New concepts and technologies in surgical and restorative instrumentation

By Jeffrey Lasner, DDS

For the past 14 years, Laschal Surgical Instruments has been developing new concepts and technologies in surgical and restorative instruments. These new concepts and technologies revolve around the use of flexibly resilient or memory (spring) stainless steel, rather than the more commonly used hardened, heat-treatable stainless steels.

Traditionally, surgical instruments are made from a stainless steel that starts out as a forging with a chemical balance that includes a minimum of 0.14% carbon. This forging is relatively soft and easily manipulated, bent, shaped and machined. The final process, just before polishing, is heat treatment.

This involves the placement of the instrument into an oven at temperatures as high as 1000 degrees F and cooled. The carbon content plus the heat treatment significantly hardens the instrument but also reduces flexibility and corrosion resistance.

By using non heat-treatable, flexibly resistant stainless steel that incorporates only a trace of carbon, Laschal has discovered many favorable features and benefits not commonly found in instruments made from the more conventional materials.

Thus far, the major uses of this technology involve scissors, forceps (tissue and restorative) and needle holders.

Scissors

Scissors do not cut by cutting, they cut by shearing. Two blades come together under the pressure created by pivoting the blades together at slight angles to one another in order to create the *shearing angle* or *bias* necessary to form the 0-degree clearance in order to shear the material placed between the blades.

Scissors do not initially fail because they get dull; they initially fail because (1) the pivot loosens and (2) because the individual blades splay:

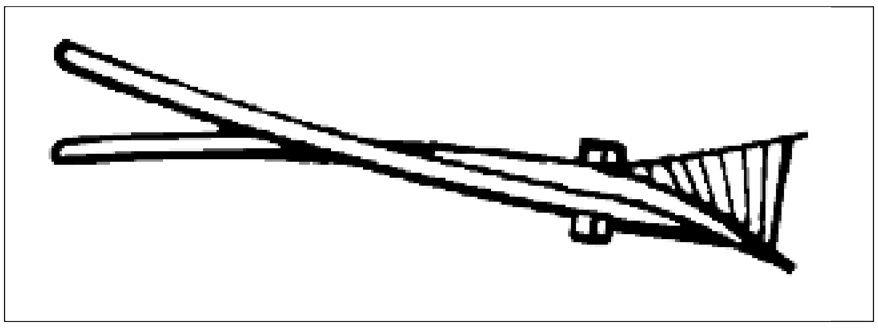

Fig. 1: A line drawing showing scissors with increased shear angle.

1. The pivot loosens because pressure created by the two, hardened steel blades coming together under pressure to create the shear is greater than the resistance provided by the screw or rivet that pivots the blades together. Thus, the screw or rivet is overstressed and loosens. How many times have we all had scissors that worked perfectly for several months, after which we had to antagonize the blades together by putting opposing forces on the rings in order to recreate the shear that was lost because of loosening?

2. Every material has a *yield strength* or *yield point*. In engineering and metallurgical terms, this is defined as the stress at which a material begins to [plastically] deform. Prior to the yield point, the material will deform elastically and will return to its original shape when the applied stress is removed.

Once the yield point is passed, some fraction of the deformation will be permanent and non-reversible. Thus, the tips of any such plastically deformed scissors will fail to cut tissue cleanly and will leave margins that are not sharply defined. This failure will make any anastomosis difficult.

Once the above deformities occur, repair of a loosened screw or rivet is expensive, often costing as much as half the original price. When the blades splay, repair is even more costly, but, more importantly, the steel has been fatigued and the repair cycle becomes more frequent.

The use of flexibly resilient stainless steel avoids the above problems:

A. Because of the flexibility, the shearing angle may be set to a level that approximates an increase of 300 percent, thereby increasing the shearing efficiency.

B. Because the blades actually flex during use, the screw or rivet is stress relieved, and therefore never loosens.

Upon re-opening, the high yield point then returns the blades to normal without any plastic deformation. If the shearing bias requires adjustment, the blades may simply be bent across one another and beyond their deformation point, and closed several times. Doing so will cause the blades to self adjust to their own pre-deformed and maximal 'shearing bias' or angle *(Fig. 1)*.

Needle holders

Splaying of the tips of needle holders is one of the more common problems surgeons face with micro needle holders. The other is that the locking mechanisms often engage unintentionally, most frequently during a delicate *instrument tie*. Since locks can freeze when the needle is half way through tissue, this is a cause of concern. The following are causative factors:

Clinicians would prefer a needle holder with a more comfortable distance between the locking components when the jaws touch. This would allow a margin of safety so that an instrument tie could be made with little chance of accidentally engaging the locks at an inopportune time.

