

# The view of Brazilian orthopedists on partial weight bearing in open fractures of the tibial shaft following osteosynthesis

A visão do ortopedista brasileiro sobre a descarga parcial de peso em ortostase nas fraturas expostas da diáfise da tíbia após osteossíntese

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## Abstract

**Background:** Tibial shaft fractures are the most frequent among long bone fractures. They are described in the literature according to the device and method of treatment, with recommendations that range from full weight bearing to non-weight bearing restrictions. There are studies comparing osteosynthesis devices and surgical aspects, but no references were found on how or when to allow weight bearing on the affected limb in the standing position. **Objectives:** The present study learned from Brazilian orthopedists which methods of osteosynthesis they use to treat open tibial fractures, whether they refer patients to physical therapy, when and why they allow partial weight bearing for both physical activity and therapy. **Methods:** Two hundred and thirty-five orthopedists answered a questionnaire during the 14<sup>th</sup> Brazilian Conference of Orthopedic Trauma. **Results:** The results showed that, in Brazil, the most widely used osteosynthesis device is the external fixator, but earlier weight bearing while standing occurs when intramedullary nails are used. Most orthopedists refer patients to physical therapy and allow partial weight bearing in the standing position according to the material used for synthesis. **Conclusions:** It was concluded that there is a preference for external fixation, that most orthopedists refer patients to physical therapy and that the synthesis material influences restrictions on partial weight bearing.

**Key words:** osteosynthesis; tibia; physical therapy; orthopedist.

## Resumo

**Contextualização:** As fraturas da diáfise da tíbia são as mais frequentes dentre as dos ossos longos. Há descrições na literatura, de acordo com o método e dispositivo de tratamento, com recomendações que vão desde a descarga total até a proibição do suporte de peso corporal em ortostase. Existem estudos comparando os dispositivos de osteossíntese e os diversos aspectos cirúrgicos, porém não são encontradas referências que descrevam como e quando se deve liberar a descarga sobre o membro acometido na posição ortostática. **Objetivos:** Verificar, entre os ortopedistas brasileiros, qual ou quais são os métodos de osteossíntese adotados para o tratamento de fraturas expostas de tíbia, se indicam o tratamento fisioterápico, quando e quais fatores influem para liberar a descarga parcial em ortostase, tanto para a função quanto para a fisioterapia. **Métodos:** 235 ortopedistas responderam a um questionário durante o XIV Congresso Brasileiro de Trauma Ortopédico. **Resultados:** Os resultados mostraram que, no Brasil, o dispositivo de osteossíntese mais utilizado é o fixador externo (FE), porém a descarga de peso em pé ocorre mais precocemente quando são utilizadas as hastas intramedulares. A grande maioria dos ortopedistas indica fisioterapia, e o período para liberação de descarga de peso parcial em ortostatismo varia de acordo com o material de síntese utilizado. **Conclusões:** Concluiu-se que há preferência pelos FEs, a grande maioria indica tratamento fisioterápico e o material de síntese influencia o tempo de liberação de descarga parcial de peso em ortostatismo.

**Palavras-chave:** osteossíntese; tíbia; fisioterapia; ortopedista.

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## Introduction

Tibial shaft fractures are the most frequent among long bone fractures, but its treatment remains controversial<sup>1</sup>. Several methods of treatment have been described in the last 50 years<sup>2</sup>. The incidence of these fractures is higher in males and in the age group ranging from 21 to 30 years, with traffic accidents being the main cause<sup>3-5</sup>.

The primary advantage of implants for the mechanical stability of the fracture is the improvement in soft tissue conditions, healing, manipulation and blood supply, which reduces the incidence of bone infection and promotes bone consolidation<sup>6</sup>. Currently there is agreement on the gold standard for the stabilization of open tibial shaft fractures up to Gustilo IIIB, which consists in the use of Reamed Intramedullary Nailing (RIN)<sup>5-7</sup>. In certain situations, there may be the need to indicate External Fixation (EF) to provide temporary or permanent stabilization, or even a Bridge Plate (BP) as a treatment option. In the literature, there is no consensus on the amount of weight bearing recommended for the postoperative (PO) period or on the time that the patient must avoid weight bearing on the affected limb<sup>7</sup>.

