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Safety of Noni mouthwash in Orthodontic patients - An Ion release study

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Abstract

Aim: The high incidence of nickel (Ni) allergy and the increasing use of Ni-containing and Cr-containing dental biomaterials have been of growing concern. The purpose of this investigation was to analyse and evaluate the rate of Ni and Cr ion release from different types arch wires used in orthodontics.

Materials and Methods: Two groups of arch wires (nickel-titanium [NiTi], SS) were stored in Noni mouthwash and tested at different intervals i.e., 1 hour, 6 hour, 12 hour, 24 hour and 1 week. The ions released from the sample (Ni and Cr ions) were evaluated using an atomic adsorption spectrophotometer.

Results: Ion release was insignificant in the solutions compared to the control solution

Conclusions: It can be concluded from our study that the amount of metal ions released was minimal in Noni mouthwash and it can be safely used as a routine mouthwash in Orthodontic patients.

Introduction

Alloys are an important constituent of every orthodontic appliance. Orthodontic treatment involves the use of archwires, brackets, ligature wires, soldered and welded metal attachments, that are made up of various alloys. Also all these materials are constantly placed under many stresses in the oral environment, which include immersion in saliva, ingested fluids, temperature fluctuations, and masticatory force.[1]

Alloy materials that are used in orthodontics, are usually made of stainless steel containing 8-12% Ni, 17-22% chromium, and various proportions of manganese, copper, titanium, and iron. These are extremely durable and relatively inexpensive. These materials have the property of corrosion resistance and biocompatibility , that makes it ideal to be used in oral cavity[1].

Nickel titanium (NiTi) and stainless steel arch wires that are used in orthodontic treatment, under cerain oral conditions, has the possible danger associated with arch wire corrosion that poses biologically harmful effects due to the released Ni and chromium ions[1]. Therefore, arch wire with a good corrosion resistance is crucial to its biocompatibility. On the other hand, the surface corrosion of arch wires may increase the friction that appears at the interface between the arch wire and bracket, reducing the free sliding action during orthodontic treatment.[2]

It is proven that ions are released from orthodontic archwires on exposure to various chemical mouthwashes. Since mouthwashes are routinely recommended in orthodontic therapy, the purpose of the study is to estimate the amount of ions released when the archwires are exposed to Noni mouthwash which is a herbal mouthwash.

Materials and method

Control group: Distilled water

Test Group: Noni mouthwash

Noni mouthwash preparation:

Step 1: Collection of Fresh ripe *M. citrifolia* fruits

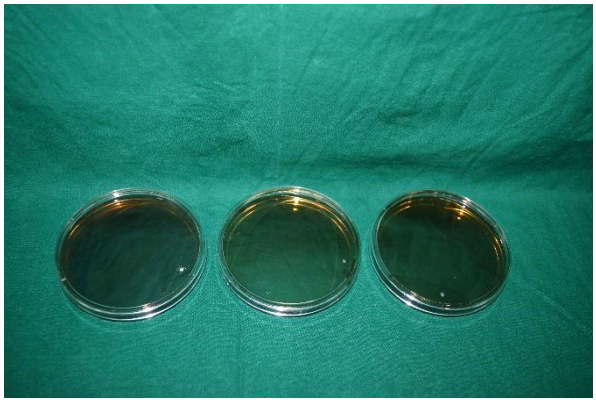
Step 2: 750 grams of Noni fruit was ground in an electronic blender that was sterilized with 70% ethanol.

Sterile water (500ml) was added to this pulp and the mixture was soaked for 2 days *in vitro*, at room temperature[3]

Two groups of archwires of different composition were used:

NiTi and Stainless steel (0.016x0.022 dimensions). These were then immersed in Noni mouthwash (Fig. 1,2) and distilled water in a petri dish for varying time intervals (Fig.1)

Figure 1 Wires immersed in Noni mouthwash



The time groups used were 1 hour, 6 hour, 12 hours, 24 hours and 1 week. Each time group had 3 samples and one sample from all time groups were selected randomly for analysis.

