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RESEARCH ARTICLE

LUMINAL CAST PLASTINATION OF EXTERNAL AUDITORY CANAL AS A TEACHING MODEL

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Key words

Plastination, EAC- External
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Abstract

Background: Anatomical models are 3 dimensional, homologous models which present anatomical structures life size or enlarged form. These models not only serve as display material but are also used for mastering medical techniques. Models allow students to touch, feel and look closely at them. Plastination is a technique which uses polymers such as resin and silicone in order to create life-like specimens or models which allow realistic visualization of anatomical aspects that are simply too difficult to describe. The study aims to create a plastinated silicone cast of external auditory canal as a teaching model for students. Methods: 8 cadavers were obtained and the external auditory canals were cleaned. Silicone was injected into the canals and the casts were obtained. Results: The casts so obtained were observed for their S shaped curvature and the two constrictions were also noted. Conclusion: The silicone cast can be used as a museum specimen, to communicate with patients to create awareness about disease process, to educate the public especially in cases of management of deafness and for medical students in surgical training and experimental otological surgeries.

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Introduction:-

In recent years teaching in all branches of medicine has changed a great deal. This applies to many of the basic sciences, including Anatomy. Although dissection is of prime importance, other audiovisual methods have helped our knowledge considerably. The ability to conceptualize and visualize the structure in three dimensional space is important in a clinical setting when operating or performing invasive medical tests.¹ Students who have low spatial ability have difficulties in understanding the structures in 3D space. Models can be utilized as effective learning materials for the study of Anatomy pertaining to certain complex structures of the body like ear and larynx. The characteristics or functions of Anatomical structure that are too small to discern adequately in a cadaver are better depicted in a model.² The use of Anatomical models are reported as effective in teaching and learning Anatomy although the form of the model and its presentation may impact the efficacy in learning for medical students. In guiding cadaveric dissection accurate models provide an ideal view to assist in an approach to a structure or region. Hence a finely constructed 3D model will benefit education in Anatomy. In a medical curriculum Anatomical models enhance student learning to meet a specific learning objective. One study showed that 3D Anatomy models were effective instructional material tools in teaching human Anatomy.³

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Plastination is a technique which uses polymers such as resin and silicone in order to create life-like specimens or models which allow realistic visualization of Anatomical aspects that are simply too difficult to describe.

The three methods of Plastination are :

1. Whole organ Plastination
2. Sheet Plastination
3. Luminal Plastination

Luminal Plastination is a technique used to study the dimensions and architecture of different cavities of organs and to study the tubular- arterial, venous, ductal branches and their variations.⁴ This is used for tracheobronchial cast of lungs, cerebral ventricles, bony labyrinth, vascular patterns of kidneys, liver, lung, spleen etc.

The External Auditory Canal (EAC) extends from concha to the tympanic membrane and has two structurally different parts. The lateral one-thirds is cartilaginous and the medial two-thirds is osseous. It forms a S shaped curve directed at first medially, anteriorly and upwards, then posteromedially and upwards and lastly anteromedially and downwards.⁵ To visualize the tympanic membrane the cartilaginous canal can be straightened by pulling the pinna posterosuperiorly enabling better view. The External Auditory Canal is oval in section. There are two constrictions, one near the medial end of cartilaginous part and the other, the isthmus in the osseous part about 2 cms from the bottom of concha. These complex directions of the EAC and the constrictions can easily be understood with the help of a model.

The study aims to create a plastinated silicone cast of external auditory canal as a teaching model for students. Using luminal Plastination method the EAC of cadavers were injected with silicone and the casts were thus obtained and studied.

Materials And Methods:-

Source of data:

Cadavers from the Department of Anatomy, JSS medical College, Hospital and Research center. Mysore
Total number- 8

Materials used:

Silicone (Industrial)
Injector gun
Syringes and gloves
Forceps
Fevicryl acrylic colours

Procedure

The external auditory canals of the cadavers were cleaned using hydrogen peroxide and tap water. Thorough cleaning was done to remove the desquamated debris from the canal. The canals were flushed using 20 ml syringe filled with tap water and were dried by mopping with cotton.