The bone consolidation of these fractures takes five months on average, and functional rehabilitation takes about a year when there is no need for additional surgical treatment<sup>7</sup>. Fernandes et al.<sup>8</sup> compared 45 patients with closed multi-fragment tibial shaft fractures treated with Unreamed Intramedullary Nailing (UIN) and BP. They concluded that the consolidation time was shorter with the use of BP, but with no significant functional differences. A comparative study between RIN and Ender Nailing (EN) for the treatment of tibial shaft fractures concluded that both methods are similar for some fractures<sup>9</sup>. Vasarhelyi et al.<sup>10</sup> advocate early mobilization and partial weight bearing as accepted principles for PO rehabilitation of lower limb injuries and claim that there is a clear advantage in immediate partial weight bearing in the standing position compared to non-weight bearing.

The cross-sectional study by Balbachevisky et al.<sup>11</sup> examined the opinion of Brazilian orthopedists regarding aspects of surgical treatment of open tibial shaft fractures in adults. The results showed that the absolute majority agrees on classification, indication of surgical treatment, irrigation pressure, antiseptics for surgical scrub, time for bone coverage and method of stabilization. The results also showed that there is no agreement as to the indication of primary wound closure and the length of antibiotic use.

Although several studies in the literature compare osteosynthesis devices and various surgical aspects, there are no specific references regarding the ideal time for partial

weight bearing in the standing position. The aim of the present study was to investigate, among Brazilian orthopedists, which osteosynthesis methods they use to treat open tibial fractures, when they refer patients to physical therapy, and when and why they allow partial weight bearing in the standing position during physical activity and therapy.

## Methods

During the three days of the 14<sup>th</sup> Brazilian Conference of Orthopedic Trauma held in May 2008, in the city of Curitiba, 235 orthopedists completed a questionnaire that addressed various aspects of the treatment of open tibial shaft fractures. The inclusion criteria for this study were presence at the conference and agreement with and signature of the informed consent form. The exclusion criterion was medical resident or student status. Participation in the study was voluntary and anonymous. The study and the questionnaire were approved by the Research Ethics Committee of Universidade Federal de São Paulo (UNIFESP), under the number CEP160/08.

The researchers approached the respondents and explained the purpose of the study and the questionnaire. Any questions that arose during the process of filling out the questionnaire were answered by the researchers or marked for clarification at the end of the process. If the respondents did not find an adequate option among the multiple-choice answers, they should leave the question blank.

The questionnaire consisted of multiple-choice questions about the clinical, surgical and rehabilitation treatment of open tibial fractures, including the following items: identification, treatment frequency, adopted classification, surgical indications, preferred implants, indication of time (in days PO) when partial weight bearing is allowed in the standing position (according to synthesis device), referral to physical therapy and the most influential aspect in allowing partial weight bearing in the standing position (Appendix 1).

The answers to the questionnaires were tabulated<sup>12</sup>, and the distributions by types of fixation were compared using Fisher's exact test, rejecting the hypothesis of independence with  $p > 0.05$ .

## Results

Most physicians (48.9%) came from the Southeast region of the country, followed by the Southern (27.4%) and Northeast (13.7%) regions, while the Midwest accounted for 8.2%

and the North for 1.8%. Regarding the specialties, traumatologists accounted for 51% of the public and hip and knee specialists accounted for 13.8% and 12.7%, respectively. Most respondents (31.9%) performed more than 30 surgical procedures a year, 25.9% between 16 and 30 surgeries; 18.5% between 11 and 15 surgeries and only 10.3%, less than 6 surgeries a year. The most widely used classification was Gustilo-Anderson (83.5%), followed by AO\_ASIF (12%) and Tscheme-Gotzen (4.1%).

