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WILCKODONTICS- A COALESCENCE OF PERFECTION!!

Orthodontology

Dr. Sarvani VL Nukaraju* Consultant Orthodontist, Navi Mumbai, *Corresponding Author.

Dr. Brigit Alphonsa Grevasis Senior Lecturer, Department of Orthodontics, K.V.G. Dental college, Sullia,

Dr Priya Chaurasia Consultant Periodontist, Navi Mumbai.

Dr. Sharath Kumar Shetty H.O.D, Department of Orthodontics, K.V.G. Dental college, Sullia.

Dr. Mahesh Kumar Y Professor, Department of Orthodontics, K.V.G. Dental college, Sullia.

ABSTRACT

Wilckodontics or PAOO procedure has multiple clinical applications specially in adult orthodontics. Wilckodontics, has made adult orthodontic treatment faster and facilitated rapid tooth movement in Adult patients . The article reviews various techniques used singly or in combination with Wilckodontics like Mono-cortical tooth dislocation and ligament distraction (MTDLD), Lasers, usage of autogenous soft tissue graft, Piezosurgery in bringing about faster tooth movement . Wilckodontics, even with the economical constrains can turn out to be an attractive treatment option and a revolution for both the patients and orthodontists.

KEYWORDS

INTRODUCTION

A rapid growth in the advancements pertaining to the field of orthodontics has led to the emergence of integrated approaches in reducing time for completion of orthodontic treatment. In the present scenario, there are many adult patients who are in quest of orthodontic treatment.[1]A comparative evaluation with the adolescents reveals several psychological, biological and clinical differences. They have insignificant growth when compared to children and hyalinization might occur during the treatment. Taking into consideration all these factors in mind adult orthodontic treatment differ and is challenging. The orthodontic tooth movement is usually influenced by a number of factors which include increased alveolar bone metabolism and bone turnover rate. These factors determine the quantity and quality of orthodontic tooth movement.[2] Periodontally accelerated osteogenic orthodontics a recent revolution has offered solutions to many limitations in the orthodontic treatment of adults. The advantages of corticotomy assisted orthodontics includes reduced treatment time, enhanced expansion, increased traction of impacted teeth and post orthodontic stability. Combining orthodontics with selective alveolar decortication and bone grafting can lead to a wider range of tooth movements while simultaneously reducing risk factors that may lead to periodontal breakdown.[3]

HISTORY OF WILCKODONTICS:

The historical background of surgically assisted orthodontic tooth movement dates back to the 1800's. Corticotomy facilitated tooth movement was first described by LC Bryan in 1893, though this gathered great importance after Henrich Kole's publication in 1959.[4]

Kole believed that it was the continuity and thickness of the cortical plate of bone (dense layer), that offered main resistance to tooth movement. He theorized that by disrupting the continuity of the cortical bone, much less time is required for completion of orthodontic treatment as he was actually creating and moving blocks of bone in which teeth were embedded. He postulated this theory as “bony block movement.” It was Henrich Kole's publication in 1959; however, that set the stage for evolution of corticotomy facilitated orthodontics.[5]

In the 1990s, Dr. Wilcko, using computed tomography, discovered that reduced mineralization of the alveolar bone was the reason behind the rapid tooth movement following corticotomies. This knowledge of corticotomy and their observations helped to develop PAOO technique in 1995.[6]

BIOMECHANICS OF WILCKODONTICS

Orthopedist Herald Frost, recognized that surgical wounding of osseous tissue results in striking reorganizing activity adjacent to the site of injury (in osseous/ soft tissue surgery). This cascade of physiologic healing events was collectively termed as “The Regional acceleratory phenomenon” (RAP).[7] This is a local response of tissues to noxious stimuli by which tissue regenerates faster than normal in a regional regeneration/remodeling process.[8] The duration usually lasts about four months in human bone and the phenomenon causes bone healing to occur 10-50 times faster than normal bone turnover. In human long bones, following surgical injury, RAP begins within a few days, usually peaks at 1-2 months, and may take from 6 to 24 months to subside completely.[9] Orthodontic force application alone is a stimulant sufficient to trigger mild RAP activity; however, when tooth movement is combined with selective decortication, RAP is maximized. In 2001 Wilcko et al., revisited the original technique of bony block movement with some modifications and suggested that this process would manifest as a part of RAP that involves the alveolar bone after being exposed to injury (corticotomy) and during active tooth movement.[10]

SURGICAL TECHNIQUE [11]

Post Case discussion regarding the treatment plans and placement of orthodontic brackets a light wire is engaged a week before the surgical procedure. The following steps are incorporated for the surgical technique.

Flap Design:

After administration of local anesthesia, sulcular releasing incisions are made lingually and labially. Full-thickness flaps are carefully reflected labially and lingually in the coronal aspect of the flap with a split thickness flap reflected at the apices of the teeth to allow mobility of the flap to enable the flap to be sutured with minimal tension. Proper identification of the neurovascular structures is important to prevent damage to these structures. The flaps should be extended beyond the corticotomy sites mesially and distally to prevent vertical releasing incisions. The interdental papilla can be reflected with the flap or left in place; however, the interdental papilla between the maxillary central incisors is preserved for esthetic purposes. After flap reflection, the area is thoroughly debrided and curettage done to remove any inflamed tissue, if present.

Decortication: Alveolar bone is activated with selective alveolar decortications, both on lingual and labial side by use of a no. 1 or no. 2 round bur or it may also be achieved with a piezoelectric knife (piezocision). The purpose of the decortication is to initiate the RAP response. Vertical groove is placed in the interradicular space, midway between the root prominences in the alveolar bone. This groove extends from a point 2 to 3 mm below the crest of the bone to a point 2 mm beyond the apices of the roots. Vertical corticotomies are then connected with a circular-shaped horizontal corticotomy. If the alveolar bone is of sufficient thickness, solitary perforations may be placed in the alveolar bone avoiding important neurovascular structures. Both corticotomy cuts and perforations should extend through the entire thickness of the cortical plate, just barely into the cancellous bone avoiding risk of damage to underlying structures like maxillary sinus and mandibular canal.

