OSSICULAR RECONSTRUCTION

Essay

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For Master Degree in Oto-Rhino-Laryngology

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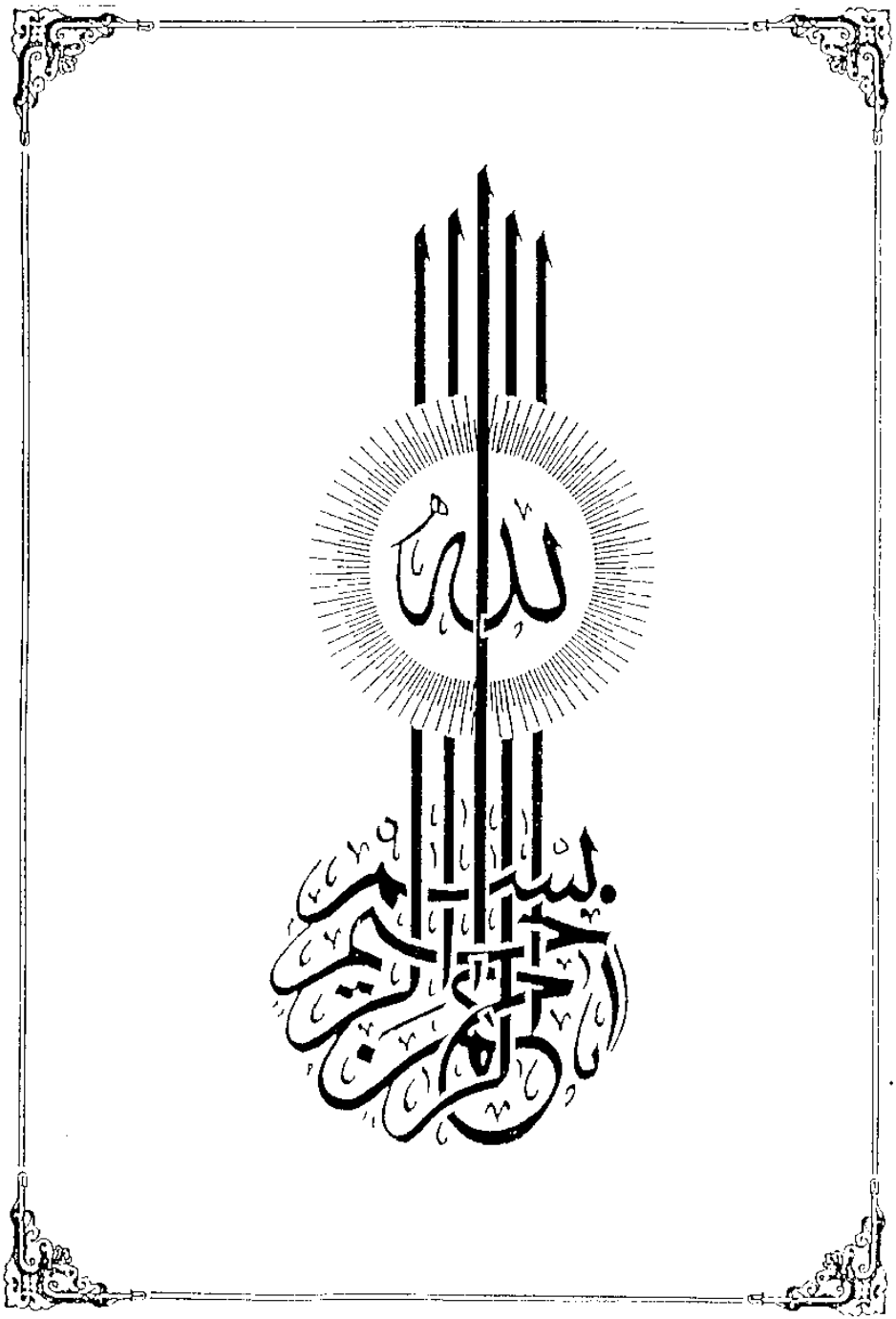

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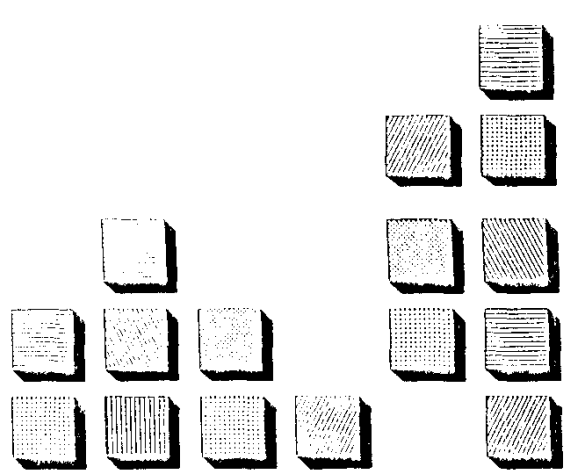
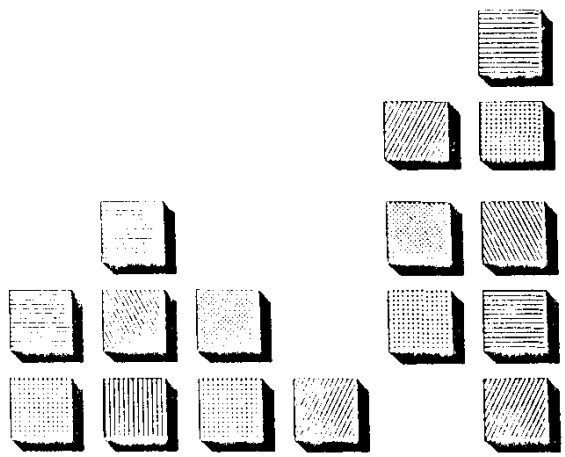


Introduction

The reconstruction of the ossicular chain in tympanoplasty has been a challenge to the otologists for over three decades. Early attempts to repair or replace defective ossicles have met universal failure. This was due to the little experience as regards the technique and materials used. Every time to time otologists had to review their results, and to re-evaluate their techniques and materials used. Several techniques were adopted and many materials were used.

