

SURGICAL EQUIPMENTS FOR PEARL CULTURE

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ABSTRACT

Special types of surgical instruments required in pearl culture have been developed indigenously for the first time. The paper describes the equipment and the process of manufacture. It also deals briefly with their uses in the preparation of tissue grafts and in the operation for nucleus insertion.

INTRODUCTION

Techniques for production of cultured pearls were developed for the first time in India in 1973 (Alagarwami 1974). An important aspect in pearl culture is a delicate surgical operation on the pearl oyster for grafting a piece of mantle tissue within the soft body of the oyster and implanting a nucleus by its side. This is done with a set of specially designed surgical instruments. Cahn (1949) and Alagarwami (1970) have given brief descriptions of the equipment used by the pearl culturists in Japan. The present communication describes the surgical instruments developed indigenously for the first time at the Surgical Instruments Plant. The material used in all cases is stainless steel of straight chromium type conforming to I.S.I. specification 30 CR 13 and 40 CR 13. The items are fabricated to fine dimensional accuracy and surface finish. Fig. 1 illustrates the instruments developed indigenously.

EQUIPMENT AND PROCESS OF MANUFACTURE

The equipments used in the operation of pearl oysters fall into two groups, namely those for the preparation of tissue grafts from the mantle lobes and those for the insertion of nucleus. The former instruments, though are simple, require fine accuracy so that the minimum damage is caused to the living tissue at various stages of preparation. These consist of a knife, a pair of scissors, forceps, spatula and scalpel. The nonmetal items required are the wooden bench and blocks, sponges and glassware.

Knife: The knife has a blade 9 cm long and a wooden handle 11 cm long. The width of blade is 1.2 cm at the base and 1.5 cm near the tip. The anterior portion of the blade is slightly curved following the curve of the shells

of the oyster so that the blade could be easily inserted between the two shells in closed condition. The blade is made by hand forging and finished by filing and grinding. The knife is used to open the unconditioned oysters by sharply cutting the adductor muscle without touching the mantle lobes.



FIG. 1. Indigenously produced surgical equipment for pearl culture: (L to R) forceps, shell speculum, scissors, nucleus-lifting needles (3), oyster stand, lancet cum graft-lifting needles (3), scalpel, spatula, retractor and knife (scale: 10 cm).

Scissors: This is an ordinary pair of straight surgical scissors of 10-cm length and is used for cutting a long and narrow strip from the edge of the mantle. The cutting edges are sharp and tips finely ground so as to enable quick cutting of a strip before the mantle withdraws under the stimulus of contact.

Forceps: The forceps is 14 cm long. The two components are filed and ground and are provided with serrations and finely ground points at the tips. The material near the joint is ground to proper size to get the required mild springiness after due hardness is imparted. It is used to lift the mantle strip from the shell, to hold it while cleaning and trimming and to reverse the strip on the wooden block to have the outer epithelial layer on top.

Spatula: The spatula is 17.5 cm long with a round handle of 13-cm length and 4-mm diameter and a blade of 4.5-cm length and 8-mm width. The required springiness is given to the blade by grinding and the edges are smoothed out. The spatula is used to remove the extraneous dirt on the mantle strip and

to smooth the folds on it. It is also used to gently keep back the mantle, labial palps and gills of the oyster during surgery so that the foot and the main body mass are exposed.

Scalpel: The scalpel is flat and is 17 cm long. The handle portion is 13.5 cm long and the blade portion is 3.5 cm. The scalpel is produced by forging from bar stock or blanked from sheet metal and the actual size and shape are obtained by filing and grinding. The instrument is heat treated to get a high hardness. The cutting edge provided at the end has a delicate curve and is 2 cm broad. A smooth and accurate sharpness is imparted to the edge. The scalpel is used for trimming the mantle strip on both edges, to remove unwanted tissue and to sharply cut the tissue into small bits of required size. It is also used in the place of scissors for cutting the strip from the mantle.

The second group of equipment used in the actual operation are mostly special instruments which are described below:

Oyster stand: The stand is used for fixing the oyster in a stable position so that both hands of the operator are free for performing the surgery. It consists of two parts, a base and the clamp proper. The base has a square plate of 4.5-cm side and a vertical tube of 5-cm height and 1 cm inner diameter welded to the base. The base is fixed to a wooden board by screws. The tube has a collar at the top provided with a threaded hole for fixing a bolt to hold the shaft of the clamp tightly in position.

