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Retractors, Dilators, and Related Inset-Pivoting Instruments

Dilators, by whose helpe the wound may be held open, that so the hidden bodyes may be seen; for when you presse together the two ends of this Instrument, the other two open and dilate themselves.

Paré, 1634[1]

As outlined in chapter 18, articulating forceps with incentric or inset pivots function in reverse fashion to forceps with centric pivots. Typically, the limbs of incentric forceps engage, but do not cross, at the pivot, dictating that closure of the handles separates the jaws, as in the case of retractors or dilators (figure 351). It is of interest that as long ago as 1723 Garengeot classified forceps into five types, placing incentric instruments in the fourth category as *pincette par charnière*, meaning inset hinge forceps.[2] Commonly, their jaws are held in contact by a closing spring mechanism between the handles, and retraction or dilatation is achieved against this resistance, often being maintained by a rack or ratchet (figure 351). A very powerful closing spring enables such forceps to act as arterial or occlusion forceps (figures 173, 352E). Reversal of this mechanism is achieved by

1. crossing the handles proximal to the pivot;
2. crossing the jaws distal to the pivot;
3. adding additional pivots, including a second incentric pivot, which together compound the action of the jaws (figures 353E, 354); and
4. outward separation of the handles with the surgeon using both hands independently.

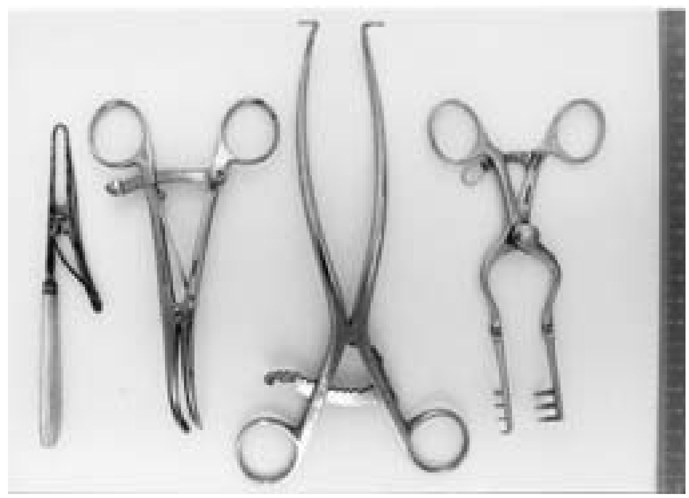

FIGURE 351
Examples of incentric forceps (pivot inset between uncrossed limbs). Left to right: Assalini tenaculum forceps for seizing arteries, early nineteenth century, self-holding and opened against spring resistance. Bailey's tracheal dilator with rack control and spring resistance. Gelpi's self-retaining retractor with rack control. Cone's self-retaining scalp retractor with rack control and jaws pivoting independently through 150 degrees. The latter three instruments all date from the mid twentieth century.

Incentric instruments include certain hinged speculums; wound, tracheal, and uterine dilators; *valet à patin* forceps; Assalini artery tenaculums; mouth gags; and a variety of self-retaining wound retractors (figures 351–354).

