



THE EFFECT OF DIFFERENT TYPES OF SPACE MAINTAINERS ON MINERALS OF SALIVA

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ABSTRACT

Purpose: The originality of the present study was to evaluate the effect of different types of space maintainers on minerals of saliva. **Methods:** The study sample was divided equally into two groups; group A: twenty children received fiber reinforced composite space maintainer group B: twenty children received band and loop space maintainers. The samples were collected before the insertion of the space maintainer and 2 weeks after its insertion **Results:** For group B band and loop space maintainers there was a post restoration statistically significant difference for both Cobalt and Chromium with a mean value of ($p \leq 0.001$), ($p = 0.007$), respectively, also Nickel increased post restoration with a mean value of ($p = 0.168$), also silicone decreased with a mean value of ($p = 0.046$) which is statistically significant, for both Sodium and Zinc no statistically significant difference was found with a mean value of ($p = 0.170$), ($p = 0.721$). For group A fiber reinforced resin composite space maintainer there is no statistically significant difference between pre restoration and post restoration for Cobalt, Chromium, Nickel, Silicone, Sodium and Zinc with mean values of, ($p = 0.081$), ($p = 0.413$), ($p = 0.168$), ($p = 0.431$), ($p = 0.172$) and ($p = 0.699$), respectively. **Conclusions** Although band and loop space maintainer showed minerals biodegradation but this degradation within normal range of minerals content in saliva, Fiber reinforced space maintainer showed less minerals biodegradation than band and loop space maintainer, Fiber reinforced space maintainer can be used successfully as alternative for band and loop space maintainer from mineral biodegradation point of view.

INTRODUCTION

Salivary fluid is an exocrine secretion consisting of approximately 99% water, containing a variety of electrolytes (sodium, potassium, calcium, chloride, magnesium, bicarbonate, phosphate) and proteins, represented by enzymes, immunoglobulins and other antimicrobial factors, mucosal glycoproteins, traces of albumin and some polypeptides and oligopeptides of importance to oral health. There are also glucose and nitrogenous products, such as urea and ammonia.^(1,2) Many salivary proteins bind to the surfaces of the teeth and oral mucosa forming a thin film of salivary pellicle, several proteins

bind calcium and help to protect the tooth surface.⁽³⁾ When a primary tooth is extracted or exfoliated prematurely, the teeth mesial and distal to the space tend to drift or be forced into it. This may result in the impaction of the succedaneous tooth, a shift of the midline of the dental arch to the affected side, and over-eruption of the opposing tooth, with subsequent impairment of function maintenance of the space may eliminate or reduce these consequences.⁽⁴⁾ To avoid malocclusion due to premature loss of the primary teeth clinicians may advise various types of space maintainers (removable or fixed appliances), depending on the child stage of dental development, the dental arch involved and the location of the

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missing primary teeth. With advances in technology, attempts have been made to utilize newer materials in the fabrication of space maintainers. ⁽⁴⁾ Nickel and chromium are two metals often used in the construction of various parts of most pedodontics appliances. Chromium is known to be an essential element for human beings and animals and it plays a role in glucose metabolism. On the other hand, the potential health effects from exposure to nickel and chromium and their compound have been scrutinized for more than 100 years, and it was established that these metals could cause hypersensitivity,^(5,6) allergic dermatitis,^(7,8) asthma,⁽⁸⁾ and ulcers of the mucous membrane. Over the last few years, the development of fiber-reinforced composites (FRC) has offered the dental profession the possibility of fabricating adhesive, esthetic and metal free tooth replacement even in the case of molar teeth. ⁽⁹⁾

MATERIALS AND METHODS

This study was carried out on forty selected Egyptian children from the Pediatric Dental Outpatients Clinic, Faculty of Dental Medicine, Al-Azhar University. The age of children was ranged from 4 to 8 years. The study sample was divided equally into two groups according to the type of space maintainer:-

Group A: twenty children received fiber reinforced composite space maintainers

Group B: twenty children received band and loop space maintainers

Clinical inclusion criteria : ⁽⁸⁾

1. Premature loss of a primary molar
2. Presence of teeth on the mesial and distal sides of the extraction space
3. Angle's Class I occlusion
4. Normal primary molar relation

Technique for construction band and loop space maintainer

A brief history was recorded and a clinical examination was done.

