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HYBRID APPLIANCES: AN UPDATE

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ABSTRACT: The advent of technology, increased public awareness and patient demands has evolved our speciality to develop with a variety of new and modified appliances. This paper describes various hybrid appliances which can be applied in different clinical situations according to the need of the patient. Selection of the components and their assemblies, resulting in appliance designs that uniquely match the needs of individual patients. Various appliances like fixed functional, esthetic mandibular advancement devices, hybrid hyrax, hybrid orthodontic treatment system, hybrid aligner therapy and biobloc therapy have been described in this paper.

INTRODUCTION: The Orthodontists job is to fit together the pieces of the human craniofacial complex puzzle. The expected outcome of this endeavor is a harmonious rearrangement that is not only functional, but also esthetically pleasing. Highly sophisticated technologies from the fields of imaging, computer graphics, robotics, computational analysis and database management are paving their way into the speciality. Over the years, for convenience and efficiency, the speciality has embraced various prefabricated and modified hybrid appliances.

Hybrid appliances are specifically customized to exploit the natural processes of growth and development. Currently there are various "named" hybrid appliances introduced in the market used to treat the same type of malocclusion, but their treatment approaches vary mainly due to difference in philosophies and/ or modifications from a previous appliance such as hybrid functional appliances.¹ Vig and Vig,² had introduced 'Component Approach' of selecting the components and their assemblies, resulting in appliance designs that uniquely match the needs of individual patients. Such an approach represents a departure from the practice of adopting a "named" appliance for the treatment of a malocclusion.

This article attempts to identify various salient components of an appliance and their contributions to the total design and different functions of such appliances in different situations.

HYBRID FIXED FUNCTIONAL APPLIANCES: Fixed functional appliances are effective in the management of Class II malocclusion especially for noncompliant, adolescent patients that does not require orthognathic surgery at a later stage.³ Fixed functional appliances have reported to correct Class II skeletal problems by encouraging mandibular growth and by eliciting dentoalveolar effects.⁴⁻⁵ These fixed functional appliances can be rigid, flexible or combination of both i.e hybrid. Various types of hybrid appliances are:

EUREKA SPRING: The Eureka Spring is a three part telescopic appliance fixed to the upper arch at the level of the molar band and to the lower arch distal to the cuspid. The main component of the Eureka spring is an open wound coil spring encased in plunger assembly.⁶

It has esthetic acceptability because of its small size and produces forces of only 140 - 170 grams at the points of attachment as compared to 220 - 280 grams of Jasper Jumper. The appliance is universal and it can be applied to both right and left side.

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SABBAGH UNIVERSAL SPRING: It is ideal for treating patients with insufficient cooperation, little remaining growth, disorders of the upper respiratory tract system such as asthma and patients who are allergic to plastics.

The Sabbagh Universal Spring can be universally used as a substitute for activator, Herbst, headgear, elastics as well as for the treatment of temporo mandibular dysfunction. Compared to other similar appliances, the Sabbagh Universal Spring has many possibilities for activation, such as turning the inner telescope tube or inserting the activation springs.¹

FORSUS: FATIGUE RESISTANT DEVICE: This is an inter - arch push spring which produces about 200 grams of force when fully compressed. The distal end of the Fatigue Resistant Device push rod inserts into the telescopic cylinder and a hook on the mesial end is attached directly to the archwire near the canine or premolar brackets.

The device gives the power to control the amount of force, whether through various available sizes or through the direct attachment to the lower arch and the use of a stop for activation. It allows for dental asymmetry correction when higher force on both sides is needed. The device allows patient to open and move their jaw more freely.^{7,8}

The Forsus Nitinol Flat Spring (FNFS) is an alternative fixed functional appliance described by Vogt in 2001.⁹ It has a Nitinol flat wire instead of the coil which is more esthetically acceptable. Force levels remain constant from the initial set -up to the time of removal. The results are faster and more efficient.

More recently, the Forsus Fatigue - resistant Device (FRD) EZ module was developed and has the advantage of ease of application onto molar band headgear tubes without additional implementation.¹⁰

THE TWIN FORCE BITE CORRECTOR: This appliance differs from others in form and constitution because it has two internal coil springs and consists of two joint telescopic systems. At the superior level it is fixed with a ball pin that is fitted into the buccal tube of molar band and fixed with a screw to the inferior arch. Such as in the previous appliance its application vary between Class II and Class III treatment, and it may be also used as an anchorage system.¹

The major drawback of this appliance is the difficulty to control the force. If we want less force, we should bend the mesial part of the ball pin in order to have more wire distal to the tube.

TWIN FORCE BITE CORRECTOR – DOUBLE LOCK: It is based on the system of lock-on screws. This new version facilitates the use of the appliance for Class III correction and it allows for a slightly better control of the force.