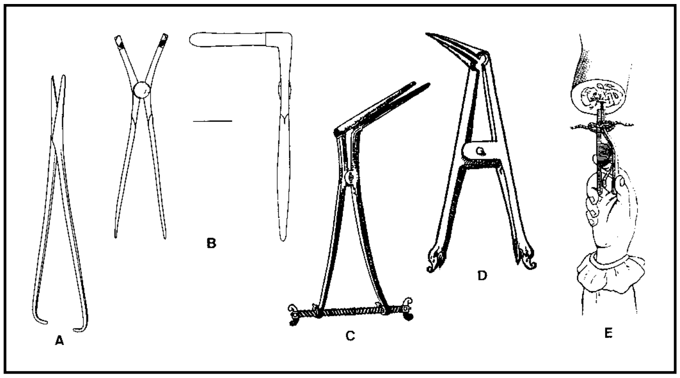

FIGURE 352
Ancient Greek to eighteenth-century incentric forceps. A: Bronze, circa 1800 B.C., with no pivot pin, believed to be secured with organic binding; the teeth suggest forceps gripped when the manipulator separated handles (from Arnott, 1997). B: Greco-Roman rectal speculum and probable wound dilator, A.D. 79 (from Jackson, 1991). C: Franco's lithotomy dilator with screw control, circa 1561. D: Franco's lithotomy speculum, circa 1561, with pivot extended well away from decorated limbs (from Niçaise, 1895). E: Heister's *valet à patin* artery-catch forceps, 1743, opened against spring resistance.

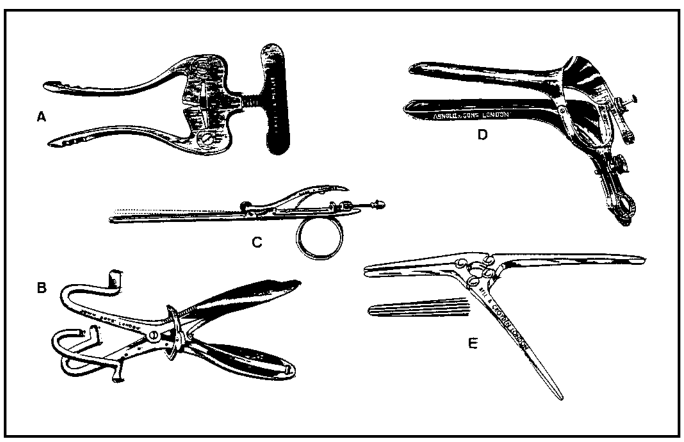

FIGURE 353
Modern instruments based on incentric pivots. A: Mouth gag derived from Heister (Mayer and Phelps catalogue, 1931). B: Colt's mouth gag controlled by an external slide with accessory tubing for anesthetic gases (from Colt, 1907). C: Meatome with one outward-cutting blade for incising phimosis (Allen and Hanbury catalogue, 1930). D: Cusco-Brewer vaginal speculum pivoting on two half joints. E: Payr's intestinal crushing clamp with powerful compound pivots (Bell and Croydon catalogue, circa 1955).

FIGURE 354
Compound joints and Assalini's forceps. Top: Stille's gouge cutters with incentric compound pivots that neutralize each other to produce centric action, that is, closure of the handles results in closure of the jaws. Center: standard Assalini's arterial tenaculum, jaws closed by spring. Bottom: Adapted Assalini structure with tissue-holding vulsellum jaws, an uncommon adaptation.

HISTORICAL BACKGROUND

The bronze forceps of Nauplion, noted in chapter 18 and dated about 1800 B.C., articulated by means of an incentric pivoting mechanism, probably stabilized by organic bindings (figures 29, 352A).[3] Because the jaws are grooved on opposing internal faces, it seems the handles were grasped individually and pulled apart by the operator to convert the jaws into a clamp or holder. However, their considerable length of 31 centimeters is suggestive of veterinary function, for example, large animal tooth extraction, rather than use in human surgical procedures.

Excavated bronze speculums of Greco-Roman origin include an incentric bivalvular form (figure 352B), subjected to recent reappraisal by Jackson. He concluded that this rectal instrument was also employed as a wound dilator for the extraction of arrowheads and other embedded foreign bodies;[4] if so, narrow apertures would require wound enlargement to accept this dilator, as emphasized by Paul of Aegina in the seventh century.[5] Albucasis does not mention the use of a wound dilator, and his vaginal speculums are not of pivoting-forceps construction. Indeed, few illustrations of incentric-controlled forceps from the medieval and early Renaissance periods have been identified.

