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Newer Archwires in Orthodontics

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Abstract **Review Article**

Recent advances in orthodontic wire alloys have resulted in a varied array of wires that exhibit a wide spectrum of properties. Appropriate use of these wires may enhance the patient comfort; reduce the chair side time and duration of the treatment. Though superior materials and techniques are now available and many replace conventional methods, one should keep in mind that no arch wire is ideal or best for all stages of treatment. Since arch wires are the main force system in orthodontics, the knowledge about newer arch wires will help us to select the appropriate wire within the context of their intended use during treatment.

Keywords: Archwires orthodontic.

INTRODUCTION

Orthodontics has achieved the status of a recognized specialty of dentistry because of a long period of craftsmanship and professional expertise. Esthetics has become today an important and integral part of the orthodontic treatment.

With the invention of revolutionary esthetic brackets, the need for esthetic wires became very strong. With the development of new alloys it becomes necessary to understand how the available energy of tooth movement varies with wire composition for wires of equal diameter [1].

Since, there is now a variety of orthodontic wire alloy from which choose the clinician is now faced with more decision in regard to wire selection. Future of the orthodontics lies in the effective and esthetic treatment.

Newer arch wires introduced in orthodontics include Supercable, copper- Niti, timolium wire, titanium niobium wire, optiflex archwire, bioforce wire combined wires, fiber reinforced composite archwire, teflon coated stainless steel wires and marsenol.

COPPER- NITI

It was Dr. Rohit Sachdeva who introduced a quartenary alloy of Nickel, Titanium and Copper & Chromium in 1994. This NiTi had both superelastic and shape memory properties. Due to the incorporation of copper these wires have better defined thermal properties than NiTi superelastic wires and showed better control over tooth movement. Wires are available in 3-transition temperatures 27, 35 & 40 degrees [2].

These third generation wires have shape-memory in addition to the low stiffness, high spring back, and super-elasticity of the first and second generation NiTi wires. The temperature range for the transition of martensitic to the austenitic phase forms the basis of the shape memory phenomenon. This was considered too low to be practical for orthodontic treatment earlier. The addition of copper to the alloy increases the transition temperature range approximating the intraoral temperature. This helps the patient to activate and deactivate the arch-wire by rinsing with warm and cold beverages [3].

Super cable arch wires

Super elastic nickel titanium coaxial wire known as ‘supercable’ introduced by Hansen in 1993 united the mechanical advantages of multi stranded

cables and the properties of super elastic archwires. These comprises of seven individual strands that are woven together in a long gentle spiral to maximize flexibility and minimize force delivery [4].

Advantages included improved treatment efficiency, simplified mechanotherapy, elimination of archwire bending, flexibility, ease of engagement regardless of crowding, minimal anchor loss, a light continuous force eliminating any adverse response of the supporting periodontium, minimal patient discomfort after initial archwire placement and fewer patient visits due to longer archwire activation periods [2].

But they are not devoid of any disadvantages. The wire ends have a tendency to fray if not cut with sharp instruments. Other disadvantages includes tendency of wires to split and untangle in extraction spaces, inability to create bends, steps, or helices and tendency of wire ends to migrate distally leading to soft tissue irritation as the teeth begins to align [5].

Titanium niobium wire

This arch wire is designed for precision tooth to tooth finishing. The stiffness of the wires is 80% of TMA wires. These wires are soft and pliable yet possess a resiliency after bending which becomes equivalent to stainless steel wires. Important features of this wire are- Used as finishing wire, soft and pliable, stiffness in bending is half of stainless steel, spring back in bending is 14% lower than stainless steel, good weld ability [6].

Timolium wire

It is an alpha beta alloy with titanium, aluminium, and vanadium as its components. This alloy has smooth surface texture, less friction, better strength than existing titanium based alloys, high yield strength and fewer surface defects. Timolium wires are excellent for all phases of treatment including alignment and bite opening, space closure as well as for torque control. Available in two arch form- standard and straight arch form [7].

Optiflex archwire

Optiflex is a totally esthetic non-metallic labial orthodontic arch wire designed by Dr. Talass in 1992 and manufactured by Ormco. It is made of clear optical fibre with distinctive mechanical properties with highly esthetic appearance and entirely stain resistant [8]. It consists of 3 layers-

a. A silicon dioxide core which provides the force for tooth movement.
b. A silicon resin middle layer which protects the core form moisture and adds strength.
c. A strain resistant nylon outer layer which prevents wire damage and further increases strength

Orthodontically beneficial properties of optiflex arch wires includes efficient tooth movement with light continuous force, increased flexibility producing a wide range of action thus invariably permitting its use with various bracket systems. However sharp bends in the wire should not be attempted. Metal ligatures should not be used as they can fracture the glass core.

When cutting the distal ends of the wire use the mini distal end cutter, which is designed to cut all the 3 layers of Optiflex. It is used in adult patients who are esthetically concerned. Optiflex wire can be used for initial alignment. It produces less force for the same amount of deflection when compared with coaxial wires. The optiflex archwires are expensive and needs to be changed every 4-6 weeks [9].

Bioforce wire

These are graded thermally active NiTi wires according to Evans and Durning classification. Method of force delivery is by variation in arch wire material composition or structure. Introduction of variable transition temperature within the same archwire leads to a form of graded force delivery within the same aligning archwire providing light force (80gms) in the anterior region and a heavier force of 300gms in the posterior region. The known manufacturer (GAC) has developed such greaded thermally activated nickel titanium wires as 'Bioforce' arch wire [10].