Because of the poor yield strength (yield point) of the hardened steel employed, manufacturers of common Castro-Viejo needle holders are reluctant to set the locking components at this comfortable distance. If they did, most except the very small needle sizes would necessitate an *overclosure* in order to engage the locks, which, in turn, would force the jaws beyond their yield point or plastic limit.

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Fig. 2: Needle holder with jaws touching and distance between prongs.

Fig. 3: Needle holder locked onto a quarter.

Fig. 4: Tissue forceps showing prongs, tissue forcers and open distal attachment.

Fig. 5: Crown/Core forceps.

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Although the jaws could then be reset using high temperatures to soften and bend back to shape, the steel would have been permanently fatigued and the [costly] repair cycle would then be shortened.

The use of flexibly resilient steel with its high yield point allows:

1. A wide distance between the locking components when the prongs of the needle holders touch, thereby minimizing the incidence of accidental engagement during a delicate instrument tie *(Fig. 2)*.

2. The ability of the micro tips to hold any size needle without splaying. Any incidental deformity because of severe instrument abuse may easily be corrected with no metal fatigue *(Fig. 3)*.

Forceps

A — Tissue

Traditional forceps are made from inflexible steel and closed on the distal ends. When the proximal ends of the forceps engage tissue, a closed system is created. Any excess pressure applied to the shanks of the forceps is directly transmitted to the tissue. It has been reported in all sub-specialties of surgery that the application of as little as 15 grams of excess pressure could easily cause an instrument-induced trauma to tissue. Obviously this would result in delayed healing at the very least, and possibly in tearing, laceration, or abrasion.

The Laschal Pressure Controlled Forceps greatly reduces this danger. Because the forceps are open on the distal ends via the male/female interlocking springs, a degree of the excess pressure is released. The bulk of the remaining excess pressure is released by the flexible nature of the prongs, which flex upon the engagement of the tissue while securely holding and manipulating tissue *(Fig. 4)*, yet the forceps are strong enough to aid in the complete passage of the needle through dense, attached gingivae.

Figs. 6A, 6B and 6C: Micro component forceps and close-ups showing forceps holding rivet and larger post.

B — For restorative or implant components

When used for holding or manipulating prosthetic, restorative or implant components, a balance between the flexible prongs of the forceps and resistance of the component is achieved. In varying configurations and designs, these forceps may be used for holding and controlling crowns or bridges during the cementation process so that neither the clinician nor assistant need, ever again, to touch a crown or bridge with wet, gloved fingers *(Fig. 5)*.

Moreover, the incredible flexibility of the steel, with its extraordinary yield strength, makes it almost indestructible as evidenced by the Laschal Micro-Component Forceps that can securely hold and manipulate an implant screw with a diameter as small as 0.25 mm or as large as one with a diameter of 7 mm *(Figs. 6A, 6B, 6C)*.

Another example of the wide uses of this new technology and its survivorship is the use of the tech-

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nology to fabricate a micro-forceps specifically designed for the removal of separated endodontic files or silver points.

In the example following, a comparison is made between the Laschal Forceps and a micro-alligator forceps more commonly used for neurosurgical procedures, but which has been adopted by many endodontists for the purposes identified above. In this comparison, tungsten carbide inserts have been added to the Laschal Forceps for maximal retention, but it will be noted that, even with the added thickness of the insert, overall dimensions of the Laschal Forceps are still half those of the alligator forceps.

You will also note that the alligator forceps are shown to have been splayed (a very common problem), which, when corrected [at significant cost], the repair cycle is more frequent since the steel has been permanently fatigued *(Figs. 7A, 7B)*. The Laschal Forceps are guaranteed not to splay *(Figs. 8A, 8B)*. If the forceps should happen to be

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Fig 7B: Top and side view of tips of alligator forceps.

Fig. 7A: Neurosurgical alligator forceps.

Fig. 8A: Laschal Micro Forceps.

Fig. 8B: Top and side view of Laschal Micro Forceps.

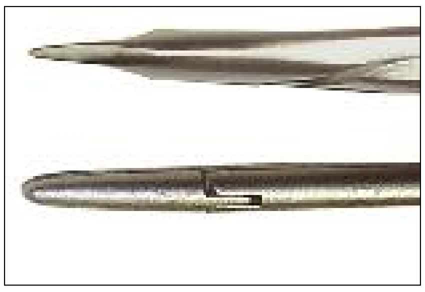

Fig. 9: A comparison of Laschal (top) and Alligator forceps.

Fig. 10: Endo file forceps

Figs. 11a: New Double Pronged Forceps

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abused to the point of splaying, they may easily be repaired with no metal fatigue due to the nature of the spring stainless steel employed.

When the prongs are contoured and fitted with a thumb lock, they can be used as an endodontic file forceps that is capable of gripping any file, from any manufacturer, with a vice-like grip. The forceps have exceptional axial and rotational stability and will not slip even when significant axial and rotational pressures are applied while trying to gain access to a calcified or partially calcified canal.

