

Awareness Regarding Different Types of Orthodontic Wires Among Undergraduate Students

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ABSTRACT:

INTRODUCTION: An effective orthodontic treatment depends not only on manual skills and understanding of clinical practices, but also on material awareness and selection. The choice of wires is one of the most important aspects of fixed orthodontic therapy.

AIM: The current study was focused on assessing the awareness level among the undergraduate dental students regarding the different types of commercially available orthodontic wires.

MATERIALS AND METHODS: This is the cross sectional investigation among the undergraduate dental school through a poll comprising 10 questions and was circulated among the undergraduates of various dental colleges, the sample size was 200.

RESULTS: The current study findings validate that the majority of the 4th year students were aware of the different types of orthodontic wire and the results of the current study indicated that there is also adequate awareness regarding the importance of different orthodontic wires.

CONCLUSION: From the survey it can be concluded that the dental students were aware of the different types of orthodontic wire and their uses in clinical practice.

KEY WORDS: Awareness;innovative survey; Knowledge;Orthodontic wire; Stainless Steel

INTRODUCTION:

At first Edward Angle began using nickel silver alloys in his orthodontic equipment in 1887. 14 to 18-carat gold was commonly used at the time. The advantage of employing gold alloys is that they may be heat treated to change their stiffness by roughly 30%. Excellent corrosion resistance. NiTi wires have been improved in order to increase their performance in dental levelling and alignment since they were initially introduced to the orthodontic market over thirty years ago. A successful orthodontic treatment requires not only manual abilities and clinical knowledge, but also material awareness and selection. One of the most significant parts of fixed orthodontic therapy is wire selection(1). Arch wires are the most common way for orthodontic treatment to generate forces. They are a functional component of fixed appliances. Through the use of brackets and buccal tubes, they are able to achieve varied tooth movements. Arch wires are made from a variety of metal alloys. When choosing wires for treatment, it's critical to understand the fundamental material properties. Orthodontic wires are devices that include a wire that aligns to the alveolar or dental arch and is used as an anchorage to correct abnormalities(2). In the early 1960s, the Naval Ordnance Laboratory in Silver Springs, Maryland, researched and produced the nickel titanium (NiTi) alloy(3). This alloy also has a special property known as shape memory, according to reports. Shape memory refers to a phenomenon that occurs in soft alloys that are easily formed at low temperatures(4).Orthodontic wires are parts of fixed appliances that are used to make the necessary tooth movements during orthodontic care. Orthodontic wires are made from a range of materials, including metals, alloys, polymers, and composites. Various laboratory tests, such as

tensile, torsional, and bending tests, are used to assess the properties of orthodontic wires(5).A new fiber-reinforced plastic orthodontic wire was created with a matrix of polymethyl methacrylate and biocompatible CaO-P2O5-SiO2-Al2O3 glass fibres that have high aesthetics as well as mechanical properties similar to metal wires(6).This material has a strong record, dating back to fixed orthodontic surgery, and wires come in a variety of shapes and sizes. As a result, the focus of this analysis was on the variations in wire features as well as their working sequence in relation to the treatment plan.(7). In olden times they began to experiment with various materials such as copper, nickel, and zinc alloys, 14-18 karat gold became his choice. Type IV gold alloys were the most commonly used material for wire production until the early 1930s(6).Stainless steel (SS) was first used in the field of orthodontics in 1929. It was created by a German firm and expected to be more durable than gold. Under tension, SS was said to be less likely to split. Because of the technical advantages of stainless steel and the fact that it was less expensive than gold, it began to gain popularity(8).

Multi-stranded stainless steel alloys are also available. Multi-stranded SS is similar to SS with loops in that it has several strands. Multi-stranded SS wires have less rigidity than single-stranded SS wires of the same diameter(9). This allows them to be used even in the early stages of treatment; their rigid structure is beneficial during the space closure and finishing phases of treatment because it prevents unwanted root growth. Cobalt was first used in orthodontic practise about 20 years later. The mechanical properties of Cr–Co were identical to those of SS. It did, however, require heat treatment in order to fully operate. Elgiloy is a proprietary alloy developed by the Rocky Mountain Orthodontics Company(10). A few years later, beta titanium alloy was produced. When heat treatment was applied to this alloy, it changed. Its atoms went through fundamental changes as a result of their structures. Beta-phase titanium alloy is another name for this alloy. In 1979, after stabilising the beta phase of titanium at room temperature in 1977, this alloy was used in orthodontics for the first time(9). Our team has extensive knowledge and research experience that has translated into high quality publications (11),(12),(13),(14),(15),(16),(17),(18),(19),(20),(21),(22) ,(23–27) (28),(29),(30) . The aim of the study is to evaluate the awareness about the orthodontic wires used among the undergraduate dental students

MATERIALS AND METHODS:

Study design, Area and study population:

A survey was conducted among dental students about knowledge and awareness regarding different types of orthodontic wires. The sample size of this survey was a total of 200 students. Participation in this study was voluntary and no incentives were provided to the participants. The survey was conducted in the month of February 2021.