The present essay is aiming to review common ossicular deficiencies, materials used for ossicular reconstruction, techniques of ossicular reconstruction and long-term results of ossicular reconstruction using different materials and techniques.

Development, Anatomy, Physiology and Pathology



Development, Anatomy, Physiology And Pathology

Development of the Ossicles

Proctor (1964) described ossicular development as follows:

The outer lateral ends of the first (Meckel's) and second (Reichert's) arch cartilages lie, respectively, above and below the developing first pharyngeal pouch. Before these arch cartilages are fully defined, condensations in the mesenchyme occur in this region at about 4-5 weeks. As development proceeds, the condensation from cartilage models which, by 6.5 weeks, are well defined as the malleus, incus and stapes. By 5 weeks, the stapes can first be recognized as a circular mass at the end of the precursor of Reichert's cartilage. Approximately 1.5 weeks later, this becomes annular as it is pierced by the first arch (stapedial) artery, and is now attached to the developing Reichert's cartilage by a membranous bar, the interhyale. At this

time, the malleus and incus are developing from cartilage at the end of the precursor of Meckel's cartilage. A groove represents the site of the future incudo-malleolar joint, and the handle of the malleus and long process of incus are already apparent. By 7.5 weeks, the handle of the malleus lies between the layers of the developing tympanic membrane.

The stapes continues to grow and its ring-like shape is converted into the definitive arch-like stapedial form. The footplate of the stapes is formed primarily from the otic capsule, and that part of the stapedial ring which fuses with the otic capsule during ossification usually regresses. In the adult, therefore, the stapedial archs are derived from second arch cartilage, while the footplate is part of the labyrinthine capsule. Frequently, however, regression of the base of the stapedial ring is incomplete so that a dual origin for the mature footplate is possible. Ossification in the stapedial cartilage starts from a single centre at 4.5 months and is followed by a complex pattern of resorption, with the results that the base, the crura and the adjoining head are eventually hollowed out.

The malleus and incus start ossification at the 4-month stage of intrauterine life and progress is so rapid that in the 25th week they are already of adult size and form.

Anatomy of the Ossicles

Sade (1966) described the anatomy of the ossicles as follows:

The middle ear sound conduction system consits of three ossicles (Malleus-incus-stapes) attached to the tympanic membrane. These transmit sound energy to the oval window. The arrangement of the ossicles is somewhat like an inverted V. (Figure 1).

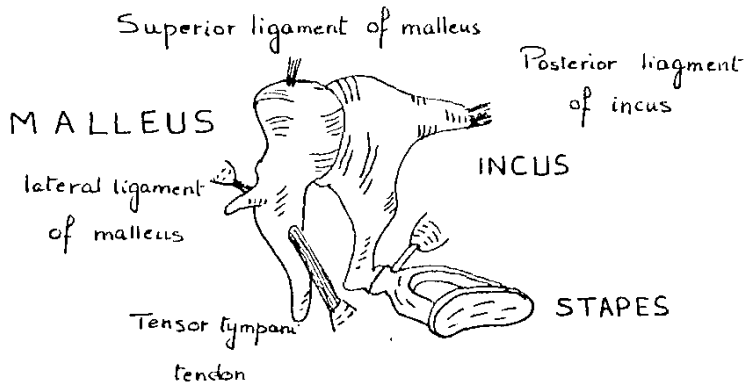


Figure 1: Osicles.

Malleus: (Figure 2)

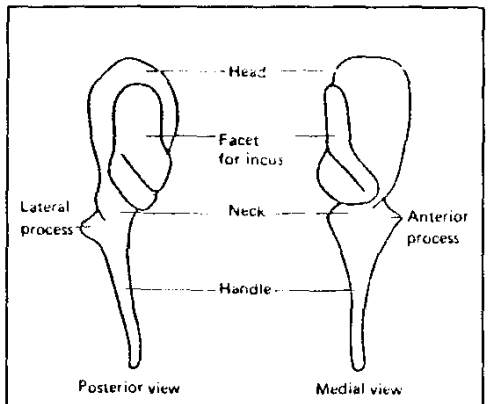


Figure 2: Malleus.

The malleus (hammer) is the largest of the three ossicles, comprises a head, neck and three processes arising from below the neck. The overall length of the malleus ranges from 7.5 to 9.0mm. The head lies in the epitympanum and has on its posteromedial surface an elongated saddle-shaped facet covered with cartilage for articulation with the incus. This surface is constricted near its middle and the smaller inferior portion of the joint surface lies nearly at right angle to the superior portion. This projecting lower part is the cog, or spur, of the malleus. Below the neck of the malleus, the bone broadens and gives rise to the following: the anterior process from which a slender anterior ligament arises to insert into the petrotympanic fissure; the lateral process which receives the anterior and posterior malleolar folds and the handle. The handle runs downwards medially and slightly backwards between the mucosal and fibrous layers of the tympanic membrane. On the deep, medial surface of the handle, near its upper end, is a small projection to which the tendon of the tensor tympani muscle inserts. Additional