The silicone was taken in a plastic container and a drop of red coloured acrylic paint was added to it. The contents were mixed thoroughly with a glass rod and the mixture was injected directly into the right EAC using a syringe. Similarly a drop of green coloured acrylic paint added to silicone was mixed and was injected into the left EAC. This was left undisturbed for 6 hours for hardening of the silicone. The cast was removed after 6 hours using forceps. The cast so obtained was cleaned with water and air dried.

Results and Observation:-

The so obtained cast was observed for its curvature where the cartilaginous part angulated posterosuperiorly and the bony canal anteroinferiorly. It formed a S shaped curve directed at first medially, anteriorly and upwards, then posteromedially and upwards and lastly anteromedially and downwards. The two constrictions were also noted.

Discussion:-

Medical students studying human gross Anatomy often have difficulty conceptualizing the internal three dimensional structure of organs. Plastination is a complementary teaching technique to demonstrate the different aspects of the human Anatomy, the type of plastination being governed by the structure to be demonstrated.

The silicone cast can be used as a museum specimen for display which can be an educative tool .

Congenital atresia of the EAC is caused by failure of canalization of the epithelial plug portion of the first branchial cleft.⁶ Hence sound cannot reach the tympanic membrane and thus conductive hearing loss occurs. To rectify this the plastic surgeon performs canalplasty procedure. This procedure can be explained to the patient and the attenders using the model. Otologists found the model an impressive tool in educating the public especially in cases of management of deafness.

Foreign bodies commonly lodge at the isthmus region of the EAC as it is the narrowest part of the canal.⁷ This can be depicted in the model to the patients and the attenders and the procedure involved in the removal of the foreign body can be demonstrated.

The silicone cast can be used for surgical training and experimental otological surgeries.

Plastinated specimens are easy to handle compared with formalin preserved specimens. The Rubber Silicone produces an excellent, soft, flexible cast, showing an unimaginable 3 – dimensional orientation of the cavity, including the abnormal extensions if any. At present, plastination has established itself as an indispensable contributor for teaching gross anatomy to clinical Anatomists.^{8,9} Teachers have agreed that plastinated human specimens are superior specimens in relation to synthetic models, on account of their ability to reflect Anatomical variations.¹⁰ Plastination is not a replacement for traditional guided dissection, but it does provide an additional learning tool to understand complex human Anatomy.

Conclusion:-

The present study was undertaken with an aim to create a plastinated silicone cast of external auditory canal as a teaching model for students. Plastinated specimens are indispensable contributors to the teaching armamentarium of clinical Anatomists. The plastinated silicone cast obtained can be used as a display in museum specimens, tool in educating the public, for surgical training and experimental otological surgeries.

Acknowledgement:-

I sincerely acknowledge the guidance provided by Dr. Shama Sundar. N M .Professor , JSS Medical college Mysore who conceptualised this study.



Fig 1:- Materials used in the study.

