly used in experiments with animals such as rats. In this method, the animal is allowed to walk through a narrow chamber with a sheet of paper placed on the floor. The hind paws of the animal are coated with non-toxic ink so that footprints are left on the paper while walking.

These footprints are then analyzed by measuring parameters such as print length and toe spread. Using

these measurements, the Sciatic Functional Index (SFI) value is calculated. The SFI helps researchers determine the degree of nerve injury and the level of functional recovery over time.

This method is simple, reliable, and widely used to study nerve damage, regeneration, and the effects of different drugs or treatments on nerve healing. Therefore, the SFI chamber is an important tool in experimental studies related to peripheral nerve injury.

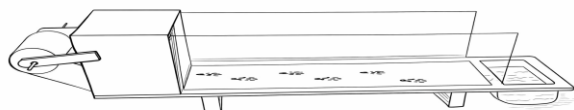


Figure 1: Sciatic Functional Index (SFI) Chamber

The Sciatic Functional Index (SFI) chamber is an experimental apparatus used in preclinical studies (rats/mice) to evaluate functional recovery after sciatic nerve injury.

It is mainly used in:

- ✓ Peripheral nerve injury models
- ✓ Neuropathy studies (diabetic neuropathy, toxic neuropathy)
- ✓ Nerve regeneration research
- ✓ Testing neuroprotective / neuroregenerative drugs

What is Sciatic Functional Index (SFI)?

The Sciatic Functional Index (SFI) is a quantitative measure of sciatic nerve function based on analysis of the animal's footprints.

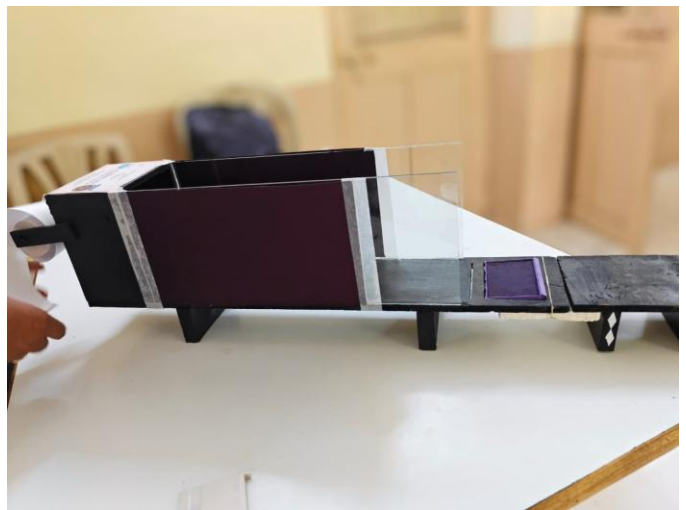
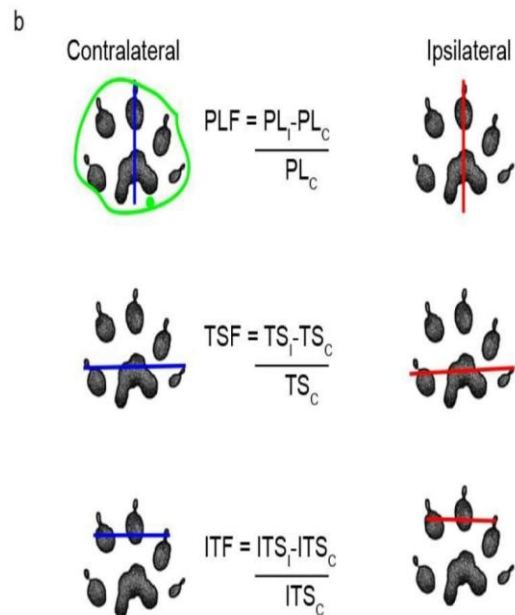


FIG.2 SFI CHAMBER



It compares:

- Normal (uninjured) paw prints
- Experimental (injured) paw prints

SFI value range:

- ✓ 0* → Normal nerve function
- ✓ -100* → Complete sciatic nerve dysfunction

dysfunction

Structure of SFI Chamber

An SFI chamber is a:



- Long narrow *walking corridor*
- Transparent side walls (to prevent escape)
- Dark start box at one end
- White paper placed on the floor
- Ink applied to hind paws
- Sometimes water/escape chamber at the end to encourage movement

The animal walks through the corridor leaving footprints, which are later measured.

