INTRODUCTION

At the end of the nineteenth century, H.O.Thomas (1886) believes in the efficiency of the principle of rest, "enforced, uninterrupted, and prolonged". The time required for restoration of motion and strength in the limb is a small price to pay for bone union (Bick, 1968). At the same period in France, Just Lucas Championniére (1911) stressed the value of mobilization of a fractured limb to prevent muscle atrophy, stiffness and the disabilities that frequently follow treatments involving restrictive immobilization techniques. For Burny (1974), the internal fixation developed by Lane (1905) and mostly Lambotte (1907) represented a possible synthesis of both theories. However, rigid fixation, made possible by massive biocompatible implants was found to interfere with normal fracture healing and bone physiology. There is evidence that under rigid plates the major loss of bone comes from a thinning of the cortex (Uhthoff et al, 1971). This thinning is to be correlated with the mechanical data showing that the major loss of stresses occur under the more rigid plate (Moyen et al, 1979).

Woo (1983) says that an ideal plate design should be one of moderate bending and torsion, but low axial stiffness, to provide adequate fixation of fractured bone, permit callus to be formed, and to allow the healed bone to take a large portion of the physiological stresses. The axial stiffness of the plate should approximate that of the underlying bone so that the bone and plate can deform in equal amounts to the loads on the screws to minimize loosening or failure. The tubular cross sectional plate design is only one of the applications of these design criteria.

The difficulties encountered in obtaining and maintaining the correct reduction of a fracture together with serious complications which may result from internal fixation has led surgeons to develop many alternative means of treatment. External fixation is one of these.

In Belgium, early in the beginning of the twentieth century A. Lambotte (1907) defined the term "ostéo-synthèse" as the surgical treatment of fractures (suture osseuse) using implants. Danis (1949) said that "For us, the osteosynthesis is another thing and more than a mechanical way to correct a failed consernative reduction, more than an ancillary procedure which we are obliged to use. It should be the method of treatment that permits us to immediately exercise muscles and joints. The original words of Danis were "Pour nous, l'ostéosynthèse est autre chose et un peu plus qu'un moyen mécanique de corriger une réduction orthopédique mal réussie, un peu plus qu'un "procédé" ancillaire, auquel on n'a recours que contraint et forcé. Elle doit devenir, avant tout, la méthode de traitement qui nous permettra de rendre aux muscles et aux articulations une activité immédiate".

Lambotte devised a large variety of internal implants but was also deeply involved with external fixation. Most of the present day external fixation devices are derivatives of Lambotte's original.

Lambotte (1913) said that "That apparatus which I had imagined in 1900

and realized in 1902, its destiny is solely for diaphyseal fractures. The principle of the fixator consists of introducing log pins in the fractured fragments which is then connected to an external support. The French words of Lambotte were "Cet appareil que j'ai imaginé en 1900 et réalisé en 1902 est destiné uniquement aux fractures diaphysaires. Le principe du fixateur consiste à enfoncer dans les fragments de longues vis qui sont rendues solidaires par un tuteur externe".

Boever (1931) was the first to present the advantages of external fixation, namely:

* simplicity of application,
* the possibility of closed reduction,
* no additional damage to the soft tissues at the fracture site,
* early motion of the joints,
* easy access to soft tissues.

Nauton (1936) defines the external fixation as a continuation by rigid metallic device outside the body and parallel to the limbs, connected to the fractured segment by very strong screws penetrating soft tissues and drilled into the bone far from the fracture site.
The French words of Nauton are "L'ostéosynthèse à tuteur externe peut se définir: une contention par une pièce métallique, rigide, extériorisée, parallèle au membre, solidarisée aux fragments fracturaires par de longues vis très robustes, dépassant les parties molles et enfoncées loin du foyer de cassure".

As we will see, the major disadvantage common to all external fixation devices was the need for preliminary reduction of the fracture prior to insertion of the pins, if necessary by open reduction. One of major advances in external fixation therefore was the introduction of the universal ball joint by R. Hoffmann in 1938, permitting reduction of the fracture after the pins had been applied.

Meanwhile, in the United States, the development of external fixation was stimulated during the second world war by the introduction of the Anderson device (1934), the Stader splint (1937), and the Haynes device (1938). Unfortunately, the occurrence of significant complications associated with these methods resulted in the virtual discontinuing of the use of external skeletal fixation in the united states (Green, 1981).

In continental Europe on the other hand, external fixation remained the treatment of choice for open fractures of the lower extremity while the principles of rigid internal fixation were developed principally for closed fractures.

This work will be based on a prospective and retrospective study of 58 cases with open fracture of the tibia, all the cases being treated by the Hoffmann external fixator.