Surgical Assistance for Rapid Orthodontic Treatment and Temporary Skeletal Anchorage

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KEYWORDS

• Corticotomies • Osteotomies • Regional acceleratory phenomenon • Anchorage • Osteogenic • Orthognathic

KEY POINTS

- Surgically assisted osteogenic orthodontics is a departure from earlier described techniques such as accelerated osteogenic orthodontics in that multiple modalities are combined not only to shorten treatment time but to accomplish results that cannot be achieved with orthodontics alone.
- Accelerated osteogenic orthodontics simply improves treatment time of otherwise regularly performed orthodontics, whereas surgically assisted osteogenic orthodontics can replace procedures such as orthognathic surgery or facilitate otherwise improbable orthodontic mechanics.
- When appropriately used, surgically assisted osteogenic orthodontics can be a useful surgical option. There is a significant reduction in cost to the patient, especially when there is a lack of insurance coverage for orthognathic techniques.
- Patient recovery is usually no more than a long weekend and overall treatment time is greatly reduced. In addition, surgeons are able to work in the comfortable environment of their own offices.
- Decreased cost, recovery time, and treatment time, and an in-office environment all increase patient acceptance and allow surgeons to provide treatment to patients who might otherwise have no options.

INTRODUCTION

Orthodontics and oral and maxillofacial surgery have been codependent specialties for many years. Orthodontics has relied on the specialty of oral and maxillofacial surgery in numerous ways to enhance orthodontic treatment and orthodontic outcomes. Various procedures have been devised over the years to enhance orthodontic treatment, ranging from surgically exposing unerupted teeth, providing hard or soft tissue grafting, orthognathic surgery, or skeletal anchorage, in addition to the routine procedures of third molar and premolar extractions. A variety of dentofacial deformities are now more easily managed by both the orthodontist and the oral and maxillofacial surgeon as a result of these advances. In spite of this, a variety of conditions that present to the orthodontist or the oral and maxillofacial surgeon are complicated by external factors such as cost, insurance coverage, hospitalization, or the patient's inability to miss work. In the past, conditions were often seen that exceeded orthodontic treatment alone but that seemed too minor for surgical correction through orthognathic surgery. New techniques are now available to manage such patients with a

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variety of orthodontic and surgical modalities comprehensively categorized as surgically assisted osteogenic orthodontics. These techniques combine previous treatment modalities to treat patients in an outpatient environment providing minimal recovery time and cost with predictable outcomes. This article reviews the historical progression of surgically assisted osteogenic orthodontics, the surgical instrumentation necessary for various treatments, the techniques involved, and specific cases as examples of these benefits.

HISTORICAL PERSPECTIVES

In 1959, Heinrich Kole[1] described a variety of surgical operations of the alveolar ridge to correct occlusal abnormalities. He showed that osteotomies could be performed around various teeth to facilitate orthodontic treatment with block movements of teeth and bone.[1] It was thought at that time that reduction in resistance of the cortex or other bony obstacles could be facilitated to allow improved or enhanced orthodontic movement. It is questionable in retrospect whether what was being described were corticotomies or true osteotomies between teeth. Later, in 1975, Lines[2] described corticotomies to facilitate rapid maxillary expansion; known today as rapid palatal expansion. In 1976, Bell and Epker[3] went on to describe selected osteotomies for rapid maxillary expansion minimizing resistance further, at regions such as the zygomatic buttress. These osteotomies were further enhanced in 1984 by Kraut[4] with the addition of a midpalatal osteotomy for rapid maxillary expansion. These techniques are now comprehensively considered as surgically assisted rapid palatal expansion, and are facilitated by orthodontic mechanics combined with osteotomies and distraction osteogenesis. In 1983, the orthopedic surgeon Frost[5] described the regional acceleratory phenomenon (RAP). Described as a complex reaction of mammalian tissues to diverse noxious stimuli such as trauma, osteotomies, or corticotomies, this phenomenon involves hard and soft tissues alike, and involves an acceleration and domination of most ongoing normal vital tissue processes. This save-our-ship–type phenomenon takes on a metabolic priority, allowing increased metabolism of bone; a process that is known to be an essential part of orthodontic movement. In 2001, Wilcko and colleagues[6] reported 2 cases that theoretically used corticotomies and alveolar bone reshaping to take advantage of the RAP. The term accelerated osteogenic orthodontics was coined and patented by Wilckodontics. The case report described a technique involving buccal and lingual flaps to expose the alveolus and create interdental corticotomies that are then connected at the apex with an apical corticotomy and multiple cortical perforations to induce the RAP and therefore enhance and accelerate bone metabolism. The emphasis of this technique was to significantly reduce the treatment time of conventional orthodontic treatment. In 2009, Wilcko and colleagues[7] described the same procedure with the addition of grafting, redefining the technique as periodontal accelerated osteogenic orthodontics (PAOO).[8] The differentiation was then made that accelerated osteogenic orthodontics was a process of creating corticotomies to enhance the RAP and expedite orthodontic treatment, and PAOO was the same technique incorporating the addition of superficial grafting with other minor refinements to the original publication. Both procedures were described as being performed at or just before the onset of orthodontic treatment to induce the RAP and allow accelerated orthodontic treatment. In 2009, Roble and colleagues[9] differentiated accelerated osteogenic orthodontics and PAOO as a component of a broader group of surgically facilitated orthodontic therapy, which included 2 distinct concepts: (1) corticotomies of the alveolar bone to induce the RAP, or (2) osteotomies of bone around teeth to induce the RAP with the addition of distraction osteogenesis (**Table 1**). Roble and colleagues[9] appropriately pointed out that Kole's[1] original concept was abandoned most likely because of a lack of orthodontic sophistication as a limitation of the time. With modern orthodontic therapy and the RAP, osteotomies such as that described by Kole[1] can be made to improve orthodontic outcomes. In 2012, Liou and colleagues[10] defined and scientifically illustrated the postsurgical

Table 1
Surgically facilitated orthodontic therapies

Surgically assisted osteogenic orthodontics	
All-encompassing with use of corticotomies, osteotomies, skeletal anchorage, and grafting with orthodontics	
Surgically facilitated orthodontic therapy	
Differentiated by corticotomy vs osteotomy	
Corticotomies	**Osteotomies**
The use of corticotomies or decortication to induce RAP	The use of single or multiple osteotomies
Typical of accelerated osteogenic orthodontics	Typical of distraction osteogenesis