Parameters Measured from Footprints

From each footprint:

1. PL (Print Length)* – heel to toe length
2. TS (Toe Spread)* – distance between 1st and 5th toe
3. IT (Intermediary Toe Spread)* – distance between 2nd and 4th toe

These are measured for:

- Normal limb (NPL, NTS, NIT)
- Experimental limb (EPL, ETS, EIT)

SFI Formula

$$[SFI = -38.3 \frac{(EPL - NPL)}{NPL}$$

$$109.5 \frac{(ETS - NTS)}{NTS}$$

$$13.3 \frac{(EIT - NIT)}{NIT}] - 8.8]$$

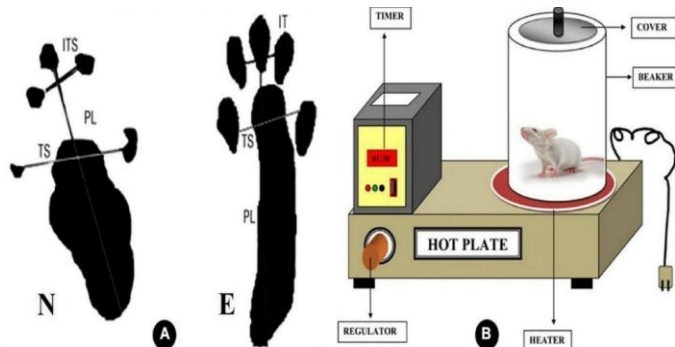


FIG.3 FOOT PRINT

Why It Is Important in Pharmacology?

In experimental pharmacology, SFI is used to:

- Evaluate : efficacy of neuroprotective drugs*
- Study : anti-inflammatory or antioxidant compounds*
- Assess :nerve regeneration therapies
- Monitor recovery after:
 - Sciatic nerve crush injury
 - Sciatic nerve transection
 - Diabetic neuropathy model-

Example Use

If a drug improves nerve regeneration:

- SFI value moves from *-90 toward 0*

- Indicates functional improvement

STANDARD OPERATING PROCEDURE (SOP)

Assessment of Sciatic Functional Index (SFI) in Rats

1. TITLE

Assessment of functional recovery following sciatic nerve injury using Sciatic Functional Index (SFI) footprint analysis in Wistar rats.

2. OBJECTIVE

To evaluate motor functional recovery after sciatic nerve injury and to assess the efficacy of test drug(s) using SFI analysis.

3. PRINCIPLE

Sciatic nerve injury alters hind limb motor function. When the rat walks along a confined corridor, footprint parameters change.

SFI is calculated from:

- ✚ Print Length (PL)
- ✚ Toe Spread (TS)
- ✚ Intermediary Toe Spread (IT)

Comparison of injured vs normal limb gives quantitative nerve function.

SFI Scale:

- 0 = Normal
- -100 = Complete dysfunction

4. Materials Required

I. Animals

- i. Adult Wistar rats (200–250 g)
- ii. Either sex (as per study design)

II. Equipment

- i. Sciatic Functional Index chamber (walking track)
- ii. White paper strips (8–10 cm width)
- iii. Non-toxic ink
- iv. Scale / Vernier caliper
- v. Digital camera (optional)
- vi. Marker pen

I. Chemicals / Drugs

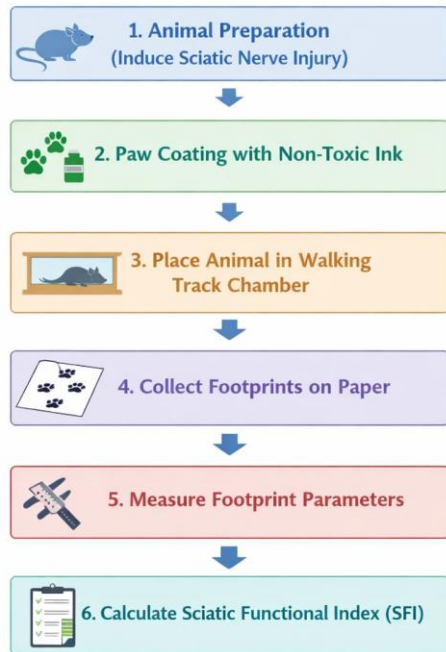
- i. Ketamine + Xylazine (for anesthesia)
- ii. Test drug(s)
- iii. Normal saline

5. Description of SFI Chamber

- i. Length: 100–120 cm
- ii. Width: 8–10 cm
- iii. Height: 15–20 cm transparent walls
- iv. Dark start box at one end
- v. Exit box at opposite end

vi. Removable paper strip placed on floor

Procedure for Sciatic Functional Index (SFI) Chamber



6. Experimental Groups (Example)

- i. Normal control
- ii. Injury control
- iii. Standard drug group
- iv. Test drug low dose
- v. Test drug high dose

7. Procedure

A. Induction of Sciatic Nerve Injury

- Perform under CPCSEA/IAEC approval.
- i. Anesthetize rat (Ketamine 80 mg/kg + Xylazine 10 mg/kg, i.p.).
- ii. Shave lateral thigh region.
- iii. Make 2–3 cm incision.
- iv. Expose sciatic nerve.
- v. Perform:

Crush injury (using artery forceps for 30 sec)

OR

Ligature / Transection (as per model)

- vi. Close muscle and skin with sutures.
- vii. Apply antiseptic.

viii. Allow recovery.

