“How do you handle extraction spaces?” This has to be near the top of the list of questions orthodontists most often ask each other ... and it’s a loaded question, at that. Like “What’s your wire sequence?” or “How do you correct Class II?” it should have a simple answer, but in reality never does. We usually start our responses with a pause, a smirk and a “That depends.”
In orthodontics, there are so many ways to get to the same finish with a great result. The everyday task of handling extraction spaces is an art in its own right, with an endless list of variables that require clarification:

• Do you extract before or after bracketing?
• Canine retraction or en-masse retraction?
• Maximum or minimum anchorage?
• Reciprocal space closure?
• Leveling and aligning before any space closure for sliding?
• Active or passive brackets in the buccal segments?
• Skeletal anchorage?
• Periodontally or osteogenically accelerated orthodontics?

Over the past decade in orthodontics, I’ve been repeatedly impressed with the clinical outcomes for handling extraction spaces using what are commonly referred to as “tiebacks” or “lacebacks.”

In the right scenarios, placed in specific ways, these unassuming pieces of stainless steel ligature wire harness great power with few side effects. Best of all, it requires almost no effort to be the beneficiary of the great clinical outcomes that tiebacks afford. Even in this wonderful age of skeletal anchorage, when we can move a tooth virtually anywhere in the arch we desire with undetectable anchorage loss or side effects to the adjacent teeth, I find the old .010 stainless steel ligature wire not only still relevant, but irreplaceable.

Despite my clear infatuation with this technique for dealing with tooth movement in extraction situations, I’ve found that not everyone shares my enthusiasm. I’ve discussed the topic with colleagues from all over the map and with residents in the university clinic, and there’s often a disconnect, almost as if we’re speaking different languages. Why is this? We’re using the same words, but the terms could have lost (or never have had) the proper specificity.

When we look at the terminology, it’s no wonder orthodontists aren’t on the same page. We’re confusing each other with talk of lacebacks, tiebacks, active or passive tiebacks, passive or active lacebacks, distal module, mesial module … and the confusion goes on. What’s the difference? Aren’t they all the same? The literature on the subject is of little help. It’s sparse to say the least, and many of the respected papers on the subject appear to have mixed and matched the terminology.

A focus on terminology
The terms laceback and tieback have been commonplace in the field of orthodontics for some time, and are often substituted for each other, when they’re actually different entities.

Laceback was popularized by McLaughlin and Bennett in the late 1980s through their work focused on understanding and minimizing the common side effects of the preadjusted straightwire appliance during leveling and aligning phases. They described lacebacks as using .010 stainless steel ligature wires extending from the most distally banded molar to the canine bracket (Fig. 1, p. 30). Lacebacks are generally placed on the brackets before the insertion and ligation of the archwire. The purpose is to restrict canine
crowns from tipping forward during leveling and aligning—a tipping caused by the addition of angulation in today’s prescription brackets.

**Tieback** refers to the use of stainless steel ligatures threaded through an elastic module that goes directly from the terminal molar to the canine bracket (Fig. 2). Unlike the laceback, this type of ligation is done after the placement and ligation of the archwire and is commonly used for active space closure.

Either lacebacks or tiebacks can be further categorized as “active” or “passive.” **Active** requires that the ligature exert a force when placed. It’s physically tightened down and is subsequently reactivated by 1–2mm of twisting at each monthly appointment. **Passive** refers to the ligature exerting no force, with the purpose of either holding canine crowns in an attempt to prevent mesial movement during initial alignment, or maintaining already-closed spaces in the buccal segments.

### Clinical applications

The next sections will focus on clinical application and efficiency of active tiebacks with fresh extraction sites in the maximum anchorage type of orthodontic situations.

Clinical trials have shown both active tieback and active laceback methods to be reliable in anterior retraction. The active tieback method using an elastomeric module has shown to have a clinically significant decrease in space-closure time compared with the laceback method with no elastic module. Elastic modules, when prestretched to twice their original size, have been shown to deliver 50–150g of force initially.

