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Utility Arches: Simple Yet Effective

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Abstract:
The utility arch is a crucial and versatile tool that assists in both interceptive and comprehensive orthodontic treatments. It can be used during different stages of orthodontic treatment, whether it is in mixed or permanent dentition.

Originally developed in 1977 by C.J. Burstone, the utility arch was created to align the curve of Spee in the mandible utilizing biomechanical principles. Over time, the utility arch was further adapted and refined by Ricketts and became an essential key component of Bioprogressive Therapy, a modern orthodontic treatment approach. The utility arch is particularly useful for intruding upper and lower incisors, as well as protruding and retruding anterior teeth.

*Ricketts utility arch is a 2*4 appliance wire that is advantageous in effective control over the incisors and molars axial inclination along with effectual correction of deep bite, and anterior crossbite. Furthermore, it stabilizes teeth passively during mixed dentition.*

This paper aims at propounding a series of case reports broaching a novel orthodontic treatment approach utilizing intrusion and protraction utility arches for a Class II Div 2 malocclusion with deep bite. The protraction utility arch was implied for the correction of reverse overjet in Class III malocclusion.

Key Word*: Utility arch, Intrusion arch, Class II div 2*

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I. Introduction

The utility arch is an auxiliary archwire that has been developed according to the biomechanical principles described by C.J. Burstone. It was later refined for incorporation into Bioprogressive therapy by Ricketts. Initially, it was developed to provide a method of leveling the curve of Spee in the mandible, but it has been adapted to perform functions beyond just lower incisor intrusion. It serves several purposes at different stages of orthodontic treatment.

The utility arch is although a complete arch that extends across both buccal segments yet engages only the first molars and the four incisors.

With a 0.018" appliance, the recommended wire for the mandibular arch is .016" x .016" or .016" X .022" Blue Elgiloy (not heat-treated). And for most maxillary arches, .016" X .022" Blue Elgiloy is recommended.

With a 0.022" appliance, .019" X .019" Blue Elgiloy can be used in either arch. When using utility arches in combination with full arch appliances, it is necessary to have auxiliary tubes in a gingival position on the first molar bands. In a pre-orthopedic phase of treatment when the buccal segments are not banded, the main buccal tube or bracket on the first molar can be used to anchor the utility arch posteriorly.

With the advent of TMA wires by Charles Burstone in 1981, properties like high spring back and high formability with low stiffness which yields large deflections for low forces came into play. Thus, utility arches are now fabricated with TMA wires.

II. Malocclusions And Their Correction

Individuals particularly those with elongated facial structures often suffer from a significant overbite, Class II malocclusions, or a Class II pt A to pt B relationship. In such cases, it is imperative to maintain control over the vertical dimension without causing mandibular rotation downward and backward along with consecutive incisor intrusion necessarily. However, patients with smaller vertical dimensions or potential for vertical growth benefit most from posterior teeth extrusion as a treatment option.

Class II malocclusion is generally explained as the distally placed relation of the mandibular arch concerning the maxillary arch along with an amalgamation of distinctive components of the dentition and skeleton affecting the patient's facial esthetics besides the functional status. The correlation between facial esthetics and sagittal occlusal relationship has been extensively researched, dating back to Angle's pioneering studies revealing that even minor deviations in tooth alignment can disrupt the contours of a patient's face, causing disharmony.

Deep overbite, one of the most prevalent malocclusions is a paramount challenge of Class II treatment, characterized by the vertical overlap in the anterior region. Deep overbite is recurrent in adult patients either by their growth pattern or by dental-related factors, such as loss of the posterior teeth.

III. Methods Of Deep Overbite Correction

I. Intrusion of teeth – The movement of the centroid (geometric center of root) apically about the occlusal plane. Pseudo intrusion can be achieved by labial tipping of incisors around its centroid. This technique can be applied to both anterior and posterior teeth.
II. Extrusion of teeth – most efficacious in patients with mandibular growth. The methodology involves the movement of posterior teeth in the vertical dimension.
III. Combination – amalgamation of anterior intrusion along with posterior extrusion can be implemented for deep overbite correction.

The decision to intrude or extrude is based on at least 3 factors: skeletal convexity, vertical dimension, and interocclusal (freeway) space.

Determining the amount of growth estimated during treatment is essential to establish the limit to which posterior teeth can be extruded. In certain malocclusions, it may be more advantageous and effective to initially intrude anterior teeth, especially in Class II, Division 2 patients, even though the ultimate plan may not necessarily mandate intrusion.

Patients with flat mandibular planes and small vertical dimensions present an entirely different problem than long-faced individuals. It is desirable in many of these patients to increase the vertical dimension. Even in these patients, it may be necessary to intrude incisors. A biomechanical alternative to the intrusion of anterior teeth in patients with short vertical dimensions is to extrude posteriors initially and maintain fixed arches in place during treatment to allow time for adaptation to occur.

Orthodontic treatment mechanics involved in treating such cases include maxillary and mandibular tooth extrusion or intrusion, maxillary clockwise rotation, and curve of Spee flattening, however, intrusion utility arch is the most commodious method in the correction of deep bite.