Stabilizations are also maintained, even if the forceps are used for complete instrumentation of a canal though the primary purpose is only to initiate instrumentation, after which the clinician may then continue instrumentation with direct finger pressure for apical location and verification of the *test file length*.

The primary purpose of the Endodontic File Forceps is to reduce fatigue of the thumb-index finger joint and the overall inconvenience of manipulating the file with wet, gloved fingers, while also fighting the rubber dam in so doing. After radiographing the test file, and mental notes are made of the paths of insertion, the clinician may certainly use any technique to complete instrumentation.

It is also of great benefit when using a microscope, since there is no obliteration of the operative field by the fingers and clear visualization is uninterrupted. Further, unlike other similar devices, which involve a series of maneuvers to attach, operate and detach, the convenient thumb lock can easily and conveniently be engaged and disengaged *(Fig. 10)*.

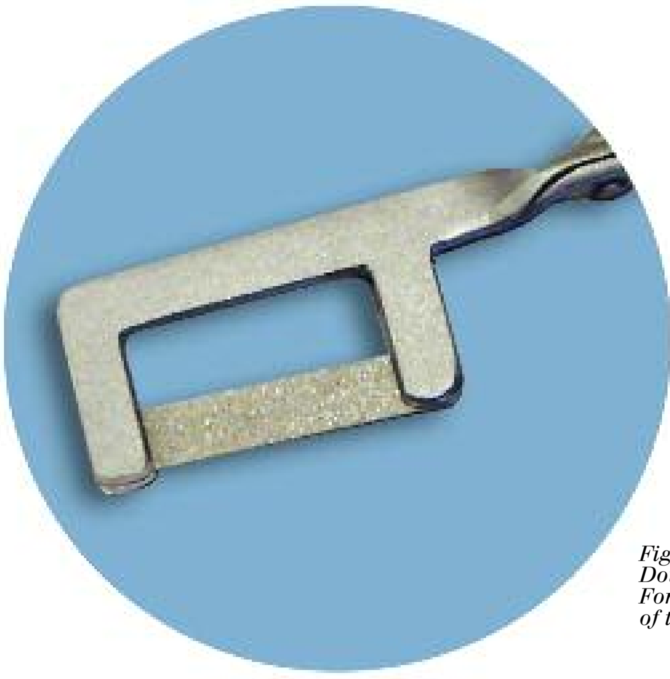
The most recent innovations from Laschal involve the development of two new forceps *(Figs. 11a and 11b)*. With the use of these forceps, clinicians need never again wrap polishing or lightning strips around their fingers when attempting to polish Class II composite restorations or when attempting to remove composite resin 'flash' after cementing crowns or bridges. It is also

Also, there is a substantial economic advantage. The clinician can now get 5 individual strips from each 6" length. Considering the cost of a package of strips, this is a significant saving-enough so that the forceps actually pay for itself within 1 year in a moderately busy practice.

Finally, and just as intriguing as the products themselves, are the methods of manufacturing developed by Laschal. While all other scissors, needle holders and [most] forceps are made from customized forgings, which must then be machined and which then go through numerous processes for completion, Laschal products are made from a single stamping, which is then laser cut and bent or formed to shape.

This reduces to consistency of manufacturing as well as the creation of any idea or design for new and improved surgical or restorative instruments, so necessary for the ever-improving techniques of modern dentistry. It means that the journey from idea to engineering concept to working prototype and ultimately to production models is a matter of hours and days rather than months and years.

Laschal Instruments have been designed to reduce or eliminate numerous clinical difficulties dentists contend with every day. Future issues of Implant Tribune will include articles on other innovations presented in depth along with abstracts explaining the technologies and methodologies of use.



Figs. 11b: New Double Pronged Forceps (closeup of tip)

ET About the author

Dr. Jeffrey Lasner, who retired from the practice of dentistry in 1989, is president and CEO of Laschal Surgical Instruments. He is the inventor or co-inventor of 15 medical or dental devices, all of which have earned letters of patent in the United States and European Union, with several still pending. The instruments are currently being distributed globally to dentists through a network of international dealers. Recently, the Laschal technologies have been incorporated laparoscopic instruments for minimally invasive surgical procedures. Dr. Lasner attended St. John's University from 1963-1966 and Western Reserve University College of Dentistry from 1963-1967. He had an Oral Surgery Internship at Morrisania City Hospital from 1967-1968 and an Anesthesia Residency at Montefiore Hospital and Medical Center from 1968-1969. He was Medical/Dental Anesthesia Liasion at Montefiore Hospital and Medical Center from 1969-1975. Dr. Lasner may be reached at jlasner@laschalsurgical.com.