Canine retraction with active tiebacks (Fig. 3) is often rapid and has minimal unwanted side effects even when using with light initial nickel titanium archwires. Fig. 3 demonstrates canine retraction with tiebacks over 12 weeks on initial archwires. It is important to note that there is no mesial-out/distal-in rotation evident on the canines that you would typically see with elastic chain or coil-spring retraction. It has been shown that the canines rotate 2.68 degrees on average with laceback tie, compared with 7.75 degrees with coil springs. One study suggests that using the tieback method of space closure has more appropriate initial force than elastomeric chain.

The forces produced from tiebacks are not continuous; in fact, after 48 hours they almost don’t exist. Approximately 11–18 percent of the initial force was lost within the first three minutes, and up to 63 percent of force decay occurred within the first 24 hours. The amount of initial force used to place tiebacks varies between clinicians. One study has shown...
not only a large interoperator variation in the forces produced during placement, but also that few operators applied similar forces when placing on two separate occasions. The large variation in placement force may seem to be a problem, but I believe that it has little relevance because of the significant force decay that occurs within the first 24 hours.

If active tiebacks are not continuous force and have a high force decay initially, how are the spaces closing? A phenomenon, coined the “trampoline effect,” has been postulated as a result of patients failing scheduled adjustment appointments and returning to the clinic with continuation of space closure well beyond the activation of the ligature. The theory speculates that intermittent movement or pumping action on the ligature wire during function and chewing continues to reactivate the auxiliary. Because of this phenomenon, it would seem that the tieback module having less restricted access of a food bolus to a buccally placed ligature would have a greater capability for tooth movement, compared with a laceback module with the steel ligature protected by a medial placement to the archwire.

Regional acceleratory phenomenon

It has been noted by many clinicians using tiebacks or lacebacks that when they’re placed, it’s not uncommon to see entire extraction spaces close up on their own and severe crowding to align at an astounding rate (Figs. 4a–d). This can be explained on a cellular level by the presence of a regional acceleratory phenomenon, or RAP. This phenomenon isn’t limited to those practicing with the aid of corticotomies or osteotomies; RAP occurs typically in the healing process of the alveolar sockets after tooth extraction. RAP is composed of two important bone-healing trademarks that are thought to facilitate orthodontic tooth movement: decreased regional bone density and accelerated bone turnover.

Clinical case

A 13-year-old male presented for treatment with slight overbite and overjet, and maxillary canines actively erupting toward the buccal (Fig. 5). The posterior occlusion was Class I molar left and full step Class III molar on the right side (Fig. 6), resulting in a significant mandibular midline discrepancy. The patient had a straight facial profile, good lip competency and mild chin deviation to the left. In spite of the asymmetric Class III dentition, the resulting chin deviation was mild enough to be considered within normal limits (Figs. 7–8; see p. 34).

Cephalometric analysis revealed a strong Class III component with severe dental compensation. At 73 degrees, the lower incisors were retroclined approximately 20 degrees from the norm. Although ANB was only slightly negative, the Wits appraisal came out to -9.3mm. Because of the severity of the Class III skeletal component and the patient being in active growth, the likelihood of future surgery was discussed before any treatment.

Treatment plan

- Begin with maxillary arch only
- Bond to create space for maxillary canine teeth
- Improve overbite and overjet
- When maxillary teeth aligned, bond sectional wire to Class III side
- Place active tieback from #30–#27
- Extract tooth #28
- Bond lower arch only when #27 is in Class I position
- Re-evaluate for lower arch miniscrews in external oblique ridge, if necessary for retraction
- Class III elastics prn
Treatment sequencing

The patient’s maxillary arch was bonded to include all teeth except unerupted canines. After three months, adequate space was created to bond the erupted canines. After six months of maxillary-only appliances, no significant mandibular growth had taken place (Figs. 9a–c; p. 34). Because of this, I felt comfortable to bond a lower sectional appliance from molar to canine on the Class III side. A 0.014 NiTi wire was used and an active tieback placed before dental extraction. Fig. 10a (p. 36) shows recent extraction site and tieback in place.