The clamp consists of two plates, the head-plate and a movable jaw. The head-plate is mounted on an adjustable tilting head which is supported on a shaft. The movable jaw is held against the head-plate by a spring. The front edges of the two plates form short, slightly curved lugs which tend to follow the curve of the oyster shell and prevent lateral movement of the oyster. To the head-plate is fixed a curved rod which passes through a hole on the shaft. A threaded hole and bolt are provided at this point to fix the rod in position. The plate assembly can be tilted from a vertical to a horizontal position according to the convenience of the operator. For fixing the oyster, the movable jaw is opened by applying finger pressure at the bottom of the plate and after the oyster is kept in position the pressure is released. The jaw holds the oyster firmly against the head-plate. The head-plate has a breadth of 5.3 cm and height of 7.0 cm. The movable jaw is 5.5 cm broad and 8.5 cm high. The shaft is 11.5 cm long and its diameter is slightly less than 1 cm. The components are individually made to size and shape and are heat treated to sufficient hardness. Then they are assembled to form the oyster stand.

Shell speculum: The shell speculum is used to keep the oyster open for the duration of operation. The instrument is 14.5 cm long and consists of two components which are made by forging from round bar stock to proper size and

shape. Each has a long straight portion and an arc. The two arms are fitted together by a male-female joint at about 5 cm from the tip. The top of the straight portion is flat and rectangular with rounded corners. The spring between the two arms keeps the instrument in a closed position normally. A metal collar is provided around the straight arms which helps in regulating the distance between the flat ends as desired. A maximum opening of 1.5 cm is obtained between the flat ends with the collar pushed to the bottom. This is about the distance between the two valves of the operable size oyster when the adductor muscle is in a fully relaxed condition under narcotisation. When the oyster partially opens the shells the flat end of the speculum is inserted between them. By gently closing the two arcs the flat ends open out and, along with them, the shells too open. When the desired gap is obtained the collar is slipped down to maintain the gap. The maximum possible opening between the shells differs from oyster to oyster and the collar helps in controlling the opening.

Retractor: It is a slender, flat rod of about 15 cm in length provided with a sharp, bent hook at the tapered end. The retractor is used to hold the foot of the oyster in a stretched position when the operation is carried out.

Lancet-cum-graft-lifting needles: There are three needles, each consisting of three parts, namely the lancet and graft lifter at the two ends and an elongated, spindle-shaped aluminium handle at the middle. The needle is 17.5 cm long, of which the lancet and graft lifter are 5.5 cm each and the handle is 6.5 cm. The lancet is a thin stainless steel shank of about 2 mm in diameter which is tapered and the tip is slightly curved and flattened to an elliptical blade. The edge of the blade is rendered smooth and sharp. The graft lifter is similar to the lancet but the tip is provided with a sharp, pointed spur. The lancet is used to make a sharp incision at the base of the foot of the oyster and to cut a channel through the tissues of the gonad up to the site chosen for nucleus implantation. The spurred tip of the needle is used to pick out the small graft tissue from the wooden block and to insert it to the site of implantation through the channel. The sizes of the cutting blade of the lancet and the spur are a graded series according to the size of incision to be made and the size of graft tissue to be lifted. The lancets and graft lifters are made to shape and size by hand forging and finished by filing and grinding with abrasive wheels. They are polished to the required level and fitted to the handle.

Nucleus-lifting needles: These are similar in construction to the former instrument, but are provided with hemispherical cups at both ends of the shanks. There are three needles, each with two cups at the ends. The cups are of different dimensions to enable lifting of nuclei (spherical shell beads) of 2mm-8mm diameter range. The cup shape is initially drawn by hand forging and finished for dimensions by pressing with iron balls of proper size in the cold condition. Then the hemispherical cup is cut to the required size of slightly less than the diameter of the sphere and imparted a vacuum finish. The cup is moistened by

dipping in sea water and touched on the dry surface of the nucleus which immediately adheres to it. The cup end is inserted into the channel through the incision cut on the body of the oyster and the nucleus is placed in contact with the tissue graft. While withdrawing the needle, the nucleus gets detached from the cup by a slight turn of the needle and remains at the site of implantation.

Besides the above special instruments, other materials required for the operation are an enamel tray with foam cushion to rest the instruments, trays to keep the oysters, shallow cups to hold the nuclei, beakers to hold sea water and fresh water and sponges.

The instruments are not sterilized in any special manner. It has been found sufficient to wash them in clean, fresh water repeatedly, wipe with soft cloth and dry well in the sun. Or, after wiping, they are dried in an ultraviolet-light chamber for about 30 minutes. During the operation, every time after the instruments have been used, they are washed in fresh water so that no tissues or reproductive elements remain adhering to them.

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