Intraoral periapical radiographs were taken in the area of tooth loss . Impressions were made by alginate impression material, study model were prepared, and a space analysis was done for every child. A prefabricated band was selected for the abutment tooth by measuring the mesiodistal diameter of abutment tooth with a caliper and correlating it with the internal diameter of the prefabricated band .The smallest stainless steel band that seats approximately 1 millimetre below the mesial and distal marginal ridges was selected. Impressions were taken with alginate impression material. Each band was then gently removed with a band remover and stabilized in the impression material in the correct position. The impression was then casted using dental stone with the band in place within 30 minutes of impression taking.⁵⁷ Technician performed construction of loop and made soldering to band. The loop was soldered with the band in its middle third. Band and loop space maintainers were cemented cement (Medicem, Promedica, Neumunster, Germany) mixed according to manufacturer's instructions. Excess of cement was removed. Low-volume suction and cotton rolls isolation were used to maintain a dry field during cementation. Space maintainers were checked for gingival Clearance and occlusal interference. Children were instructed not to eat for 30 minutes following cementation. In addition, parents were instructed to notify the clinician immediately. if the band and loop space maintainer became loose, or if any discomfort was encountered. Regular follow up appointments were scheduled at 4-6 months.

Technique for construction fiber reinforced composite space maintainer

A brief history was recorded and a clinical examination was done. Intraoral periapical radiograph were taken in the area of tooth loss .In

order to determine the length of FRCSM required, the distance between the mesiobuccal line angle of the primary canine and distobuccal line angle of the second primary molar was measured using a digital vernier caliper. No grooves or slots were prepared on the abutment teeth in order to prevent unnecessary loss of tooth structure. After administration of adequate anesthesia, isolation was done using a rubber dam and suction. Both the abutment teeth (primary canine and second primary molar) etched with 35% phosphoric acid for 40 seconds. The teeth were rinsed, air-dried and wetted with an adhesive (Adper Single Bond-2® 3M) that was lightcured for 20 seconds. A thin layer of flowable composite (VLC Flowable Filling composite-Prime Dent) was applied to the buccal surfaces of the abutment teeth without light-curing it. The cut length of FRCSM was placed on this flowable composite, extending from the buccal aspect of primary second molar to buccal aspect of primary canine.

The ends of the fiber were adapted to the teeth surfaces with a plastic filling instrument. Preliminary curing was done individually at each end of the fiber framework for 40 seconds, during which the other end was protected from the light source. An additional layer of flowable composite was applied over the area where the fiber abutted the tooth surface and this was light-cured for 40 seconds. A similar procedure was repeated on the lingual aspect of the abutment teeth. Any uncovered fiber was further covered with flowable composite. The space maintainer was checked for gingival clearance and occlusal interference. Finishing was done using composite finishing burs. Instructions on oral hygiene and appliance maintenance were given to both children and parents

A fresh un-stimulated whole saliva sample will be collected before insertion of the space maintainers, patient will be asked to spit in a sterile container immediately after getting up or at least 2 hours after breakfast. Two weeks after insertion of the space

maintainers in both groups, a second sample will be collected from each patient immediately after get up or at least 2 hours after breakfast. The samples will be transferred to special equipment called atomic absorption spectrophotometer which will measure the percentage of minerals found in the saliva for each sample

Data management and analysis:

Data will be collected, tabulated and statistically analyzed using Statistical Package for the Social Sciences (SPSS) software program.

RESULTS

Co results:

Group (A) Fiber reinforced resin composite space maintainer: No statistically significant difference was found between (Pre-restoration) and (Post restoration) where ($p=0.081$).

