Valley International Journals
Open Access Journal
New Thinking New Innovation

International Journal Of Medical Science And Clinical Inventions
Volume3 issue 12 2016 page no. 2446-2449 e-ISSN: 2348-991X p-ISSN: 2454-9576
AvailableOnlineAt:http://valleyinternational.net/index.php/our-jou/ijmsci

Archwires: A Walk for an Orthodontist

Dr.Roli Nath BDS[1], Dr.Aravind S Raju MDS[2], Dr.Renji K Paul MDS[3], Dr.Harish Koushik MDS[4] Dr.Merin George MDS[5]

[1]Consultant Dental Surgeon E-100 , East of Kailash New Delhi
[2]Associate Professor, Department Of Orthodontics ,St.Gregorios Dental College Kerala.
[3]Associate Professor,Department of Orthodontics St.Gregorios Dental College Kerala
4Associate Professor, Department of Orthodontics, Krishnadevaraya College of Dental Sciences Karnataka
[5]Assistant Professor ,Department of Oral Medicine and Radiology, Mar Baselios Dental College Kerala.

Corresponding Author : Dr.Roli Nath BDS

Consultant Dental Surgeon,E-100 , East of Kailash ,New Delhi

ABSTRACT: As we know orthodontics was the first speciality in dentistry there were many innovations tookfor the progress needed to make the speciality. Hence innovations in the archwires was very important. The original archwires used in orthodontics were made of gold but metallurgical advances have meant that a wide range of metal alloys are now available. This article reviews about the evolution and progress made in the archwires for orthodontic tooth movement.

Key Words : Archwires ; Alloys ; Orthodontist .

INTRODUCTION

The ideal properties required of an orthodontic archwire will depend upon the stage of treatment and the type of tooth movements being carried out and no archwire material will offer all of these together according to Kapila & Sachdeva. For this reason, a number of different archwires are required during a course of orthodontic treatment and these will vary in both the type of metal used and the dimensions. The particular sequence that an orthodontist chooses is often down to personal preference.[1]

HISTORY

According Greekmore in 1982 , in orthodontics we need less force and greater tooth movements. Hence use of archwires in the bracket slot was very important.Based on the writings of Schwartz , Father of Fixed and Edgewise Orthodontics , Dr. Edward Angle , used archwire termed the E arch in which E stands for Expansion. Dr.Angle and his disciples made use of many arch wire provided it was a gold alloy. Stainless steel was not used in orthodontics until the 1930's . The gold arch wire size as selected by Dr.Angle measured 0.022 by 0.036 inches . Initially the 0.036 inch dimension was occlusogingival or placed in a ribbon arch. In 1925 Dr.Angle proposed the Edgewise appliance and hence further refinements was made and hence gold alloy edgewise archwire was reduced in size to 0.022 by 0.025 inch. In the 1940's stainless still replaced gold alloys for orthodontic appliances. In 1990's full size rectangular archwires are available that deliver less force than small diameter , round stainless steel.

TYPES OF ARCHWIRES

STAINLESS STEEL

Stainless steel, or a cobalt–chromium alloy (Elgiloy; Rocky Mountain Co.) with similar properties, replaced precious metal in orthodontics because of considerably better strength and springiness with equivalent corrosion resistance. Stainless steel's rust resistance results from a relatively high chromium content. A typical formulation for orthodontic use has 18% chromium and 8% nickel (thus the material is often referred to as an 18-8 stainless steel). These material entered dentistry in 1919 being introduced by Krupp's Dental Polyclinic in Germany by company's dentist Dr.F Hauptmeyer.[1] The steel ligatures used to tie orthodontic archwires into brackets on the teeth are made from such "dead soft" wire. Steel archwire materials are offered in a range of partially annealed states, in which yield strength is progressively enhanced at the cost of formability. The steel wires with the most impressive yield strength ("super" grades) are almost brittle and will break if bent sharply. The "regular" grade of orthodontic steel wire can be bent to almost any desired shape without breaking. If sharp bends are not needed, the super wires can be useful, but it is difficult to show improved clinical performance that justifies either their higher cost or limited formability.[2,3]

COBALT -CHROMIUM ALLOY :