After 11 weeks with the tieback in place, tooth #27 was approaching Class I relationship and the remaining teeth in the lower arch were bonded (Figs. 10b and 10c, p. 36). Great care was taken to keep the natural compensations in the lower arch, to prevent the development of anterior crossbite, so tooth #22 was not engaged onto the archwire until after appropriate space had developed.

After all teeth were bonded and incorporated into the appliance, routine continuous straightwire mechanics were used to finish the case (Fig. 11a, p. 37). The finishing wires were maxillary 17x25 Beta-Ti and lower .018 SS. Light posterior box elastics were used for six weeks to aid in interdigitation (Fig. 11b, p. 37). Fig. 11c (p. 37) shows patient’s occlusion at final detailing appointment, 15 months after starting treatment.
Discussion

This complex, asymmetric Class III case has treated out quite well and efficiently. The use of the active tieback to close the extraction space provided all the anchorage necessary in this maximum anchorage situation. Why aren’t all complex orthodontic cases requiring extraction being treated this way and completed in 15–18 months? After all, it’s extremely simple to do, the molars are great anchorage and best of all, the RAP is free turbocharging for space closure.

I think it’s important to bring up what the current literature has to say about this. The overwhelming majority of articles discussing retraction with tiebacks or lacebacks typically conclude that the canine retraction is adequate, but there is significant posterior anchorage loss associated. A recent meta-analysis concluded, “There is no evidence to support the use of lacebacks for the control of the sagittal position of the incisors during initial orthodontic alignment.” Another recent article concluded, “Active laceback produced anchorage loss of maxillary first molars.”

How can this be? Time and time again, I’ve seen tiebacks do a wonderful job at controlling lower incisors with minimal posterior anchorage loss. As I

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Figs. 7 and 8: Cephalometric measurements: The analysis shows a Class III skeletal pattern with severe Class III dental compensations. Although many of the skeletal and dental components are Class III, the patient has an acceptable profile.

Figs. 9a–c: Initial leveling and alignment was done in the maxillary arch only to improve overbite and overjet before any lower arch treatment, without decompensating the lower teeth and creating an underbite. This time was used to evaluate growth of the mandible. If unfavorable mandibular growth occurred, treatment plans would be altered or treatment discontinued with certainty that the unwanted changes were not orthodontically induced.
studied the half-dozen or so available articles on this topic, a mention of a protocol for timing of the extractions was not evident to me in any of the publications. Nor do they mention how long it had been between extraction and placement of the laceback or tieback. This is an important distinction, because it has been shown that teeth move faster in proximity to a recent extraction, compared with a healed extraction site.\(^\text{15}\)

If one follows the MBT philosophy step by step, McLaughlin proposes a waiting period for space closure with passive tiebacks or lacebacks until true passive insertion of a 19x25 stainless steel archwire can be achieved\(^\text{2}\) for the sake of improving sliding mechanics. Without a protocol for having the tieback in place before or immediately after extraction, one may be missing out on a great deal of Mother Nature’s own tooth-moving accelerator, the RAP. In fact, the increase in cellular activity is so great that Frost documented that RAP can expedite hard- and soft-tissue healing stages between two and 10 times that of normal physiological activity.\(^\text{9}\)

A 2013 study stated that extractions can be a good source for inflammatory markers. (These markers play an important role in osteoclast recruitment.) Because of this, the group proposed that, when possible, extractions should be delayed until the time of major tooth movement.\(^\text{16}\)

What if our patients are getting the extractions before initiating orthodontics, or if they’re in orthodontic treatment and have the extractions performed but don’t see us for six weeks? What if we’re waiting for our large-diameter wire to become completely passive? Orthodontic literature has shown that extraction undoubtedly leads to decreased bone density in the extraction.\(^\text{17, 18}\) Could we be missing out on the wonderful advantages that biology has to offer? ■
Fig. 11a: Routine straightwire mechanics were used to finish the case. Tooth #22 was only engaged in to the archwire after space had been created.

Fig. 11b: Elastic chain was used to close residual extraction space and for final midline correction.

Fig. 11c: Patient’s occlusion at final detailing appointment before debonding. 15 months after starting treatment

References