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Connecticut new archwire (CNA) -AREVIEW

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ABSTRACT

This article reviews Connecticut new archwire (CNA),a new variant of titanium molybdenum archwire (TMA)which was developed with the assistance of Dr. Ravindra Nanda at the University of Connecticut. CNA archwire is nickel-free and has more titanium but less molybdenum, zirconium, and tin.

This review throws light on the various characteristics of CNA wiresthatare not much known and studied, which could help in improving and enhancing the effectiveness of orthodontic treatment.

This archwire is an excellent alternative to TMA archwire, as it has a low deflection rate, least stiffness, and high formability. Because of its better range of action, high spring back, and less frictional resistance,makes CNA wires ideal for space closure in sliding mechanics.

As it displays superb formability for placement of loops and bends it can be used in loop mechanics due to consistent MF ratio throughout deactivation.

Keywords

Orthodontic wire, CNA wire, Beta titanium, Friction, Formability, nickel free.

INTRODUCTION

The emergence of the dental materials sciences in the field of orthodontics has helped orthodontists in improving clinical performance.Archwires are an essential part of orthodontic treatment to move the teeth to a targeted position by the application of forces to them.[1]Selecting the appropriate archwire requires a thorough knowledge of the biomechanical and clinical applications of various archwires.[2]

However, very little information is available in the orthodontic literature regarding the CNA wires.Hence,the objective of this review article is to give an insight into the composition, various properties, and clinical applications of Connecticut new archwires (CNA) orthodontic wires.

Composition of CNA wire

CNA wires were developed with the assistance of Dr. Ravindra Nanda. CNA wires are a new variant of TMA and in comparison, to TMA wires they are nickel-free and have more Titanium and less molybdenum, zirconium, and tin. (Table 1) The Zirconium in CNA wires contributes to increased strength and hardness and prevents the formation of an embrittling omega phase during processing at elevated procedures.[2] Less zirconium might contribute to decreased stiffness of CNA wires.

It being nickel-free makes these wires more biocompatible.

COMPOSITION	%
Titanium	80.75
molybdenum	9.78
zirconium	5.75
Tin	3.78
Nickel	0

Table 1: Composition of CNA wire.

Surface topography and mechanical properties

Surface roughness

Surface topography can critically affect the esthetics and performance of orthodontic components.

In the study conducted by Shraddha et al, the surface roughness was assessed usinga scanning electron microscope at a magnification of 200 x showed irregular surface with verticle fissures.

Surface profilometry showed that of the two titanium-based wires, CNA wire was smoother than TMA.[2]

Tensile strength

In a study conducted by Juvvadi et al standard tensile strength was evaluated using a Universal testing machine, it showed that the Ultimate tensile strength (UTS) of CNA wire was greater than TMAimplying greater fracture strength than TMA.

Youngs modulus

The E or Young's modulus corresponds to the elastic stiffness or the rigidity of the material.Increased values indicate stiffer wires.[3,4]

A study by Renato Parsekian Martinset al and Juvvadiet al showed that Young's modulus of CNA wire was the least, indicating that CNA wire was less stiff than TMA wire.[2,5]

Bending properties

Load deflection properties are critical in determining the biologic nature of tooth movement.[5]

In a study conducted byJuvvadi et al, CNA wire showed the least load-deflection compared to TMA. This would be of benefit in a clinical situation where engagement of the wire in the bracket of a malaligned tooth would deliver controlled forces to the tooth and supporting tissues.[2]

Evaluation of unloading characteristics showed the resilient and consistent nature of CNA compared with TMA wire, CNA had low stiffness and therefore higher spring-back.

Wire dimensions and force levels

Wire dimension plays an important role in tooth movement. Cross-sectional dimensions of TMA and CNA have been analyzed in a study by Juvvadi et al. CNA wires were closer to the stated dimensions than TMA hence with CNA wires there will be fewervariations with expected force delivery thereby ensuring greater predictability of tooth movement.

Frictional force

Friction between the bracket and archwire during sliding mechanics is of great concern in orthodontics, as it reduces the effectiveness of the orthodontic appliance and slows down tooth movement. The static and kinetic frictional forceswere lower of CNA wires compared to TMA wires.[2,9 11]

Clinical implications

1) It can be used in space closure due to less frictional resistance in sliding mechanics.
2) Can be used in loops mechanics due to consistent MF ratio throughout deactivation.[10]
3) Used in intrusionbecause ofslow force magnitude and force constancy from the memory and spring-back characteristics of the material.[9]

CONCLUSION:

- CNA wire has a smooth surface.
- Ultimate tensile strength (UTS) of CNA wire was greater than TMA implying greater fracture strength than TMA.
- Young's modulus of CNA wire is least indicating that CNA wire is less stiff than TMA wires.
- CNA wire has less load deflection rate.
- CNA wires exhibit fewer variations with expected force delivery as the wire dimensions are closer to the stated dimension.
- The static and kinetic frictional force was lower of CNA wires compared to TMA wires.

With all these properties CNA can be considered a superior alternative to TMA wires because of low deflection, least stiffness, and high formability.

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