Elgiloy, the cobalt–chromium alloy, has the advantage that it can be supplied in a softer and therefore more formable state, and the wires can be hardened by heat treatment after being shaped. The heat treatment increases strength significantly. After heat treatment, the softest Elgiloy becomes equivalent to regular stainless steel, while harder initial grades are equivalent to the "super" steels. This material, however, had almost disappeared by the end of the twentieth century because of its additional cost relative to stainless steel and the extra step of heat treatment to obtain optimal properties.[3]

AUSTRALIAN ARCHWIRE

A J Wilcock of Australia came with a new wire called Australian archwire .It became famous because it combines high resiliency with toughness . This wire has been mainstay of Beggs Technique . There are various grades of archwire such as regular , regular plus , special , special plus , premium , premium plus and supreme.[4]

NICKEL TITANIUM ARCHWIRE :

Niti archwires are of many types depending on the generations :

First generation : Reported by Andreasen in 1971 . It was marketed as Nitinol by Unitek /3M . For clinical orthodontics it had very low elastic modulus and and extremely wide working range.

Second generation : Chinese Niti which had a property of superplastics .It exhibits non linear loading and unloading characteristics more pronounced than those of the original nitinol wire.

Third generation : Japanese Niti which had superplastics behaviour and shape memory characteristics of theses alloy are based on reversible transformation between austenitic and martensitic Niti Phases.

Fourth Generation : In the early 1990's thermally activated nickel titanium wire were introduced whose transition temperature is close to the level of body temperature.

Archwires formed from nickel–titanium alloys are extremely useful during initial orthodontics alignment due to their exceptional ability to apply light force over a large range of activations. The first nickel–titanium alloy was developed for the space program and named nitinol (Ni, nickel; Ti, titanium; NOL, Naval Ordnance Laboratory). The properties of NiTi alloys cannot be discussed without first understanding that these alloys can exist in more than one crystal structure. At lower temperatures and higher stress, the martensitic form is more stable, while at higher temperatures and lower stress, the austenitic form is more stable. Although many metal alloys exist in different crystal structures, the uniqueness of NiTi is that the transition between the two structures is fully reversible and occurs at a remarkably low temperature. This phase transition allows certain NiTi alloys to exhibit two remarkable properties found

DOI:10.18535/ijmsci/v3i12.7

in no other dental materials—shape memory and superelasticity.[5]

BETA-TITANIUM

In the early 1980s, after Nitinol but before A-NiTi, a quite different titanium alloy, beta-titanium (beta-Ti), was introduced into orthodontics. This beta-Ti material (TMA, Ormco/Sybron [the name is an acronym for titanium-molybdenum alloy]), was developed primarily for orthodontic use. It offers a highly desirable combination of strength and springiness (i.e., excellent resilience), as well as reasonably good formability. This makes it an excellent choice for auxiliary springs and for intermediate and finishing archwires, especially rectangular wires for the late stages of edgewise treatment.[6]

CHINESE NITI

In 1985 Dr.Tien Hua Chang developed Chinese NITI. These wires were studied by means of a bending test to determine wire stiffness , spring-back and maximum bending moments . These wires have an unusual deactivation curve in which relative constant force are produced over a long range of action. these wires can be defected 1.6 times as far as nitinol wire or 4.4 times as far as stainless Steel wire without appreciable permanent deformation.[7]

JAPANESE NITI

In 1986 a new Japanese nickel titanium alloy wire was developed by the Furukawa Electric Co. Ltd of Japan. These wire exhibit an unusual property termed superelasticity which no orthodontic wire has shown. These wires are least likely to undergo permanent deformation during activation.[8]

ROCKING CHAIR NITI

These wire are super elastic reverse curve archwires which have an excellent choice for initial levelling , bite opening and closing , consolidation. The unique rocking chair shape has multidimensional bends permanently forged into the wire to counter unwanted tooth movements.[9]

COPPER NITI

These were the newer wires which were developed by Rohit Sachedeva and Suichi Miyazaki in the year 1994. They are various transformation temperatures ranging from 15 degrees C , 27 degrees C, 35 degrees C and 45 degrees C (C- Celsius).[10]

CV Niti : Masel intriduced CV niti wires as an alternative to copper niti wires . They are three types 27 degree celsius for maximum force activation ; 35 degree celsius for moderate force activate on and 45 degree celsius for moderate force activation. [11]