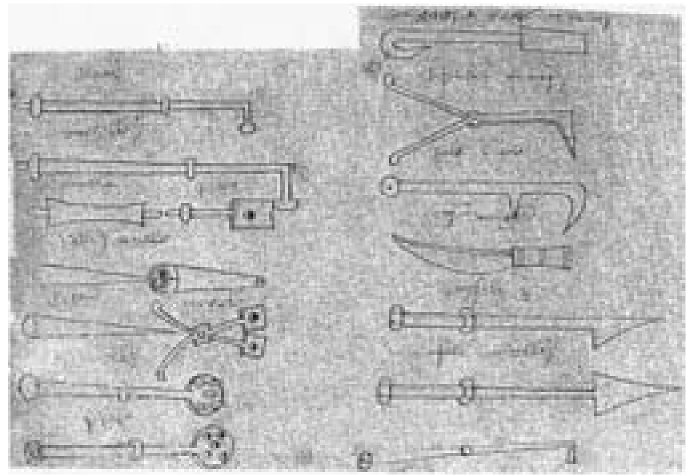

FIGURE 355
Renaissance incentric-pivoting forceps, from a fifteenth-century manuscript of the works of Guy de Chauliac, showing mainly cauteries but also an incentric nasal or rectal speculum (on the right, second from the top).

It is remarkable that in the fourteenth century, John of Arderne, famous for an illustrated and detailed operative manuscript for the surgery of fistula-in-ano, did not employ an anal speculum,[6] an instrument that would have refined both diagnosis and operative technique. Instead he used a cochlear or wooden spoon to act as a crude dilator and retractor in the anal canal. One fifteenth-century illustration, however, said to be a copy of a fourteenth-century manuscript of Guy de Chauliac, shows an inset-pivoting nasal speculum, pictured alongside instruments for fistula-in-ano, and perhaps was also employed in fistula surgery (figure 355). In 1556, Franco illustrated a similar speculum and also a hinging dilator, both designated for lithotomy (figure 352), although it is probable anal, vaginal, and wound inspection or dilatation were undertaken with the same instruments.[7]

Paré illustrated simple incentric dilators in 1564[8] (figure 172), and recommended them for arrowhead and gunshot-missile extraction, as well as for examining the nose and anal canal. In the Putti Museum collection of surgical instruments from the sixteenth and seventeenth centuries, similar dilators are noted, augmented by closing springs to promote urethral stone extraction.[9] In the same collection and of similar date is an anal speculum based on the Roman design discussed earlier. When Woodall illustrated a very similar anal speculum in 1617, he commented, "For if there happen into the orifice of the fundament any excoriation or exulceration, then can nothing better be brought to the grieved place, than by this speculum: neither can the griefe be seen without it. . . . For I hold none so witlesse which cannot make use thereof, when they once see but the instrument; and yet let not the young Artist be too busie in using this instrument without good reason."[10] Subsequently, anal, vaginal, aural, and nasal speculums changed little until operative techniques expanded in the late eighteenth and nineteenth centuries.

Outward-cutting incentric blades are the feature of so-called incision shears, used to enlarge narrow wound tracks in the search for missiles and noted by Brunschwig in 1497[11] (figure 35) and Franco in 1561[12] (figure 172A). Some incision shears were constructed with two pivots in parallel, separated by a central bar. However, Woodall maintained that incision shears were little used, and that a simple knife was a much less complex instrument for wound enlargement.[13] From the double-bladed incision shears a single-bladed form evolved, which came to be known as both *deceptive forceps* and *the deceitfull Pincer* by Scultetus[14] because the blade remained hidden until the last moment; this instrument was used for enlarging wounds and for application as a herniotome, later becoming the well-known *lithotome caché* of Frère Come in about 1748 (figures 44, 172C). The latter has an incentric outward-cutting blade designed to act within the prostatic capsule during stone extraction, if correctly applied. Around 1836, Dupuytren reinvented the incision shears as a double-bladed *lithotome caché*[15] (figure 244K), a much more elegant version of Brunschwig's and Franco's original instruments. A smaller version of the single-bladed *lithotome caché* was adapted by Savigny in 1798 for dividing paraphimotic or penile meatal strictures, and was still used in the mid twentieth century (figure 353C).

In the early eighteenth century, Heister[16] and Garengeot[17] both depicted the *valet à patin* artery forceps, which relied on a return or closing spring to