Table 1 shows the data obtained for each method of fixation regarding when partial weight bearing is allowed in the standing position, referral to physical therapy, when weight bearing during exercise therapy is allowed, and the most influential factor for this permission.

The stabilization method used by most respondents was EF (83.4%), followed by UIN (48.5%) and RIN (48.1%). The use of BPs accounted for 35.7% of respondents, and the ENs were found in only 0.9%. A preference was observed for EF ( $p < 0.001$ ).

Most traumatologists (96%) referred patients to physical therapy, regardless of the type of fixation ( $p = 0.810$ ), and most of them (52.4%) allowed weight bearing after 30 days on average ( $p = 0.915$ ).

The highest frequency of permission for partial weight bearing using EF was between 30 and 44 days PO (21.4%) and between 45 and 59 days PO (19.3%), but this trend was not statistically significant ( $p = 0.054$ ). Ninety six percent of respondents claimed to refer patients to physical therapy after using EF; only 51.4% of these allowed weight-bearing exercise therapy after 30 days ( $p < 0.001$ ). The most influential factor in allowing partial weight bearing for this implant was the type of osteosynthesis material (TOM), representing 70.3% of the opinions, followed by X-ray results (35.9%) and pain (14.9%).

For UIN, the highest frequency of permission for partial weight bearing in the standing position was between one and seven days PO (35.1%;  $p < 0.001$ ). Referral to physical therapy

**Table 1.** Presentation of variables.

	% of physicians who use each method				
	RIN	UIN	BP	EF	EN
	48.1% (113)	48.5% (114)	35.7% (84)	83.4% (196)	0.9% (2)
When do you allow postoperative partial weight bearing?					
1-7 days PO	43.4% (49)	35.1% (40)	18.3% (15)	13.4% (25)	-
8-14 days PO	14.2% (16)	16.7% (19)	4.9% (4)	7.5% (14)	-
15-21 days PO	20.4% (23)	14.9% (17)	12.2% (10)	11.2% (21)	-
22-29 days PO	3.5% (4)	7.0% (8)	8.5% (7)	7.5% (14)	-
30-44 days PO	10.6% (12)	15.8% (18)	19.5% (16)	21.4% (40)	50.0% (1)
45-59 days PO	7.1% (8)	3.5% (4)	18.3% (15)	19.3% (36)	-
60-89 days PO	-	5.3% (6)	11.0% (9)	12.3% (23)	50.0% (1)
90 days or more PO	0.9% (1)	1.8% (2)	7.3% (6)	7.5% (14)	-
Do you refer patients to physical therapy?					
Yes	97.3% (108)	94.7% (108)	96.4% (80)	96.4% (189)	100.0% (2)
When do you allow weight-bearing exercise therapy*?					
After 30 days	58.8% (60)	48.5% (49)	52.6% (40)	51.4% (92)	-
After 45 days	19.6% (20)	20.8% (21)	21.1% (16)	22.3% (40)	-
After 60 days	13.7% (14)	20.8% (21)	15.8% (12)	15.1% (27)	100.0% (2)
After 90 days	7.8% (8)	9.9% (10)	10.5% (8)	11.2% (20)	-
What is the most influential factor in allowing partial weight bearing?					
TOM	73.5% (83)	71.7% (81)	70.2% (59)	70.3% (137)	50.0% (1)
X Ray	33.6% (38)	31.0% (35)	27.4% (23)	35.9% (70)	-
Pain	18.6% (21)	15.9% (18)	15.5% (13)	14.9% (29)	50.0% (1)
Signs of Infection	-	-	-	-	-
Others	2.7% (3)	1.8% (2)	3.6% (3)	3.6% (7)	-

\* If patient was referred to physical therapy; RIN=reamed intramedullary nailing; UIN=unreamed intramedullary nailing; BP=bridge plate; EF=external fixation; EN=ender nailing; TOM=type of osteosynthesis material; PO=postoperative.

was observed in 94.7% of cases, and the most common period before allowing partial weight-bearing exercise therapy was after 30 days (48.5%;  $p < 0.001$ ). The most influential factor in allowing partial weight bearing was the TOM, representing 71.7% of opinions.