THE CALIBRATED FORCE MODULE AND ALPERN CLASS II CLOSERS: These appliances substitute Class II elastics, applied to the inferior arch close to the molars and fixed by a screw, and mesial or distal to upper cuspids, and also fixed to the arch. Its coil spring produced a force between 150 and 200 grams. The system generated tooth movement by employing gentle and continuous force 24 hours a day.¹

FIRST CLASS HYBRID MOLAR DISTALIZATION APPLIANCE: It is a combination of rigid buccally and flexible palatally positioned distalization force system. It has vestibular and palatal components.

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Formative screws are soldered on the buccal sides of the first molar bands, occlusal to the single tubes and split rings welded to the second premolar or second deciduous molar bands, control the vestibular screws. Stop screws are used to maintain the distal positions of the molars after active movement has been completed. In the palatal aspect, the appliance is modified Nance button and has a butterfly shape for added stability and support during retention. The butterfly section is soldered to the second bicuspid or deciduous molar bands.

Nickel titanium.010 "x. 045" coil springs, approximately 10 millimeters each in length, are fully compressed between the bicuspid solder joints and the tubes on the deciduous molar or second bicuspid bands. These springs are designed to balance the action of the vestibular screws, preventing molar rotations and development of posterior crossbites.¹¹

It produces rapid distalization of the maxillary first and second molars even when the second molars have completely erupted.

HYBRID HYRAX APPLIANCE-EARLY CLASS III TREATMENT WITH A HYBRID HYRAX-MENTOPATE COMBINATION: The Hybrid Hyrax-Mentoplate approach for early Class III treatment offers several advantages over other methods. Such a combination produces direct force by the Mentoplate or indirect by Hybrid Hyrax to skeletal structures. Rapid expansion opens the midpalatal sutures for better maxillary protraction. Anchorage is stable and reliable with such an appliance and no extraoral devices are required. The placement procedure is less invasive than when multiple miniplates are used. The upper and lower arches remain fully accessible for orthodontic tooth movements.¹²

HYBRID MANDIBULAR ANTERIOR POSITIONING APPLIANCES FOR OBSTRUCTIVE SLEEP APNEAS: Obstructive sleep apnea - hypopnea syndrome (OSAHS) is characterized by recurrent upper airway obstruction during sleep. Oral appliances (OAs) provided effective and safe long - term therapy for patients with OSAHS. Follow-up is recommended since long - term alterations take place, although these appear to be minimal.¹³ these appliances hold the lower jaw forward and open, preventing the tongue and throat tissues from collapsing the critical airway. These appliances reduce sleep apnea associated health risks without the need for surgery, medications, or other therapies. various appliances are:

SOMNOMED MAS: It is a Mandibular Advancement Splint (MAS) that treats both snoring and obstructive sleep apnea (OSA), by positioning the lower jaw forward. It is a custom made appliance consisting of upper and lower dental plates with a unique patented fin-coupling mechanism. The jaw is moved only to alleviate snoring and reduce OSA.¹⁴

NARVAL APPLIANCE: It is based on Computer Aided Designing – Computer Aided Milling (CAD-CAM) technology. It provides minimal bulk and absence of contact with incisors reduces dental sensitivity due to abrasion. Lateral flexibility eliminates “locked - in” sensation and offers a freedom to talk and drink. The patented Optimized Retention of the Mandible (ORM) articulation enhances mouth closing and physiological breathing during sleep.¹⁴

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MOSES APPLIANCE: Dr. Alan Moses introduced a unique design that actually encourages the tongue to move forward into the opening. It activates reflexes to advance the tongue. It lowers elevator muscle activity, reduces clenching and decreases bruxism. The two part design is extremely comfortable for the patient.¹⁴

SUAD APPLIANCE/ NASAL AIRWAY SYSTEM: It allows more lateral movement than most of the appliances and made for patients with clenching habit especially at night. The thermo flex material usually requires heating in warm water to soften it enough to place it every night. It also comes with a Morning Repositioner which is used for isometric exercises (Clenching on bicuspid area) for fifteen minutes in morning to help the bite return to normal.¹⁴

OASYS ORAL/ NASAL AIRWAY SYSTEM: It is the first dental device to be reviewed by both the dental and ENT divisions of the FDA and to be approved as a dental device for treatment of snoring and sleep apnea through mandibular repositioning and also acts as a nasal dilator for reduction of nasal resistance and improved nasal breathing.¹⁴

SILENT NITE: This device does not interfere with habit of mouth breathing and is one of the more comfortable designs. It is not made for severe grinders but it is a comparatively small device with tiny connectors attached to transparent flexible upper and lower forms.¹⁴

BIOBLOC ORTHOTROPICS: It a method of facial growth guidance which changes unfavourable vertical growth to more favourable horizontal growth often resulting in corrections similar to those that result from successful orthognathic surgery.

