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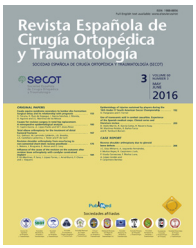

ORIGINAL ARTICLE

# Tibial bone lengthening via external fixation: Comparative study of the traditional technique and a technique with intramedullary nail assistance☆

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**KEYWORDS**
Lengthening;
Nail;
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**Abstract**
*Objective:* To compare outcomes and complications when performing bone lengthening with two different techniques: isolated external fixation versus external fixation combined with intramedullary nail.
*Material and method:* Comparative retrospective study of 30 cases of tibial lengthening divided in two symmetrical groups. Cases were matched based on several variables to maximise homogeneity between the groups.

Variables used for comparison were external fixation time, external fixation index, rate of consolidation, clinical outcomes, complications and range of joint motion.
*Results:* Mean external fixation time was 2.08 months in the group lengthened with nail while the standard group showed 5.85 months ($p < 0.0001$). Mean external fixation index was 0.42 months per centimetre in the nail group compared with 1.15 in the group without nail ($p < 0.0001$). There were no significant differences in the rate of consolidation (1.23 months per centimetre against 1.15) or in terms of clinical outcomes. We found differences in the rate of complications (1.2 per patient to 2.6) in favour of the technique with nail. There were no differences in the range of motion of ankle joint.
*Discussion and conclusions:* Lengthening over an intramedullary nail is more effective than using external fixation alone for tibial lengthening with regard to time of external fixation, index of external fixation and complication rate. We found no advantages in terms of consolidation and joint mobility.


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**PALABRAS CLAVE**
Alargamiento;
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Fijador;
Intramedular

**Alargamiento óseo tibial mediante fijación externa. Estudio comparativo entre la técnica tradicional y la asistida por clavo intramedular**

**Resumen**
*Objetivo:* Comparar resultados y complicaciones al realizar elongaciones óseas con dos métodos diferentes: fijación externa aislada versus fijación externa sobre clavo intramedular.
*Material y método:* Estudio comparativo retrospectivo de 30 casos de elongación tibial divididos en dos grupos simétricos. Los casos se emparejaron en función de una serie de variables para maximizar la homogeneidad entre los grupos.

Las variables utilizadas para la comparación fueron el tiempo de fijación externa, el índice de fijación externa, el índice de consolidación, los resultados clínicos, las dificultades y el rango de movilidad articular.
*Resultados:* El tiempo medio de fijación externa fue de 2,08 meses en el grupo alargado sobre clavo, frente a los 5,85 del grupo estándar ($p < 0,0001$). La media del índice de fijación externa fue de 0,42 meses por centímetro en el grupo de clavo frente a los 1,15 del grupo sin clavo ($p < 0,0001$). No hubo diferencias significativas en el índice de consolidación (1,23 meses por centímetro frente a 1,15) ni en cuanto a los resultados clínicos. Se aprecian diferencias en la tasa de complicaciones (1,2 por paciente frente a 2,6) en favor de la técnica con clavo. No hay diferencias en el rango de movilidad articular del tobillo.
*Discusión y conclusiones:* La elongación sobre clavo intramedular es más efectiva que la fijación externa aislada para alargamientos tibiales en cuanto al tiempo de fijación externa, índice de fijación externa y tasa de complicaciones. No se han demostrado sus ventajas en cuanto a índice de consolidación y movilidad articular.


## Introduction

External fixation has been and continues to be the most common method of bone lengthening because of its minor invasiveness which enables corrections on multiple planes and the possibility it offers to the surgeon for undertaking secondary corrections or altering mounting rigidity at will.

However, the fixators are not exempt from problems. Their use is only viable in patients who collaborate to maintain appropriate hygiene (to avoid infections), and the transfixion of musculature and soft tissues may lead to the appearance of stiffness or severe muscle contractions. We should also mention the discomfort involved for the patient, living with an external device which impedes daily activities and may be an added psychological complexity. Another specific problem of the external fixators is deciding on the appropriate removal time as early removal may lead to bone regeneration fracture.

One of the routes followed aimed at reducing external fixation time and improving clinical outcomes is the technique known as lengthening over nail [LON]. The procedure consists of placing an intramedullary nail without impeding the simultaneous implantation of the external fixator and practising osteotomy. The nail helps to encourage lengthening from the inside of the canal, theoretically reducing axial deviations, and stabilising the bone by blocking it once the distraction phase has been completed. The fixator may thus be removed without waiting for bone healing, with the hope that this will minimise the problems associated with the use of this device. Different studies published have found significant differences between the use of the LON technique and the traditional technique without assistance from intramedullary implant.[1–5] The author systematically analysed and compared the results obtained in tibial elongations using the LON method and the standard external fixator lengthening (EFL). The objective of this article is to study the differences between both methods to confirm the hypothesis in accordance with the intramedullary nail assisted distraction osteogenesis (LON) is a more effective therapeutic procedure than the isolated external fixator lengthening (EFL) for tibial elongations.

## Material and methods

In order to make a valid comparison between the LONG and EFL, we made a retrospective study of 15 tibial elongations carried out with each technique. Variability between patients and pathologies hindered analysis and for this reason the difficulty and risk of each case was classified on a scale based on 12 parameters approved by the scientific community,[1] modified for tibial lengthening. The parameters are shown in Table 1.

### Intramedullary nail assisted tibial elongations (LON)

Fifteen patients treated between February 2003 and December 2013 were taken as the study sample Mean time of follow-up was 2.5 years (range between 2 and 10 years). The mean patient age at surgery was 23.06 years (range between 15 and 42 years). Seven patients were male and eight female. The 15 patients treated for discrepancy in