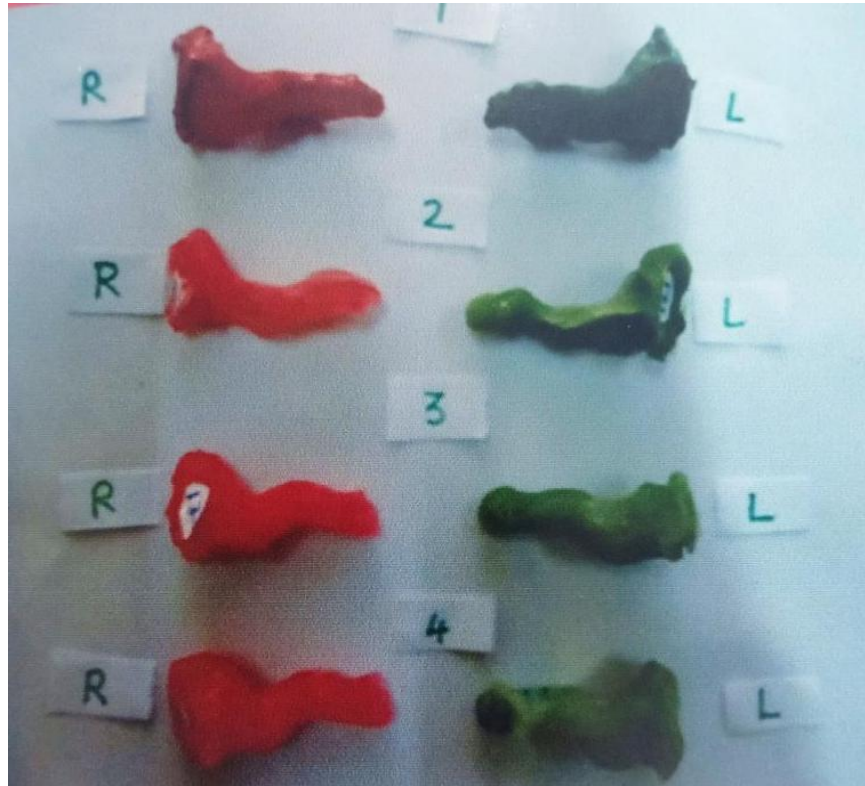


Fig 2:-Silicone casts of the right and left external auditory canal represented as alphabets R and L, the narrow part is the medial end and the broader part is the lateral end of the canal.

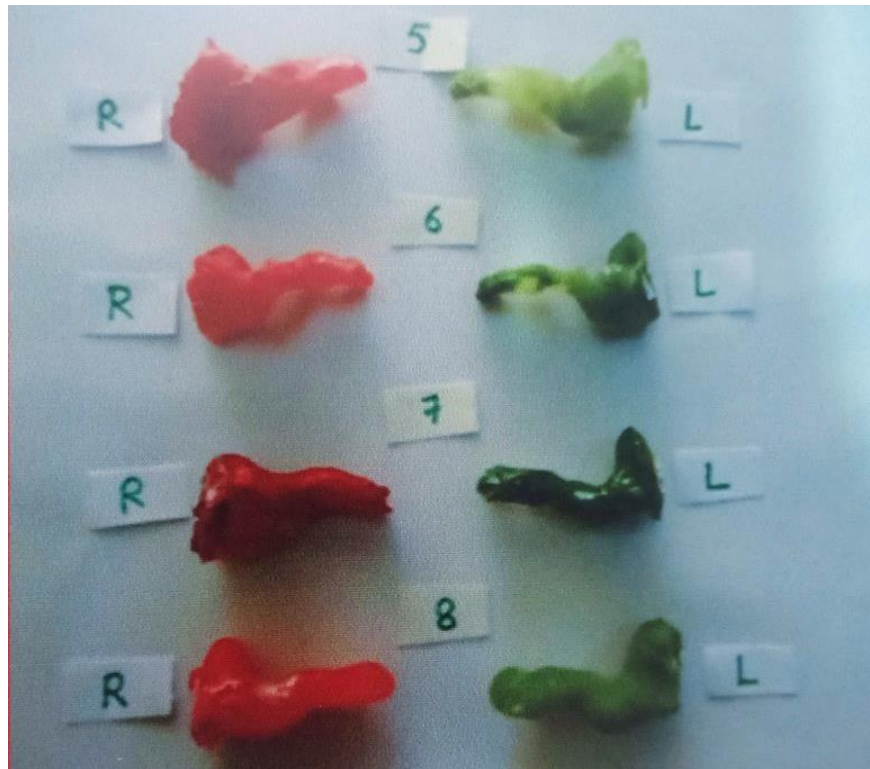


Fig 3:-Silicone casts of the right and left external auditory canal represented as alphabets R and L, the narrow part is the medial end and the broader part is the lateral end of the canal.

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