Study Instruments:

A questionnaire was prepared after extensive review of the existing literature. The questionnaire was reviewed and amendments were made to improve clarity of pertinent questions and eliminate ambiguous responses. The survey instrument was a structured questionnaire with close ended questions. It consists of a brief introduction regarding the purpose of the study, questions pertaining to demographic data and questions regarding research objective 10 questions were circulated to the participants in a google form.The method of representation of the data is as pie chart

Data analysis

Only completely filled online forms were included in the study.The full response was verified by two reviewers and the controlled data was entered on the same day. The entered data were analysed using

SPSS. Descriptive analysis was performed to calculate frequencies of categorical variables. Chi square analysis was used to determine the association between the year of study and the responses to different questions in the survey. The level of significance was set at $p < 0.05$. The independent variables are age and sex. The dependent variables are knowledge and attitude.

RESULTS:

This study was conducted to assess the awareness level among the undergraduate dental student population regarding the different types of commercially available orthodontic wires. In this study, Figure 1 depicts the association between the year of the study and the responses for the query regarding the most common wire used in orthodontic treatment. 16.00% responded to stainless steel from 1st year, Majority (24.50%) of 2nd year students reported that Stainless steel wire is used, followed by 16% of first years followed by 13.00% of 3rd years and 9.50% from 4th year. Pearson chi square is less than 0.05. Hence statistically significant (Figure 1). Figure 2 represents the association between the year of the study and the responses to the query regarding the advantages of using stainless steel wire. 16.50% responded to excellent formability from 1st year, Majority (20%) of 2nd years responded that Stainless steel has excellent formability, followed by 16.50% of 1st years followed by 7.50 % of 3rd year and 9.50% of 4th year students.. Pearson chi square is less than 0.05. Hence statistically significant (Figure 2).

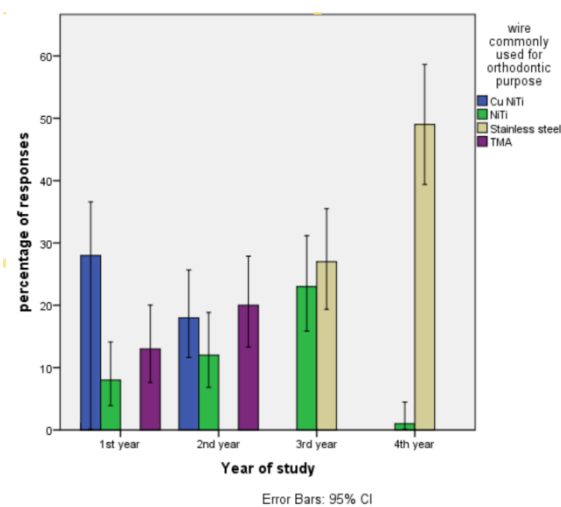


Figure 1: Bar graph showing the association between the year of the study and the responses for the query regarding the most common wire used in orthodontic treatment. X axis represents the year of study, Y axis represents the number of responses. 16.00% responded to stainless steel from 1st year, Majority (24.50%) of 4th year reported that Stainless steel wire is used, followed by 16% of first years followed by 13.00% of 3rd years and 9.50% from 4th year. Pearson chi square = 0.00 which is less than 0.05. Hence statistically significant.

