Editorial

Good, better, best for what?

Numbers are an everyday part of many orthodontic practices. The student of advanced orthodontics is exposed very early to the wonders of cephalometric analysis, with its angles and millimeters and sophisticated statistical manipulations. Even dental casts may be analyzed in this way.

With all of those impressively precise procedures, one would think that little of importance could escape the notice of the clinician skilled in their use. One would also think that numerical evaluations are being used as intensively as possible. Wrong on both counts.

There is another set of numbers that could well be the most important of all, but they are not a usual part of routine orthodontic procedures. These are the numbers that describe the mechanical actions of our appliances as they interface with the patient's tissues. Recent developments have given these measures of force effects a new significance that is still not fully apparent.

Orthodontic therapy is a force management procedure largely based on the use of metal wires for storing and distributing therapeutic forces. Wire behavior is probably the most consistent and predictable of all of the factors in orthodontic therapy. That consistency and predictability have made it possible to generally ignore the specifics of these mechanical characteristics in the past. The clinician learned to expect certain behavior and accepted it as a matter of course. That is fine as long as nothing changes, but now things *are* changing.

New wire alloys now on the market exhibit behavior patterns so different from those of conventional materials that their unique characteristics call for a completely new look at appliance mechanics. Simple substitution of these new alloys in established techniques can result in dramatically different and sometimes unexpected tooth movements near and far.

Yes, life *was* simpler in the old days, even the old days of the late seventies. Longer ago than that, when present techniques were first evolving, gold was the material of choice for most orthodontic mechanisms. By purely mechanical standards based on energy storage efficiency, gold alloys are among the most inadequate materials ever used in our specialty, yet they accomplished every type of correction that is achieved today. Appliances were designed to work within those mechanical limitations, which were sometimes even turned to advantage as a built-in safety factor.

The low proportional limit of gold alloys means a low capacity for force storage—they take a permanent set at relatively small loads. In engineering language this translates as inefficiency, but that apparent disadvantage kept the strength of gold wires within reasonably safe limits of clinical force. The similarly limited working range also kept increments of tooth movement small enough to minimize concern about therapeutic misadventure.

The displacement of gold by stainless steel brought a significant increase in the capacity for energy storage and delivery. This was quickly recognized and soon largely compensated by the introduction of a narrower .018″ (.45 mm) bracket slot. The accompanying reduction in wire size from the old maximum of .022″ (.55 mm) brought the stiffness of steel wires down to levels comparable to gold, but its higher proportional limit still provides a somewhat elevated force storage capacity. Steel can move teeth farther than gold, but not drastically so.

Now the titanium-based alloys have brought new and far-reaching changes that are at the same time subtle and dramatic. The remarkably different elastic behavior profiles of these metals are described in some detail in the article by Kusy and Greenberg in this issue. Some of the most important therapeutic ramifications still await evaluation. Old rules must be rewritten to integrate these materials into the therapeutic armamentarium; mere adjustments in size are not enough.

Major differences revolve around the long elastic range of the titanium-based alloys. What appears so gentle at first glance has the capacity to wind up and store deceptively high levels of force and then release it over a long range of movement. Those spectacular movements may be impressive, but clinical goals go beyond showmanship. Our ability to do the wrong things has been enhanced at least as much as our ability to do the right things.

Kusy and Greenberg illustrate some of those differences with comparisons based on a set of arbitrary criteria. These are illustrative, not absolute. They illustrate a method for comparing wires, not for treating patients, and the authors take care to point out that their statements of relative merit apply only for the specific objectives that were assumed at the outset. Other even diametrically opposite criteria and conclusions could be equally appropriate in other circumstances.

For example, they also point out that while the titanium alloys excell spectacularly in flexibility, their stiffness is comparably low. The titanium alloys fall far short of conventional metals where the need is for control requiring resistance to deformation, as with elastic traction or control of arch form.

It is not a matter of good, better, best for orthodontics. It is a matter of suitability for specific objectives. We have become comfortably accustomed to a very limited menu with easy choices that offer movement and control in useful but limited measure. Now we find ourselves faced with an expanded menu that includes trade-offs involving such factors as dramatic increases in movement coupled with new lows for control. This calls for judgments never needed up to now.

The individual clinician must always know and understand the needs and options at every stage of therapy. Real progress requires more than merely plugging the technology of the 80's into the treatment methods of the 30's. Kusy and Greenberg have provided a useful data base for reaching many of those new decisions with informed care and understanding. The baton is now in the clinician's hands.

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