A volume of 20 ml of the test solution were collected and stored in glass sample bottles(Fig 2) and tested for the amount of ions present using an atomic adsorption spectrometer

Figure 2. Noni samples stored in glass sample vials

The atomic adsorption spectrophotometer (Figures 3 and 4)

Atomic absorption spectrometer measures the quantity of chemical elements in environmental samples by measuring the absorbed radiation. A reading of the spectra is produced when the sample is excited by radiation. Atomic absorption methods measure the amount of energy in the form of photons of light that are absorbed by the sample

For every element analyzed, characteristic wavelengths are generated in a discharge lamp (hollow cathode lamp), and in turn are absorbed by a cloud or vapor of that element(Fig.4).[1]

Figure 3. The atomic adsorption spectrophotometer

Figure 4. Absorption by the Cloud/ vapour

Results

Table 1 Nickel ion release in Noni mouthwash

Name	*Ave. ABS[Peak Height]*	*Conc. (ppm)*	*Fact Cons. (ppm)*	*SD*	*RSD(%)*	*Corr. Factor*	*Result**	*Measure Time*	*ABS.*		*Times*	*Valid*
STD 1	**0.0725**	1	**----**	**-**	**-**	**1**	**----**	**15:34:48 tt**	**0.0725**		**1**	**1**
STD 2	**0.1334**	3	**----**	**-**	**-**	**1**	**----**	**15:35:12 tt**	**0.1334**		**1**	**1**
STD 3	**0.229**	5	**----**	**-**	**-**	**1**	**----**	**15:35:37 tt**	**0.229**		**1**	**1**
Samp1	**0.3296**	----	**7.7181**	**-**	**-**	**1**	**7.7181**	**15:36:01 tt**	**0.3296**		**1**	**1**
Samp2	**0.0754**	----	**1.2218**	**-**	**-**	**1**	**1.2218**	**15:36:26 tt**	**0.0754**		**1**	**1**
Samp3	**0.0775**	----	**1.2755**	**-**	**-**	**1**	**1.2755**	**15:36:43 tt**	**0.0775**		**1**	**1**
Samp4	**0.0778**	----	**1.2832**	**-**	**-**	**1**	**1.2832**	**15:36:58 tt**	**0.0778**		**1**	**1**
Samp5	**0.0748**	----	**1.2065**	**-**	**-**	**1**	**1.2065**	**15:37:13 tt**	**0.0748**		**1**	**1**
Samp6	**0.0726**	----	**1.1503**	**-**	**-**	**1**	**1.1503**	**15:37:27 tt**	**0.0726**		**1**	**1**
Samp7	**0.0759**	----	**1.2346**	**-**	**-**	**1**	**1.2346**	**15:37:39 tt**	**0.0759**		**1**	**1**

Table 2.Interpretation of results(Nickel ion)

Sample 1 normal water	7.7ppm
Sample 2 Noni control	1.2ppm
Sample 3 Niti in noni mouthwash,1 hour	1.27ppm
Sample 4 Niti in noni mouthwash,6 hour	1.28ppm
Sample 5 Niti in noni mouthwash,12 hour	1.20ppm
Sample 6 Niti in noni mouthwash,24 hour	1.15ppm
Sample 7 Niti in noni mouthwash,1 week	1.123pm

Table 3.Chromium ion release from SS wires in Noni mouthwash

Name	Ave. ABS[Peak Height]	Conc. (ppm)	Fact Cons. (ppm)	SD	RSD (%)	Corr. Factor	Result*	Measure Time	ABS[Peak Height]	Times
STD1	**0.1103**	1	**----**	**-**	**-**		**----**	**13:54:43t**	**0.1103**	**1**
STD2	**0.0306**	3	**----**	**-**	**-**		**----**	**13:55:03t**	**0.0306**	**1**
STD3	**0.0551**	5	**----**	**-**	**-**		**----**	**13:55:32t**	**0.0551**	**1**
Samp1	**0.0006**	----	**7.6906**	**-**	**-**		**7.6906**	**13:56:57t**	**0.0006**	**1**
Samp2	**0.0003**	----	**7.7558**	**-**	**-**		**7.7558**	**13:57:13t**	**0.0003**	**1**
Samp3	**0.0008**	----	**7.792**	**-**	**-**		**7.792**	**13:57:28t**	**0.0008**	**1**
Samp4	**0.0001**	----	**7.7268**	**-**	**-**		**7.7268**	**13:57:41t**	**0.0001**	**1**
Samp5	**0.0003**	----	**7.7558**	**-**	**-**		**7.7558**	**13:57:57t**	**0.0003**	**1**
Samp6	**0.0001**	----	**7.7413**	**-**	**-**		**7.7413**	**13:58:15t**	**0.0001**	**1**