B. Training of Animals (Important Step)

- a) Train rats to walk through chamber 2–3 days before surgery.
- b) Ensure smooth, uninterrupted walking.
- c) Exclude animals that refuse to walk.

C. Footprint Collection Procedure

- a) Cut white paper strip to chamber length.
- b) Apply non-toxic ink to both hind paws.
- c) Place rat in start box.
- d) Allow rat to walk toward dark/escape box.
- e) Collect clear footprint strip.
- f) Repeat 2–3 trials per rat.
- g) Select best clear footprints.

Perform on:

- i. Day 0 (baseline)
- ii. Post-op Day 3, 7, 14, 21 (or as per study design)

8. Measurement of Parameters

From footprints measure:

1. Print Length (PL)

Heel to tip of third toe

2. Toe Spread (TS)

Distance between first and fifth toe

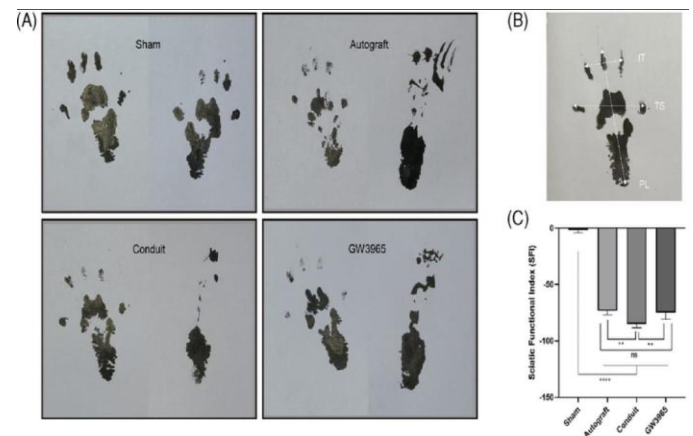
3. Intermediary Toe Spread (IT)

Distance between second and fourth toe

Measure for:

* Experimental limb (E)

* Normal limb (N)



9. Calculation of SFI

$$[SFI = -38.3 \frac{(EPL - NPL)}{NPL}]$$

$$* 109.5 \frac{(ETS - NTS)}{NTS}$$

$$* 13.3 \frac{(EIT - NIT)}{NIT} - 8.8]$$

Interpretation

| SFI Value | Interpretation |

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0 to -10	Normal
-10 to -40	Mild dysfunction
-40 to -80	Moderate dysfunction
-80 to -100	Severe dysfunction

Overall, the Sciatic Functional Index chamber is an important tool in neuro pharmacology and experimental research. Its simplicity, low cost, and accuracy make it widely used in studies related to peripheral nerve injury and nerve regeneration. This method plays a significant role in understanding nerve recovery and developing better therapeutic approaches for nerve damage.

Improvement toward 0 indicates nerve recovery.

11. Statistical Analysis

- ✓ Express as Mean \pm SEM
- ✓ Analyze using:
- ✓ One-way ANOVA
- ✓ Followed by Tukey post hoc test
- ✓ $p < 0.05$ considered significant

12. Precautions

- ✓ Ensure uniform ink application.
- ✓ Avoid smudged footprints.
- ✓ Maintain consistent lighting.
- ✓ Always compare injured limb with contralateral normal limb.
- ✓ Same observer should measure all prints (reduce bias).

13. Ethical Considerations

- ✓ Follow CPCSEA guidelines.
- ✓ Provide post-operative analgesia.
- ✓ Monitor for infection.
- ✓ Humane endpoint criteria must be predefined.

14. Outcome Measures

Primary:

SFI score

Secondary (optional):

- ✓ Histopathology
- ✓ Nerve conduction velocity
- ✓ Muscle weight ratio
- ✓ Oxidative stress markers

CONCLUSION:

The Sciatic Functional Index (SFI) chamber is a simple and effective method used to evaluate the functional recovery of the sciatic nerve after injury. It helps researchers analyze the walking pattern of experimental animals by studying their footprints. From these footprints, important parameters such as print length and toe spread are measured to calculate the SFI value.

The SFI chamber provides reliable and quantitative data about nerve damage and regeneration. It allows researchers to monitor the improvement in nerve function over time and to evaluate the effectiveness of different treatments or drugs used for nerve repair.

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