Asian Pacific Journal of Nursing

Journal homepage: www.mcmed.us/journal/apjn

# A REVIEW ON DIFFERENT ORTHODONTIC WIRES

**[1]Gaurav Solanki* [1]Namita Lohra[1]Jaya Lohra[2]Renu Solanki**

[1]Jodhpur National University, Jodhpur, Rajasthan, India.
[2]Lachoo Memorial College of Science and Technology, Rajasthan, India.

**ABSTRACT**

Orthodontic wire is the basic need for any appliance. Wire comes in different size, material, properties etc serving different purpose for each type. The wire properly selected in size, material, properties serves as good tool in orthodontic practice when the wire is properly bent and tempered to project the desired force. Different types of alloyed wires have come still stainless steel wire remains the choice for any treatment. This articles focuses on different such wires.

**Key words:** Wires, Orthodontics Wires, Alloys etc.

Corresponding Author

**GauravSolanki**
Email:-drgauravsolanki@yahoo.com

Article Info

*Received 12/03/2014; Revised 20/03/2014*
*Accepted 03/04/2014*

## INTRODUCTION

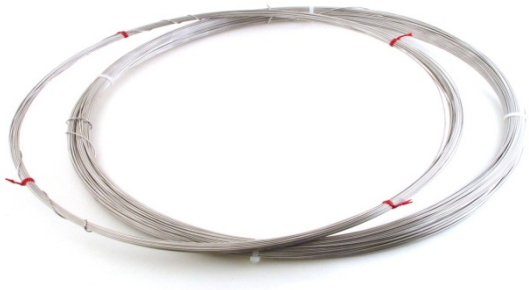
Wire is the basic need of all orthodontic appliances and practically all orthodontic forces for which appliances are used are projected by means of wires. The wire properly selected in size, material, properties serves as good tool in orthodontic practice when the wire is properly bent and tempered to project the desired force. The failure of many forms of treatment depends upon the correct selection of wires, possessing adequate properties combined with careful manipulation. Recent advances in orthodontic wire alloys have resulted in a varied array of wires that exhibit a wide spectrum of properties. The materials used by orthodontics have changed rapidly in recent years. In 1929 Lucien de Costa introduced austenitic stainless steel orthodontic wire with greater strength, high modulus of elasticity, good resistance to corrosion and low cost [1]. Presently we have many choices and one may select, from all the available wire types, one that best meets the demands of a particular clinical situation. The selection of the best wire available for particular situation provides the benefit of optimum and predictable treatment results. We must be aware of the mechanical properties and the clinical application of these wire, so that we can chose a right wire for particular condition. In this article we have discussed different type of wires namely: stainless steel, cobalt-chromium, nickel-titanium, beta-titanium etc.The objective of the article is to give the basic knowledge on orthodontic wire characteristics and usage [2].

### Gold Wires

Pure Gold is the noblest of all dental metals as it rarely tarnish and corrode in the oral cavity. It is inactive chemically and it is not affected by air, heat, moisture and most solvents. It is also the most ductile & malleable of all metals.Pure gold is extremely soft, but its hardness increases many folds after cold working & hard working. Although its ductility decreases after cold working, wire is the principal form in which wrought gold dental alloy is used. Nowadays the use of Gold alloys is markedly reduced because it is too soft to use as an orthodontic appliance and its high cost [3].

**Stainless Steel Arch Wires**

Stainless steel is the most widely used and accepted material in orthodontics. When 12 to 30% chromium is added to steel, the alloy formed is commonly called stainless steel. Smaller dimension of stainless steel wire are advocated in initial stage of treatment during alignment especially in severely displaced teeth due to high stiffness and high modulus of elasticity of these wires. Stainless steel has a lower spring back than those of newer titanium-based alloys. When we bend the stainless steel wire, then Residual stresses arises in the wire, which can markedly affect the elastic properties of the wire. To remove the residual stresses heat treatment is done after bending the wire into an arch, loops or coils. This helps to enhance the elastic properties of the wire [4].



**Advantages of Stainless Steel [5]**

- Low cost.
- Biocompatible.
- Excellent formability.
- Can be soldered and welded.

**Disadvantages of Stainless Steel:**

- High force delivery.
- Relatively low spring back.
- Corrosion after heating to temperatures required for joining.