Types Of Utility Arches And Their Biomechanics

Passive Utility Arch

As the name suggests, it is not meant to move the teeth in any direction and is not activated during treatment. The passive utility arch is used for stabilization or space holding. It is particularly useful during the mixed dentition phase as it allows the canines and premolars to erupt properly.

It originates in the auxiliary tube on the first molar and immediately a 90° bend is placed anterior to the tube, followed by a posterior vertical step. An additional bend at a right angle forms a horizontal segment that runs parallel to the occlusal plane. A bend at the embrasure between the canine and the lateral incisor redirects the wire upward toward the occlusal surface. For the incisal segment, the wire is bent at a final 90° angle and positioned in the brackets of the upper anterior teeth. Any irregularities in the position of the upper anterior teeth are usually corrected with a sectional leveling arch before a utility arch is placed. The archwire is continued similarly to the opposite molar. (Fig.1)

Intrusion Utility Arch

The intrusion utility arch has a similar design to that of the passive arch, but it is activated to intrude the lower anterior teeth. A light continuous force is delivered post-activation. As with the passive arch, the intrusion arch is stepped down at the molars, passes through the buccal vestibule, and is stepped up at the incisors to avoid distortion from occlusal forces.

Engaging the utility arch produces approximately 25g of force on each of the lower incisors; a force level considered ideal for lower incisor intrusion. The overall effect is an intrusion and torquing of the lower

incisors, as well as a tipping back of the lower molars. Molar rotation and expansion or contraction of molar width can be achieved by activating the molar section of the arch. (Fig 2,3)

There is a slight retrusive activation of the arch by pulling the wire posteriorly and then twisting the end of the arch gingivally. Any type of utility arch can be activated for an intrusive movement by placing an occlusally directed gable bend in the vestibular segment.

Retraction Utility Arch

Its utilization in retracting and intruding incisors is obvious in cases of upper incisor flaring. However, this type of mechanics helps retract the four anterior teeth as a unit, particularly in the maxilla. The retrusion utility arch can close interproximal spaces while intruding and aligning the upper anterior teeth and correcting midline discrepancies. (Fig. 4)

The retraction utility arch starts from the auxiliary tube on the molar, and about 5-8mm of wire protrudes forward before a posterior vertical step of 3-4mm is placed. The vestibular segment extends forward to the interproximal region between the lateral incisor and the canine. Here, a 90° bend is placed, and a loop is formed in which the anterior leg crosses behind the posterior leg. After a 5-8mm vertical step forward, another right-angle bend carries the wire across the front teeth. An anterior contour in the wire is made to simulate the arch form.

Protraction Utility Arch

Utilized for proclining upper and lower incisors, particularly for flaring and intruding maxillary incisors in Class II malocclusion cases. In contrast to the retraction utility arch, the posterior vertical step of the protrusion arch must be flush with the auxiliary tube. The vestibular segment traverses anteriorly to the interproximal region between the canine and lateral incisor. The anterior leg of the loop is positioned mesially, thus providing a canine offset. The protrusive force is produced by tying the anterior segment of the utility arch into the anterior brackets. An occlusal-directed gable bend in the vestibular segment is used for intrusion. The anterior vertical step is 5-8mm long, the incisal segment runs through the incisor brackets. (Fig 5)

When the protrusion utility arch is passive, the anterior segment lies approximately 2mm anterior to the expected position in the incisor brackets. The protrusive force is produced by tying the anterior segment of the utility arch into the anterior brackets. An occlusally directed gable bend in the vestibular segment can be used for intrusion. The protrusion arch is activated by removing the anterior segment from the brackets, bending the posterior vertical step forward from 90° to 45°, and replacing the archwire in the brackets.

IV. Discussion

Class II div 2 malocclusions represent a specific irregularity in bite characterized by a specific ratio of teeth and jaw bases & a distinct skeletal profile - Orthognathic maxilla and retrognathic mandible along with a horizontal growth pattern and skeletal deep bite.

As previously discussed, the orthodontic approach for the deep bite correction method includes intrusion of the anterior teeth, extrusion of the posterior teeth, or both. The biomechanics of the intrusion utility arch is useful in achieving both mechanisms.

For, class III malocclusions are usually growth-related discrepancies and surgery can be part of the treatment plan but due to patients' nonconformity, the surgery is not possible. Therefore, the purpose of this report is to orthodontically treat such patients with a Class III malocclusion non-surgically with the help of the utility arch. Also, it is important to use the lowest magnitude of force that is capable of intruding the incisors. If the magnitudes of forces are too high, the rate of root resorption will increase not the rate of intrusion and with intrusion utility arch it is possible to control the applied force.

V. Conclusion

The utility arch is a vital and indispensable component of orthodontic treatment which is highly efficient in intruding upper and lower incisors while effectively protruding and proclining the anterior teeth. In addition, utility arches are extensively used in orthopedic and orthognathic surgical procedures.

Through this paper, we have presented the effectiveness of utility arches in various cases maintaining mandibular rotations imperatively and treating patients non-surgically.

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