Group (B) Band and loop space maintainer (B): A high statistically significant difference was found between (Pre-restoration) and (Post restoration) where ($p\leq 0.001$).

Cr results:

Group (A) Fiber reinforced resin composite space maintainer: No statistically significant difference was found between (Pre-restoration) and (Post restoration) where ($p=0.413$).

Group (B) Band and loop space maintainer (B): A high statistically significant difference was found between (Pre-restoration) and (Post restoration) where ($p=0.007$).

Ni results:

Group (A) Fiber reinforced resin composite space maintainer: No statistically significant difference was found between (Pre-restoration) and (Post restoration) where ($p=0.430$).

Group (B) Band and loop space maintainer (B): No statistically significant difference was found between (Pre-restoration) and (Post restoration) where ($p=0.168$).

Si results:

Group (A) Fiber reinforced resin composite space maintainer: No statistically significant difference was found between (Pre-restoration) and (Post restoration) where ($p=0.431$).

Group (B) Band and loop space maintainer (B): A statistically significant difference was found between (Pre-restoration) and (Post restoration) where ($p=0.046$).

Na results:

Group (A) Fiber reinforced resin composite

space maintainer: No statistically significant difference was found between (Pre-restoration) and (Post restoration) where ($p=0.172$).

Group (B) Band and loop space maintainer (B): No statistically significant difference was found between (Pre-restoration) and (Post restoration) where ($p=0.170$).

Zn results:

Group (A) Fiber reinforced resin composite space maintainer: No statistically significant difference was found between (Pre-restoration) and (Post restoration) where ($p=0.699$).

Group (B) Band and loop space maintainer (B): No statistically significant difference was found between (Pre-restoration) and (Post restoration) where ($p=0.721$).