Sample 1 Noni control-7.69ppm
Sample 2 SS in Noni mouthwash,1 hour-7.75ppm
Sample 3 SS in Noni mouthwash,6 hour -7.79ppm
Sample 4 SS in Noni mouthwash,12 hour -7.72ppm
Sample 5 SS in Noni mouthwash,24 hour -7.75ppm
Sample 6 SS in Noni mouthwash,1 week -7.74ppm

Table 5. Nickel ion release from NiTi wire in distilled water

Distilled water (Nickel Ion) 0 hour	0.002ppm
1 hour	5.15ppm
6 hour	5.32ppm
12 hour	5.22ppm
24 hour	5.56ppm
1 week	5.89ppm

Table 6. Chromium ion release from SS wire in distilled water

Distilled water (Chromium ion) 0 hour	0.004ppm
1 hour	2.24ppm
6 hour	2.33ppm
12 hour	2.45ppm
24 hour	2.75ppm
1 week	2.67ppm

Tables 1 and 2 shows the Nickel ion release from NiTi wire immersed in Noni mouthwash.

Tables 3 and 4 shows the chromium ion release from stainless steel wire immersed in Noni mouthwash.

Tables 5 and 6 shoes the Nickel and Chromium ion release from NiTi and SS archwires in distilled water

The ion release in respect to Nickel and Chromium from Niti and Stainless steel wires were not significant since the samples showed equal amounts of ions with respect to the control samples

Both Nickel and Chromium values in Noni mouthwash showed similar concentration of ions compared to the control group which had no wire immersed in it indicating that there was little to no ion release in these solutions.

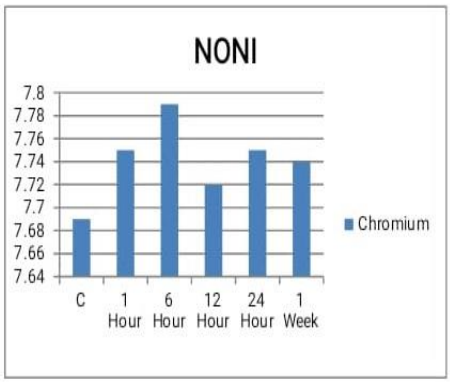
In distilled water both chromium and nickel ion release did not show any variation suggesting a stable nature in distilled water