Particulate bone grafting: It is done in most areas that have undergone corticotomies. Approximate volume of particulate bone graft used is 0.25 to 0.5 ml per tooth depending on the pretreatment thickness, the direction and magnitude of orthodontic forces and the lip support. The materials most commonly used for grafting after decortication are deproteinized bovine bone, autogenous bone, decalcified freeze-dried bone allograft, or a combination. Excessive graft should not be placed to avoid interferance with repositioning of flap.

Flap closure: Primary closures of the gingival flaps without excessive tension are the therapeutic endpoints. Flap should be closed using non resorbable interruptrd loop sutures. Total recovery from procedure takes 7 to 10 days. Antibiotics and analgesics are prescribed for five days along with chlorhexidine mouth rinses. Sutures are left for 1-2 weeks.

Orthodontic Adjustments: The placement of orthodontic brackets and activation of the arch wires are typically done the week before the surgical aspect of PAOO is performed. After full recovery from the procedure, orthodontist adjusts brackets about every two weeks. However, if complex mucogingival procedures are combined with the PAOO surgery, the lack of fixed orthodontic appliances may enable easier flap manipulation and suturing. After flap repositioning, an immediate heavy orthodontic force can be applied to the teeth and in all cases initiation of orthodontic force should not be delayed more than 2 weeks after surgery. A longer delay will fail to take full advantage of the limited time period that the RAP is occurring. The orthodontist has a limited amount of time to accomplish accelerated tooth movement. This period is usually 4 to 6 months, after which finishing movements occur with a normal speed. Depending on the case, orthodontic treatment extends from 3 months to 9 months and retainers for at least 6 months is compulsory.

BENEFITS OF WILCKODONTICS [11]

1. Rapid tooth movement, lesser treatment time and lesser relapse than conventional orthodontics
2. More bony support and reduced periodontal problems.
3. Less root resorption, less furcation invasion, less chances of gingival recession and subsequent cervical abrasion following orthodontic treatment.
4. No facial profile change.
6. Reduced need for appliances and headgear.
7. Utilization of both metal and ceramic brackets.

CLINICAL APPLICATIONS

The clinical applications for the Wilckodontics or PAOO procedure include:

1. Facilitation in eruption of impacted teeth and slow orthodontic expansion.
2. Acceleration in retraction of canine after premolar extraction.
3. Resolving crowding and shortening treatment time.
4. Enhance stability after orthodontic treatment.
5. Open bite correction and molar intrusion.
6. Manipulation of anchorage.

COMPLICATION AND SIDE-EFFECTS:

Although rare but some complications and side effects may occur in few cases which include:

1. Subcutaneous hematomas of the face and the neck.
2. Mild pain, swelling, and infection.
3. Requires use of anesthesia.
4. Patients on regular use of NSAIDs cannot be treated with this technique.
5. Does not lend itself to Class III malocclusion cases.

MODIFICATION OF WILCKODONTICS

Usage of autogenous soft tissue graft:

One of the drawbacks faced in this technique is the exposure of the root surfaces in some areas which can be due to the thin gingival biotype as well as thin cortical plate of bone. Hence, the usage of autogenous soft tissue graft such as connective tissue grafting which is still considered to be the gold standard among all other soft tissue grafting techniques can be included under the full thickness flap reflected.[12]

Piezosurgery:

Conventional tools such as chisel and mallet or motor-driven instruments such as surgical burs, microsaws with external irrigants, or trephine burs have been used traditionally in performing corticotomy procedures which require greater exposure of the surgical site and are difficult to control in areas which require precise cut and are densely mineralized. In addition, the frictional heat generated by motor-driven instruments may also hinder the healing process. To overcome these disadvantages the piezoelectric device (Piezosurgery®) has been introduced. Piezosurgery® can be used in periodontology and implantology to supplement the existing oral surgical procedures and in some cases as a replacement. The mild vibratory movements of the Piezosurgery® knife enables it to be used with greater precision to cut and causing less discomfort to the patient when compared to traditional surgical instruments.[13]

Lasers:

Laser assisted flapless corticotomy is a useful non-invasive procedure for reducing treatment time and damage to periodontium. It enhances the orthodontic tooth movement by reducing the cortical bone layer following Erbium, Chromium doped Yttrium Scandium Gallium Garnet (Er-Cr: YSGG) laser irradiation, without surgical flap reflection.[14]

Monocortical tooth dislocation and ligament distraction (MTDLD) technique

The use of Monocortical tooth dislocation and ligament distraction (MTDLD) technique combines two different dental movements that work separately but simultaneously on opposite root surfaces. On the root surface corresponding to the direction of movement, vertical and horizontal microsurgical corticotomies are performed around each tooth root with a piezosurgical microsaw to eliminate cortical bone resistance. The immediate application of strong biomechanical forces produces rapid dislocation of the root and the cortical bone together. On the root surface opposite the direction of movement, the dislocation force produces rapid distraction of ligament fibers. During the osteogenic process that follows, application of normal orthodontic biomechanics achieves the final tooth movement.[15]

CONCLUSION

Wilckodontics a coalescence of perfection, has made adult orthodontics a facilitated and fast reality. The technique developed from incorporating the older concepts elicits tissue response which has been proved to be beneficial in the treatment of clinical situations like de-crowding, molar intrusion etc. Hence Wilckodontics , even with the economical constrains can turn out to be an attractive treatment option and a revolution for both the patients and orthodontists.

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