Combined wires

The anterior portion of combined wire is made of titanal and posterior part is of stainless steel. Titanal is a nickel titanium alloy manufactured by Lancer Pacific. It consists of 3 types. 1. Dual Flex-l, 2. Dual Flex-2, and 3.Dual Flex-3.

The Dual Flex-1: It consists of ananterior section made of 0.016-inch round titanal and a posterior section made of 0.016-inch round steel. At the junction of the two segments, cast ball hooks are present mesial to the cuspids. The flexible front part easily aligns the anterior teeth and the rigid posterior part maintains the anchorage and molar control by means of the "V" bend, mesial to the molars. It is used at the beginning of treatment. They are very useful with the lingual appliance, where anterior inter bracket span is less [11].

The Dual Flex-2: It consists of a flexible front segment composed of a 0.016 x 0.022" rectangular titanal and a rigid posterior segment of round 0.018" steel. The rectangular anterior titanal segment when engaged in the bracket slots impedes movement of the anterior teeth, while closing the remaining extraction sites by mesial movement of the posterior teeth [11].

The Dual Flex-3: This consists of a flexible anterior part of a 0.017 X 0.025-inch titanal rectangular wire and a posterior part of 0.018 square steel wire. The Dual Flex-2 and 3 wires provide anterior anchorage and control molar rotation during the closure of posterior

spaces. They also initiate considerable anterior torque [11].

Fiber reinforced composite archwire

Fiber reinforced composite arch wires are fabricated using a procedure called pultrusion. Fiber bundles are pulled through an extruder, in which they are wetted with a monomer resin. Then the monomer is cured with heat and pressure resulting in polymerization. Circular or rectangular wires are formed during curing.

This may be shaped into a different morphology by further curing, a process known as beta staging. For this, the monomer should initially only be partially cured. The composite archwires have higher kinetic coefficients of friction than stainless steel but lower coefficients than either Nickel-titanium or Beta-Titanium. At high forces and angulations abrasive wear of the composite surface at the archwire-bracket interface was observed. It can lead to release of glass fibers within the oral cavity, which is Unacceptable [12].

Teflon coated stainless steel wires

Teflon coating imparts to the wire a hue, which is similar to that of natural teeth. This coating protects the wire from the corrosion process. Lee white stainless steel wire has an epoxy coating and is suitable with plastic or ceramic brackets [4].

Marsenol

This is a tooth colored Nickel Titanium wire coated with an elastomeric poly tetra fluroethyl emulsion exhibiting all the same working characteristics of an uncoated super elastic Nickel Titanium wire, manufactured by Glenroe technologies [4].

CONCLUSION

Archwires are a very important and integral part of treatment with fixed orthodontic appliances. With the development in the field of orthodontics, many newer arch wires have come up that provides a clinician variety of options to choose from. These newer wires provides a lot of advantages over conventional wires in terms of efficiency, total treatment time, and finishing. Moreover, the demand for esthetic treatment options in orthodontics led to the development of esthetic archwires. These new archwires try to combine both esthetics as well as good clinic performance. The knowledge of these archwires is absolutely imperative to keep up with the newer trends.

REFERENCES

1. Malik, N., Dubey, R., Kallury, A., Chauksye, A., Shrivastav, T., & Kapse, B. R. (2015). A review of orthodontic archwires. Journal of Orofacial Research, 6-11.
2. Quintão, C. C. A., Menezes, L. M., & Elias, C. N. (2009). Force-deflection properties of initial orthodontic archwires. World journal of orthodontics, 10(1).
3. Dalstra, M., & Melsen, B. (2004). Does the transition temperature of Cu–NiTi archwires affect the amount of tooth movement during alignment?. Orthodontics & craniofacial research, 7(1), 21-25.
4. Agwarwal, A., Agarwal, D. K., & Bhattacharya, P. (2011). Newer orthodontic wires: A revolution in orthodontics. Orthodontic Cyber J, 1-17.
5. Sebastian, B. (2012). Alignment efficiency of superelastic coaxial nickel-titanium vs superelastic single-stranded nickel-titanium in relieving mandibular anterior crowding: a randomized controlled prospective study. The Angle Orthodontist, 82(4), 703-708.
6. Dalstra, M., Denes, G., & Melsen, B. (2000). Titanium- niobium, a new finishing wire alloy. Clinical orthodontics and research, 3(1), 6-14.
7. Krishnan, V., & Kumar, K. J. (2004). Mechanical properties and surface characteristics of three archwire alloys. The Angle Orthodontist, 74(6), 825-831.
8. Talass, M. F. (1992). Optiflex archwire treatment of a skeletal class III open bite. J Clin Orthod, 26, 245-252.
9. Nagalakshmi, S., Sriram, G., Balachandar, K., & Dhayanithi, D. (2014). A comparative evaluation of mandibular incisor decrowding with coaxial and optiflex arch wires and their load-deflection rates. Journal of pharmacy & bioallied sciences, 6(Suppl 1), S118.
10. Iijima, M., Muguruma, T., Brantley, W., Choe, H. C., Nakagaki, S., Alapati, S. B., & Mizoguchi, I. (2012). Effect of coating on properties of esthetic orthodontic nickel-titanium wires. The Angle Orthodontist, 82(2), 319-325.
11. Cannon, J.L. (1984). Dual-flex archwires. J Clin Orthod, 18(9); 648-9.
12. Kusy, R. P., & Kennedy, I. K. C. (1999). U.S. Patent No. 5,869,178. Washington, DC: U.S. Patent and Trademark Office.