According to 43.4% of the respondents, the use of RIN allows partial weight bearing between one and seven days PO. This group is statistically significant ( $p < 0.001$ ). The majority of those who chose RIN refer patients to physical therapy for open tibial fractures (97.3%). The most frequent period to refer patients to exercise therapy with weight bearing in the standing position was between 30 and 44 days PO (58.8%;  $p < 0.001$ ).

According to 18.3% of respondents, the use of BP allows partial weight bearing between one and seven days PO. The periods of 30 to 44 days and 45 to 89 days (19.5% and 18.3% respectively) were also frequently cited, and there was no period of frequency ( $p = 0.061$ ) of permission for weight bearing in the standing position. The vast majority of respondents (96.4%) refer patients to physical therapy for open tibial fractures treated with BP. The respondents selected the period of 30 days (52.6%) as the most frequent to allow weight-bearing exercise therapy while standing. Once again, the factor that most influences these professionals is the TOM (70.2%).

Only two respondents opted for the use of EN (0.9% of respondents), precluding detailed analysis of this fixation. Figure 1 represents the time period when the respondents allow partial weight bearing in the standing position for each method of fixation.

## Discussion

Bhandari et al.<sup>13</sup>, in their systematic review and meta-analysis, compared the use of UIN with EF in the treatment of open tibial fractures. The authors concluded that, in patients treated with intramedullary nailing, there was a significant reduction in the number of reoperations, implant failure and infection compared to patients treated with EF<sup>13,14</sup>. In the systematic review, which compares RIN to UIN of the spinal cord, the results showed that RIN is significantly better. Indirectly, Bhandari et al.<sup>13</sup> concluded that the treatment of open shaft fractures with RIN yields better results than EF. In this study, there was equivalence in indications of EF (83.4%) and intramedullary nailing (80.9%), when RIN and UIN were added.

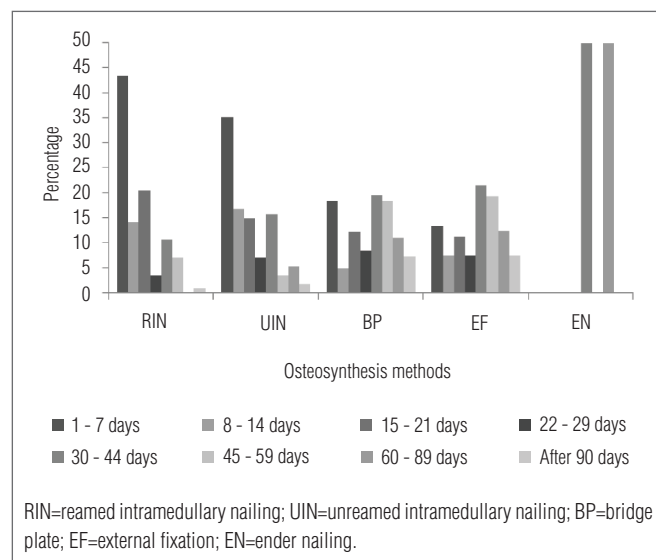
In Brazil, the use of EF is more common than the use of intramedullary nailing<sup>11</sup>. This is because fixation is cheaper, more readily available and easier to learn, and as

previously mentioned, the results are satisfactory. There is also the possibility of using EF temporarily, then converting to definitive internal fixation. The present study confirms these data with 83.4% of respondents claiming to use this device.

The use of BPs was reported by 35.6% of respondents. This treatment method has also been used in Brazil due to its lower cost and greater availability. Another aspect of the present study was the fact that only 0.9% of orthopedists used EN. Although the studies by Merianos, Cambouridis and Smyrnis<sup>15</sup> and Sakaki, Crocci and Zumiotti<sup>9</sup> concluded that the results of osteosynthesis with nails and EN are similar, EN was not noted as a preferred method.