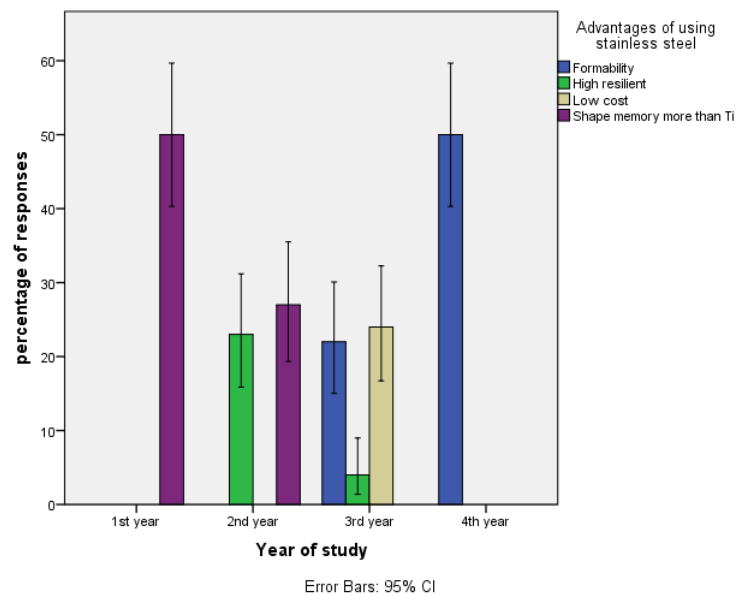


Figure 2: Bar graph showing the association between the year of the study and the responses to the query regarding the advantages of using stainless steel wire. X axis represents the year of study, Y axis represents the number of responses. 16.50% responded to excellent formability from 1st year, Majority 20% of 4th years responded that Stainless steel has excellent formability, followed by 20% of 1st year students answered that it has high shape memory than Ti followed by 7.50% of 3rd year answered that it is due to formability and 9.50% of 2nd year students.. Pearson chi square = 0.00 which is less than 0.05. Hence statistically significant.

DISCUSSION:

In previous studies they have found that Multi-stranded stainless steel alloys are also available(8). In previous studies they found that Multi-stranded SS is similar to SS with loops in which it has several strands(31). In previous studies they found that Multi-stranded SS wires have less rigidity than single-stranded SS wires of the same diameter(32)(33). In previous studies they have found that Stainless Steel has rigid structure and is beneficial during space closure(34). In previous studies they have found that Ferritic stainless steel wire is most commonly used in orthodontic treatment but in the present survey they have concluded that Austenitic stainless steel is most commonly used as orthodontic treatment(35). In previous studies they found that about all the dentists use NiTi for orthodontic treatment meanwhile in my survey they observed that stainless steel is most commonly used (36) In another study, Mandall et al. performed a clinical research with three wire sequence modules, which were randomly applied to patients. They separated into Group A and Group B in which Group A had a sequence of conventional 0.016-inch nickel–titanium, conventional 0.018×0.025-inch nickel–titanium, and 0.019×0.025-inch SS wires. Group B had a sequence of conventional 0.016-inch nickel–titanium, followed by 0.016-inch steels, and finally 0.020-inch SS wires.(37). In our study, the majority of participants (53.23 percent) cited great formability as a benefit of employing stainless steel in orthodontics followed by 33.33% of the participants selected low cost as the advantage of using stainless steel in orthodontics, followed by 10.45% of participants who responded that it has Spring back more than Titanium wires and 2.49% responded that stainless steel has the advantage of being high resilient. Ability of the wire to return to original shape after heating in which majority of the students about 37.31% responded to it as shape memory, 34.33% responded to it as called joinability, 15.52% responded to it as superelasticity and 11.94% responded it is as welding. Disadvantages of Cobalt Chromium Nickel alloy in which majority

(49.25%) responded it as loss in yield strength, 29.85% responded it as better corrosion resistance, followed by 12.44% of the participants who responded it as the high resistance to distortion and 7.98% responded it as formability. Most commonly used stainless steel in orthodontic treatment in which the majority of the participants around 54.23% responded it as Austenitic stainless steel, 33.33% responded it as Ferritic stainless steel and 11.94% responded that it as martensitic steel. Composition percentage of Nickel titanium alloy in which the majority of the participants around 49.25% responded it as 55% nickel and 45% titanium, followed by 24.38% who responded it as 45% nickel and 55% titanium, 14.43 of participants responded it as 65% nickel and 35% of titanium and 11.44% responded it as 35% nickel and 65% titanium. The percentage of cobalt in Cobalt Chromium Nickel alloy in which the majority of the participants ,around 47.26% responded it as 40% Cobalt, 24.36% responded it as 30%Chromium , 16.92% responded as 50% Cobalt and 10.95% responded it as 60% nickel .Beta Titanium is also called as majority of the participants about 52.24% responded it as Titanium Molybdenum. Which of the following is a soft type of Cobalt Chromium Nickel alloy in which majority of them (45.27%)responded that it is Blue elgiloy. Limitation of this study was the small sample size and the futurescope is to spread awareness regarding the different types of orthodontic wires and its importance in clinical practise.

CONCLUSION:

It is evident from the current survey that the majority of the dental students were aware about the different types of orthodontic wire and their uses. Out of the total study population, 4th year dental students possessed more awareness compared to others.

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CONFLICT OF INTEREST:

There was no potential conflict of interest.

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