Statistical Analysis

Table 5.Graphical representation of Chromium ion release in noni mouthwash

NONI

1) Chromium



2) Nickel

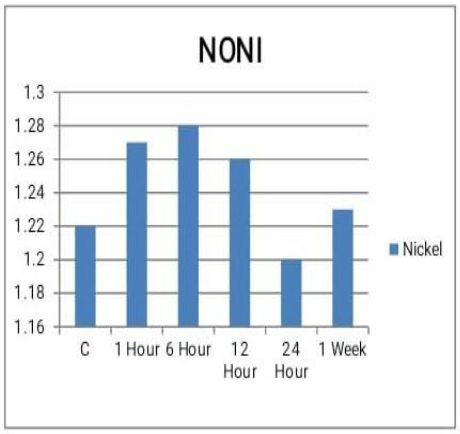
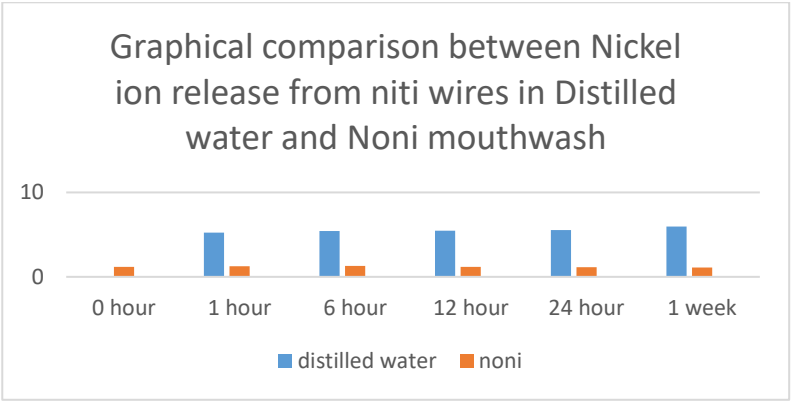
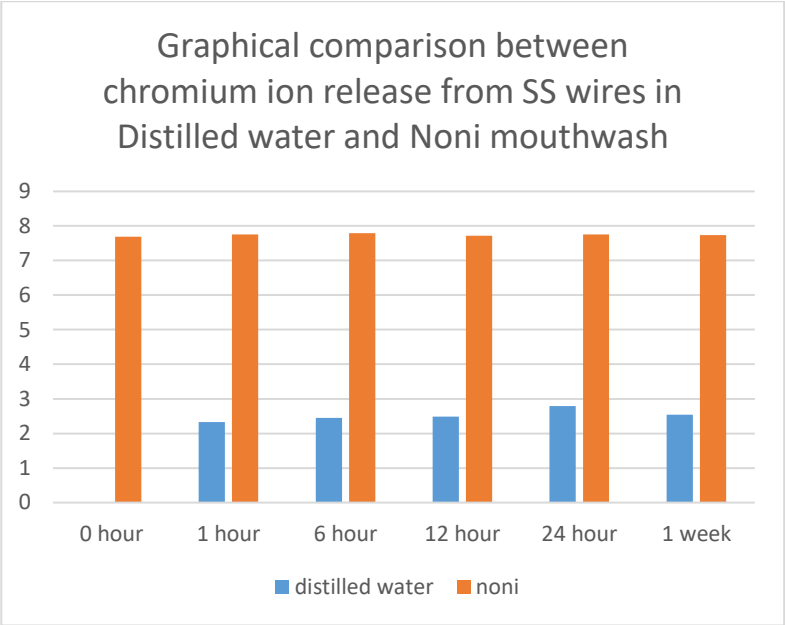


Table 6. Graphical representation of Nickel ion release in noni mouthwash





Statistical analysis showed a variance of 0.00112 for chromium release in noni mouthwash. Nickel release in noni mouthwash showed a variance of 0.0098 in noni mouthwash respectively.

It showed negligible variation on the Nickel and Chromium ions in Noni mouthwash and hence can be safely used for patients undergoing orthodontic treatment without the fear of ion release from orthodontic archwires.

Discussion

Antimicrobial mouthrinses given to orthodontic patients have proven to show an improvement in the oral hygiene status, when used along with other oral hygiene measures[4]. Moreover, these patients are considerably susceptible to initiation of dental caries and gingivitis. Many chemical mouthrinses are used routinely that causes staining of teeth. Use of Herbal mouthrinses has many advantages over chemical mouthrinses. Our present study was done to check the effect of Noni mouthrinse on the ion release in routinely used orthodontic wires.

NiTi orthodontic wires from different manufacturers would have different corrosion resistance[4,5]. We assayed the corrosion resistance, in terms of ion release, of different NiTi orthodontic wires at different interval.

Both the archwires showed stability in ion release in noni mouthwash as well distilled water. This suggests that herbal mouthwashes can be used safely without any cause for concern regarding excess ion release of allergic reactions

Corrosion of orthodontic alloys is observed in the intraoral environment, regardless of the alloys' metallurgic structure, and it is also known that the extent of manufacturing defects may accelerate the process[6]. Increase in prevalence of Ni hypersensitivity and demand and availability of orthodontic treatment have created growing interest in the composition of alloys and the release of metals during treatment.[7]

The results of our current study showed that the ion release from arch wires when immersed in Noni mouthrinse was very negligible, thereby substantiating that Noni mouthrinse can be prescribed safely in patients undergoing Orthodontic treatment.

Conclusion

In this present study the release of Ni and Cr was insignificant when the Niti and SS wires were immersed in Noni mouthrinse. No variations were seen with control sample and Noni mouthwashes. Hence proving that Noni Mouthrinse can be used safely in patients undergoing Orthodontic treatment.

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