According to the interviewed professionals, RIN allows partial weight bearing in the standing position sooner. Indeed, biomechanical studies comparing RIN, EF and plates have shown that the nails provide greater stability. This is corroborated by the fact that patients treated with intramedullary nailing are referred to physical therapy with weight bearing earlier. A less stable method delays permission for partial weight bearing in the standing position and can often change the positioning and symmetrical distribution of body weight in the medium to long term.

In the literature, there is also some disagreement on weight bearing, even partial, in the standing position, which may be reflected in the lack of consensus among the respondents for all devices, as in the case of EF and BPs. Court-Brown<sup>16</sup> claims that, when tolerable, RIN would be strong enough to allow immediate weight bearing, unlike UIN. Regarding EF, the author states that the weight bearing is related to the radiographic presence of fracture consolidation,



**Figure 1.** Implant methods and number of days postoperative when orthopedists allow partial weight bearing.

claiming that few fixators provide enough stability<sup>17</sup>. In contrast, Sande et al.<sup>18</sup> and Hoppenfeld and Murthy<sup>19</sup> reported that two-legged stance would be very premature on the first week PO, both for intramedullary nailing and EF. Weight bearing would only be delayed for BPs. In the present study, 18.3% of respondents allow partial weight bearing between the first and seventh day PO in osteosynthesis using BPs, contrary to the data of various authors who only allow partial weight bearing after radiographic signs of bone consolidation<sup>20-22</sup>.

It may be considered a positive factor to find that 96% of respondents refer patients to physical therapy, given the impact that an open tibial fracture can have on a young, productive individual. The early rehabilitation of patients allows a faster return to activities of daily living. Several authors have shown that early mobilization and resumption of weight bearing improved mobility, reduced hospital stay and morbidity, and reduced costs to the health system<sup>22</sup>. For patients treated with intramedullary nailing and EFs, partial weight bearing in standing position is allowed after a few days. These benefits lead to better blood supply to the site of the bone and soft tissue wounds, allowing a faster healing process<sup>15,23,24</sup>.

In a cohort study, Karladani et al.<sup>25</sup> compared lower limb function after tibial fracture treated with plaster or intramedullary nailing. They concluded that patients treated with intramedullary nailing had better postural control, better performance in the one-leg stance test and still had a better ratio of symmetry to isometric contraction strength. This difference may have occurred because the subjects treated with intramedullary nailing can perform activities in the standing position before those who were treated with plaster, reducing the loss of control and distribution of body weight.

Duda et al.<sup>26</sup> measured the impact of partial weight bearing while standing 14 days after EF. The authors found that partial weight bearing helped raise patient awareness and did not affect consolidation. They also found no direct relationship between interfragmentary movements and partial non-weight bearing and weight-bearing forces. Similar results were reported by Segal et al.<sup>27</sup> for tibial plateau fractures.

About 52% of respondents allowed partial weight-bearing exercise therapy in the standing position after 30 days, with little variation among the various methods of treatment. This percentage follows a similar pattern in all evaluated periods, which is inconsistent with the fact that about 70%

claim that the TOM is the most influential factor in allowing weight bearing in the standing position. The devices have different functions, but became similar when the professional opted for exercise therapy with weight bearing.

This practice can hinder the success of physical therapy because it slows down the process of regaining the symmetry and body weight distribution needed to return to normal activities. It is worth noting that these lesions occur in patients who are in a highly productive phase. When carried out properly, rehabilitation accelerates the recovery process and allows an early return to work activities. More government investment in the area of rehabilitation would certainly lower costs to society.

Work and household activities are tasks that require postural control and muscle resistance and distribution. These activities are hampered by the asymmetrical posture acquired during the period of non-weight bearing in the standing position. Exercise therapy is also hampered because the majority of orthopedists use a stabilization method which they claim delays weight bearing in the standing position and also because of the lack of information about when to allow exercise therapy while standing.