**Chrome- Cobalt – Nickel Alloy Archwire:**

Cobalt – Chromium – Nickel Orthodontic wires are very similar in appearance, mechanical properties and joining characteristics to stainless steel wires, but have a much different composition and considerably greater heat treatment response. Cobalt-chromium (Co-Cr) alloys are available commercially as Elgiloy, Azura, and Multiphase. Elgiloy is available in four tempers: soft (blue), ductile (yellow), semiresilient (green), and red (resilient) in increasing order of resilience [6]. The differences in mechanical properties arise from proprietary variations in the wire manufacturing process. Since this wire fractures easily after heat treatment, all adjustments should be made before this precipitation-hardening process. Non heat-treated Co-Cr wires have a smaller spring back than stainless steel wires of comparable sizes, which can be improved by adequate heat treatment. In most circumstances mechanical properties of Co-Cr are similar to those of stainless steel except that it has greater resistance to fatigue and distortion and longer function as a resilient spring.

**Advantages [7]**

- Low cost.
- Biocompatible.
- Good formability.
- Can be soldered and welded.
- Excellent corrosion resistance in mouth.

**Disadvantages:**

- High elastic force delivery
- Lower spring back than stainless steel.

**Nickel-Titanium Arch Wires:** The name Nitinol is an acronym derived from the elements which comprises the alloy, Ni from nickel, Ti from titanium and Nol from Naval ordinance laboratory. It is available as NiTi, Nitinol, Orthonol, Sentinol and Titanal.The most advantageous properties of nitinol are the good spring back and flexibility, which allow for large elastic deflections. It is useful in circumstances that require large deflections but low forces. Nitinol wires have greater spring back and a larger recoverable energy than stainless steel or beta-titanium wires when activated to the same amount of bending or torquing. This results in increased clinical efficiency of nitinol wires since fewer arch wire changes or activations are required [8].

**Beta Titanium Arch Wires:** Beta titanium is the newest alloy to be introduced. Titanium has been used as structural metal since 1952 and is commercially available as TMA (titanium-molybdenum alloy). Beta titanium has a modulus of elasticity lesser than stainless steel and about twice that of nitinol. This makes its use ideal in situations where lesser amount of forces is required.The spring back for beta titanium is superior to that of stainless steel but less than Nitinol arch wires. A beta-titanium wire can therefore be deflected almost twice as much as stainless steel wire without permanent deformation. Beta-titanium wires also deliver about half the amount of force as do comparable stainless steel wires [9].

**Multi Stranded Wires:** Very small diameter stainless steel wires can be braided or twisted together by the manufacturer to form larger wires for clinical orthodontics. In terms of performance, the wire is delivering higher forces per unit of activation over a greater distance and strength is also increased. The result is an inherently high elastic modulus material with low

stiffness because of its co-axial spring like nature. It can Investigation, Kusy and Stevens state that although the elastic properties of multi stranded wires vary widely, several of these wires compare favorably with some of the beta-titanium and nitinol wires [10].

**CONCLUSION**

One cannot deny the use of stainless steel wires be round or rectangular in shape. In a more recent even though there are more advanced wires available to us in dentistry today. The stainless steel is the most commonly and widely used orthodontic wires for fabrication of any appliance. Though newer wires are proving to be of good quality and soon will be used widely.

**REFERENCES**

1. Hugh. Wire. Encyclopaedia Britannica. Cambridge University Press. 1911, 11th ed, 738.
2. http://www.ada.org/3061.aspx.
3. R Vanarsdall. (2000). Orthodontics, Current Principles and Techniques. Diagnosis and Treatment Planning in Orthodontics. Mosby.
4. Robling. (2006). Biochemical and Molecular Regulation of Bone Remodeling. *Annual Review of Biochemical Engineering*, 1–12.
5. Orthopedic Research Society. Bone disposition, bone resorption, and osteosarcoma. 2010.
6. http://www.ncbi.nlm.nih.gov/pubmed/20225287.
7. Alana K. (2010). Orthodontic Reviews. *World Journal of Orthodontics*, 11, 16–22.
8. Annie. (2011). Orthodontics Treatment Using Three-Dimensional Model Simulation. Regents of the University of Minnesota.
9. Artun J. (2005). Apical root resorption six and 12 months after initiation of fixed orthodontic appliance therapy. *Angle Orthod*, 75(6), 919–26.
10. Vergari A. (2000). A radiographic comparison of apical root resorption after orthodontic treatment with a standard edgewise and a straight-wire edgewise technique. *Eur J Orthod*, 22(6), 665– 74.