Biobloc appliance is another treatment modality for correction of Class II malocclusion and have different effects compared to functional appliances. It aims to redirect jaw growth anteriorly in a more horizontal direction so that a better oral posture and soft tissue facial profile can be developed. The Biobloc technique involves both the orthopedic and functional elements.¹⁵

The technique consists of several appliances used in sequence. The first appliance attaches to the maxilla and has an expansion screw to widen the maxilla, a palatal archwire to advance the anterior maxillary teeth.¹⁶ The second appliance, which also attaches to the maxillary teeth postures the mandible forward and has flanges extending inferiorly into the lingual vestibule of the mandible that prevent mandibular retrusion because the flanges elicit a pain response when the mandible is retruded. As both the arches are not tightly locked together via acrylic contacting the teeth, there is little or no retractive effect to the maxilla.¹⁶

HYBRID AESTHETIC FUNCTIONAL APPLIANCE (HAF): HAF appliance is intended to integrate aesthetics in functional orthodontic therapy. It is of double plate design consisting of thermoplastic and acrylic parts. The upper component is a vacuum formed plate, made of transparent hard polyethylene sheet with 2 mm thickness, equipped with an acrylic advancement bar positioned in the anterior midpalatal region. Similarly, the lower plate is constructed by thermoplastic material of the same width. An acrylic guidance surface is placed over the plastic coverage on the lingual surfaces of lower incisors and canines, aimed to fit the upper bar. The posterior teeth are intentionally exposed to facilitate eruption and leveling of a deep curve of Spee. This appliance meets both the therapeutic as well as aesthetic demands of young age groups.¹⁷

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HYBRID BITE JUMPING FUNCTIONAL APPLIANCE: This appliance is a forward bite jumping appliance used in Skeletal Class II malocclusion which primarily induces condylar growth.¹⁸ The appliance normalizes the growth pattern of the affected mandibular side to a greater extent in younger children (3–7 years) than in older ones (11 years) and in mild to moderate cases rather than severe. This appliances can be used for the treatment of hemifacial microsomia. Conventional treatment of patients with hemifacial microsomia involves orthognathic surgery or distraction osteogenesis of the mandible. A study showed that low – intensity pulsed ultrasound (LIPUS) enhances mandibular growth when combined with functional jaw orthopaedic appliances. The treatment protocol included daily application of LIPUS for 20 minutes along with a Hybrid Forward Bite Jumping Appliance. LIPUS application was performed for 8–12 months.¹⁹

HYBRID ORTHODONTIC TREATMENT SYSTEM (HOTS): Ikegami et al introduced an innovative method in first premolar extraction cases. It comprises the following three components: a miniscrew, Dual-dimension wires and Multiloop Edgewise Archwires (MEAW). The insertion of miniscrews allowed the maxillary canines to be retracted along the canine curvature with the round portion of the DDW (Dual-dimension Wire), along with simultaneous retraction the four incisors with the rectangular portion controlling their torque. In the finishing stage, after the closure of the extraction space, MEAW is used to further fine-tune the overjet, overbite, and posterior occlusal relationship.²⁰

HOTS consists of four clearly defined treatment steps: (1) Setup (Insertion of the miniscrews in the maxilla and initial leveling arch of 0.012-inch Ni-Ti wire), (2) Levelling (Further leveling and canine retraction with 0.016-inch Ni-Ti archwire) (3) Separate but simultaneous anterior and canine teeth retraction, (4) Final adjustment (Final overjet and overbite correction and settling of posterior teeth with MEAW).

QUICK STRAIGHT TEETH: It is the latest invisible technology that provides a very discrete and comfortable way to quickly align teeth with excellent results that can even be seen as quickly as 4 - 16 weeks.²¹ The treatment involves a programme of 5 transparent removable appliances that can be used singularly or in a combination to deliver the desired results to the patient:

- Q100 - It is a individually crafted clear removable tray that will gently and gradually aligns teeth.
- Q200 - It is quite similar to the Q100. The main difference being is that it has an added power chain on the front of the tray which focuses on moving the front teeth.
- Q500 - This is the flagship appliance in this systems range. As well as having the power chain, it also has the Q spring that focuses on aligning the front teeth forward and is designed to provide much faster results.
- Q300 - This is a hybrid of the Q500 appliance. It uses Adam's clasp for retention.
- Q400 - This appliance is again a hybrid of the Q500. It incorporates molar bands for retention.

HYBRID DISTRACTOR: It is a combined bone borne and tooth borne mandibular symphyseal distraction device. The hybrid distractor is secured by two mandibular bone screws and bonded circumdental wires on the mandibular canines or premolars. These appliances vary in patient acceptance, cost, invasiveness and patient comfort. The skeletal component of the total expansion achieved was greater in the hybrid distractor device as compared to other two devices. During distraction, the hybrid distractor effected more parallel expansion of basal and alveolar bone than the tooth borne distractor.²²

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CONCLUSION: Hybrid appliances form an useful addition to the clinician's orthodontic armamentarium. Many of these appliances need further studies to substantiate the claims made by their respective originators. With this in mind, clinicians must take great care in selecting the right patient and also pay attention to every detail in the manipulation to attain successful results with these appliances. It implies an understanding of craniofacial biology, the cause of malocclusion, the specific adaptation response to each named appliances. Clearly all appliances are capable of producing changes with proper diagnostic objectivity. The clinician can take advantage of the best parts of the appliance.

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