Bourdieu<sup>28</sup> questioned the relationship between researchers and respondents. It is considered necessary to question the questionnaire itself. Often, the respondent does not answer appropriately due to time constraints or even answers it quickly without proper understanding of the research. In some cases, the questions are not relevant to the respondent, or he/she never reflected on what is being asked. Therefore, in the present research, any questions were immediately discussed with the researchers and clarified in an attempt to improve the reliability and reproducibility of the questionnaire results.

Given the fact that there are proper methods of exercise therapy and osteosynthesis that allow early weight bearing in the standing position with subsequent benefits to the patient, it can be concluded that multi-professional clarification may accelerate the recovery process. The results of the present study showed that EF was the method preferred by most Brazilian orthopedists to treat open tibial shaft fractures and that most orthopedists refer patients to physical therapy. When the method of treatment is intramedullary nailing, weight bearing in the standing position is allowed sooner for physical activity but not for physical therapy, similarly to the various methods of osteosynthesis although most respondents claimed that the TOM is the factor that most influences restrictions on partial weight bearing in the standing position.

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## Appendix 1

The following questionnaire aims to determine how Brazilian orthopedists allow partial weight bearing on open tibial shaft fractures treated with osteosynthesis in adults. Your opinion is very important. Thank you.

### 1. Identification

Orthopedist

Subspecialist?

Yes  No

Area:

Trauma  Hand  Sports  Knee  
 Pediatrics  Foot  Tumor  Shoulder  
 Spine  Hip  External Fixation

Recertified?

Yes  No

Region:

N  NE  MW  SE  S

### 2. How many open tibial shaft fractures do you treat a year?

0 to 5  11 to 15

6 to 10  16 to 30

More than 30

### 3. Which classification of open fractures do you use?

Gustilo-Anderson

AO-ASIF

Tscherne-Gotzen

Other

### 4. What fixation method do you use for open tibial shaft fractures? (Check all that apply.)

Reamed Intramedullary Nailing

Unreamed intramedullary Nailing

External Fixation

Bridge Plate

Ender nailing

### 5. If reamed intramedullary nailing was used, when do you allow postoperative partial weight bearing?

between 1 and 7 days PO  between 30 and 44 days PO

between 8 and 14 days PO  between 45 and 59 days PO

between 15 and 21 days PO  between 60 and 89 days PO

between 22 and 29 days PO  90 days or more PO

### 6. If unreamed intramedullary nailing was used, when do you allow postoperative partial weight bearing?

between 1 and 7 days PO  between 30 and 44 days PO

between 8 and 14 days PO  between 45 and 59 days PO

between 15 and 21 days PO  between 60 and 89 days PO

between 22 and 29 days PO  90 days or more PO

### 7. If bridge plate was used, when do you allow postoperative partial weight bearing?

between 1 and 7 days PO  between 30 and 44 days PO

between 8 and 14 days PO  between 45 and 59 days PO

between 15 and 21 days PO  between 60 and 89 days PO

between 22 and 29 days PO  90 days or more PO

### 8. If Ender nailing was used, when do you allow postoperative partial weight bearing?

between 1 and 7 days PO  between 30 and 44 days PO

between 8 and 14 days PO  between 45 and 59 days PO

between 15 and 21 days PO  between 60 and 89 days PO

between 22 and 29 days PO  90 days or more PO

### 9. If external fixation was used, when do you allow postoperative partial weight bearing?

between 1 and 7 days PO  between 30 and 44 days PO

between 8 and 14 days PO  between 45 and 59 days PO

between 15 and 21 days PO  between 60 and 89 days PO

between 22 and 29 days PO  90 days or more PO

### 10. Do you refer patients to physical therapy?

Yes  No

### 11. If the answer to question 10 is yes, when do you allow weight-bearing exercise therapy of the operated limb?

After 30 days  After 60 days

After 45  After 90 days

### 12. What is the most influential factor in allowing postoperative partial weight bearing?

Type of osteosynthesis material  Pain

Sign of infection  X ray (consolidation)

N=North; NE=Northeast; MW=Midwest; SE=Southeast; S=South; PO=postoperative.