MUTLISTRANDED ARCHWIRES

Dentaflex is available as triple strand , coaxial six strand and braided eight strand. D-Rect is an 8 stranded interwoven braided rectangular arch wire with 3 dimensional control and slot filling capabilities.Respond is 6 stranded with central core wire which deliver bight initial forces while filling the archwire slot for greater control.[12]

OPTIFLEX ARCHWIRE :

This was designed by Dr.Talass in the year 1992.These wires have three layers which consists of silicon dioxide core which provides force for the movement of teeth. Silicon resin middle layer protects the core from moisture and adds strength and stain resistant nylon outer layer.[13]

LEE WHITE WIRE

These wire manufactured by LEE PHARMACEUTICAL is a resilient stainless steel or nickel titanium arch wire bonded to a tooth coloured EPOXY coating suitable for ceramic and plastic brackets.

POLYPHENYLENE POLYMERS AS ESTHETIC ORTHODONTIC ARCHWIRES

Polyphenylene (Primospire, Solvay Advanced Polymers, Alpharetta, Ga) polymer was extruded into wires with clinically relevant round and rectangular cross sections. Tensile, flexure, spring-

DOI:10.18535/ijmsci/v3i12.7

back, stress-relaxation, and formability characteristics were assessed. Arch forms and secondary shapes were formed. Smooth wires with consistent cross-sectional dimensions, high spring-back, and good ductility were produced. Forces delivered were generally similar to typical beta-titanium and nickel-titanium wires of somewhat smaller cross sections. The polyphenylene wire did experience stress relaxation for up to 75 hours. The force magnitudes place polyphenylene wires in the category of an alignment or leveling wire. High formability allowed shape bending similar to that associated with stainless steel wires.[14]

CONCLUSION

Archwires along with the bracket system play an important role for the physiological tooth movement. Each stage of treatment an orthodontist has to follow sequence of archwire to obtain a goal set for orthodontic tooth movement. Availablity of many archwires has changed the field of orthodontics.Still research are taken to improve the material property to obtain a maximum result.

REFERENCES

1.Proffit W.R., Fields H.W Jr.: Contemporary orthodontics – Mosby 3rd Edition 2000 :326-334.

2.Klump JP , Duncason MG , Nanda , Kurier GF . Elastic energy stiffness ratio for selected orthodontic wires . AM J Orthod Dentofacial Orthop : 1994 ; 106 (6) : 588 -596.

3.Cramb AW. A short history of metals .Available at : http :// www.cdaqro.com/hostory/metals.htm.

4.Wilcock A.J., Jr. : Applied materials engineering for orthodontic wires. Aust. Jor. Orthod. 1989; V:22-29.

5 . Graber TM ; Vanarsdall RL .Orthodontics - Current Principles and Techniques, 3rd ED , Mobsy . 2000.

6.Burstone CJ; Goldberg AJ ; Beta - titanium : a new orthodontic Alloy .Am J Orthod 1980:77:121.

7.Burstone CJ ; Qin B ; Morton JY. Chinese Niti wire - A new orthodontic Alloy . Am J Orthod 1985 ; 87 ; 445 - 52.

8.Miura F;Mogi M ; Ohura Y ; Hamanaka H. The super-elastic property of Japanese NiTi alloy wire for use in orthodontics .Am J Orthod 1986 ; Jul 90(1) ;1 - 10 .

9.Xie L ; Chen L ; Zhang LN ; Gao H ; Zhang J . Three dimensional changes of lower teeth with Niti round or square rocking chair archwire. Shanghai Kaou Qiang Yi Xue ; 2012 ; Feb 21(3) ; 66 - 72.

10. Kapila S , Sachdeva R. Mechanical Properties and clinical application of orthodontic wires. Am J Orthod and Dentofac Orthop. 1989 :96 ; 100-109.

11. Kusy RP. a review of contemporary archwires : their properties and characteristics. Angle Orthod : 1997 ; 67 ;445 - 52.

12.James LC .Dual flex archwires .J Clin Orthod ;1984 ; 18(9) ; 648 - 649.

13.Talass ME. Optiflex archwire treatment of a skeletal Class 2 Open bite . J Clin Orthod 1992 :26 : 245 - 52.

14. Burstone CJ , Liebler SA, Goldberg AJ. Polyphenylene polymers as esthetic orthodontic archwires.Am J Orthod Dentofacial Orthop. 2011 Apr;139(4 Suppl):e391-8.

DOI:10.18535/ijmsci/v3i12.7