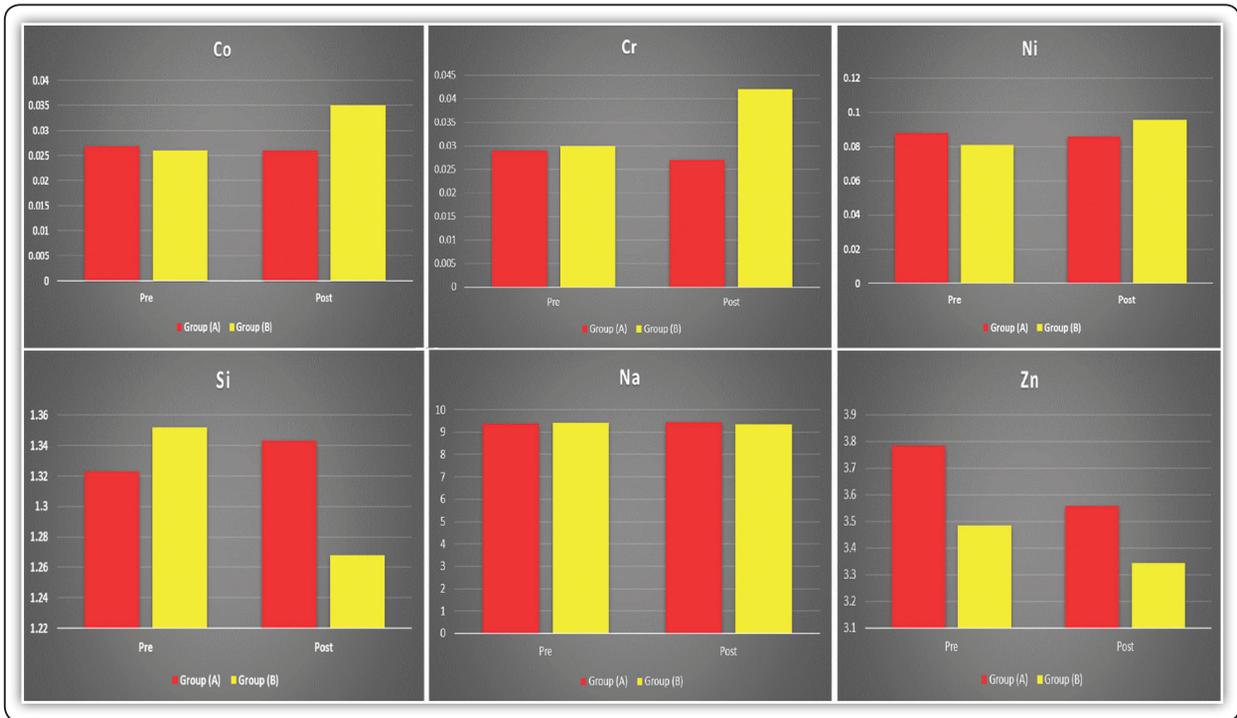


FIG (1)

DISCUSSION

For group B Results were measured using Atomic absorption spectrophotometer device there was a statistically significant difference between pre and post restoration found in Co, Cr, also there was a statistically significant difference stating the decrease of Si, and no statistically significant difference was found in Zn, Na, Ni, but Ni increased with a mean value of $[0.015 \pm 0.047]$ ⁽¹⁰⁾. In another studies Svein⁽¹¹⁾ studied corrosion base metal alloys by placing in artificial saliva for 2 months and same findings were reported by other investigators. De Micheli and Riesgo⁽¹⁰⁾ stated that current nickel alloy composition is such that the amount of nickel and other metals released due to electrochemical corrosion could never reach the toxic dose of 10 mg/kg body. Hensten-Pettersen⁽¹²⁾ and Jacobsen and Sunderman⁽¹³⁾ showed that amount of nickel in human saliva ranges from 0.8 to 4.5 µg/l and demonstrated that concentration of nickel as small as 2.5 mg/ml were toxic to human gingival cells in tissue culture. Robert⁽¹⁴⁾ stated that the average dietary intake of nickel is 200- 300 g/day, but Vreebrug⁽¹⁵⁾ reported that the lethal oral dose for nickel in humans probably lies between 50 and 500 mg/kg body weight. Other study stated that The chromate salts which cause skin sensitivity and dermatitis, results from the corrosion of base metal alloys. Chromium allergy related to contact in mouth is rarely reported. The incidence of chromium allergy was reported 10% in males and 3% in females by investigators^(16,17) The release of nickel and chromium very much below when compared with the average dietary intake of nickel (200-300 µg/day) and chromium (280 µg/day) which were not capable of causing any toxic effects. In the present study results were calculated by Atomic absorption spectrophotometer for group A there were no statistically significant difference found in Co, Cr, Ni, Si, Na, Zn, minerals between pre and post restoration, this agrees with other

study that stated that the FRCR space maintainer has the advantage that resins are virtually insoluble in oral fluids.⁽¹⁶⁾ Moreover, In the present study the result of the group B stated that there is statistically significant difference in the mineral of Co between pre and post restoration for Co this may be explained by biodegradation of Co from metal alloys used in dentistry which agrees with other studies^(14,15) These findings may proves that there is biodegradation of the band and loop space maintainer used for group B patients,⁽¹¹⁾ and there is no biodegradation of fibereinforced resin composite space maintainer of group A as resins are insoluble in the oral fluids.⁽¹⁵⁾

CONCLUSIONS

1. Although band and loop space maintainer showed minerals biodegradation but this degradation within normal range of minerals content in saliva.
2. Fiber reinforced space maintainer showed less minerals biodegradation than band and loop space maintainer.
3. Fiber reinforced space maintainer can be used successfully as alternative for band and loop space maintainer form mineral biodegradation point of view.

RECOMMENDATIONS

1. Patients who are going to receive space maintainer should be instructed to perform a good level of oral hygiene as the insertion of space maintainers might increase the minerals of saliva.
2. A longer follow up periods are needed to observe the long term effect of different types of space maintainers on the change of saliva minerals.

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