



Elastomeric Ligatures and Chains

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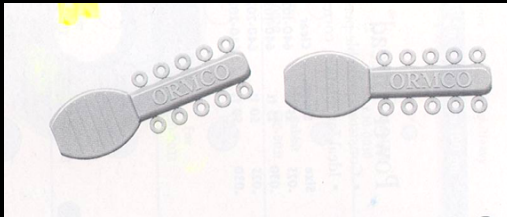
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Composition and Structure

- Elastomeric ligatures and chains are made of polyurethanes
- They have rubber-like elasticity due to long chain, lightly cross-linked structures



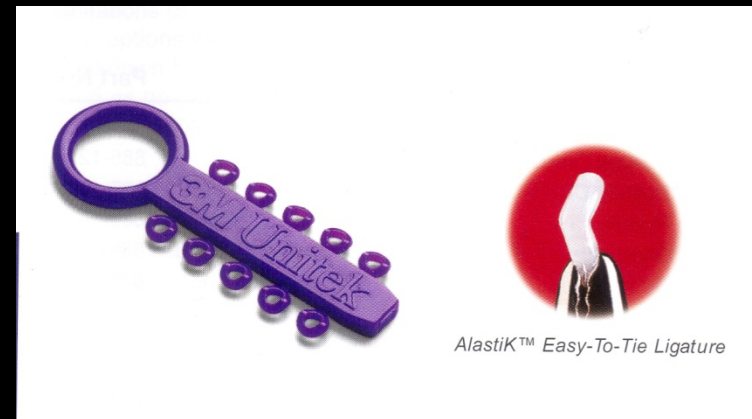
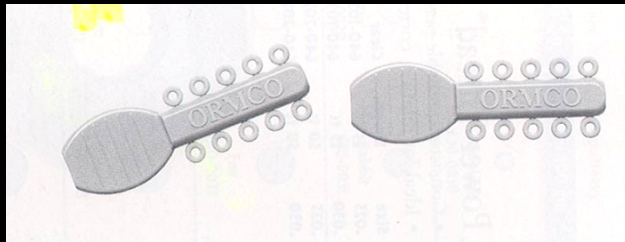
Elastomeric Ligatures

- Ease of application
- Patient friendly nature
- Potential for fluoride release
- Decreased force delivery



Elastomeric Ligatures

- After initial placement there is force decay, which reach 50-60% during the first 24-hours
- Then the force decay continues at a lower rate for 7-10 days



Elastomeric Ligatures

- These elastomeric ligatures are suitable for initial aligning and leveling
- Their rapid force loss and permanent deformation make them not suitable for rotational and torque corrections



Elastomerics in the Oral Environment

They are not inert in the oral environment

Water act to weaken the intermolecular forces in the polyurethanes leading to chemical degradation

These elastomerics are susceptible to hydrolysis of the ester or ether linkages

This leads to force degradation

Elastomeric Ligatures

The structure and surface properties are affected by:

pH

Temperature

Plaque accumulation

Formation of microbial colonies

- To overcome the force decay problem of these elastomeric ligatures manufacturers increased the wall thickness

The effect of dietary pigmentation on the esthetic appearance of clear orthodontic elastomeric modules

Nabeel F Talic and Abdullazeez A Almudhi

ABSTRACT

Objective: To compare the stain resistance of three types of clear elastomeric modules exposed to several common dietary substances through the assessment of the perception of a group of dentists to discoloration using visual analog scale (VAS).

Materials and Methods: Elastomeric modules from Unitek (AU),Ormco (OR), and dentaurum (DE) were immersed in the following food substances: Coffee, black tea, chocolate, energy drink, ketchup, and Coca-Cola for 72 h. VAS was used to reflect the module staining severity.

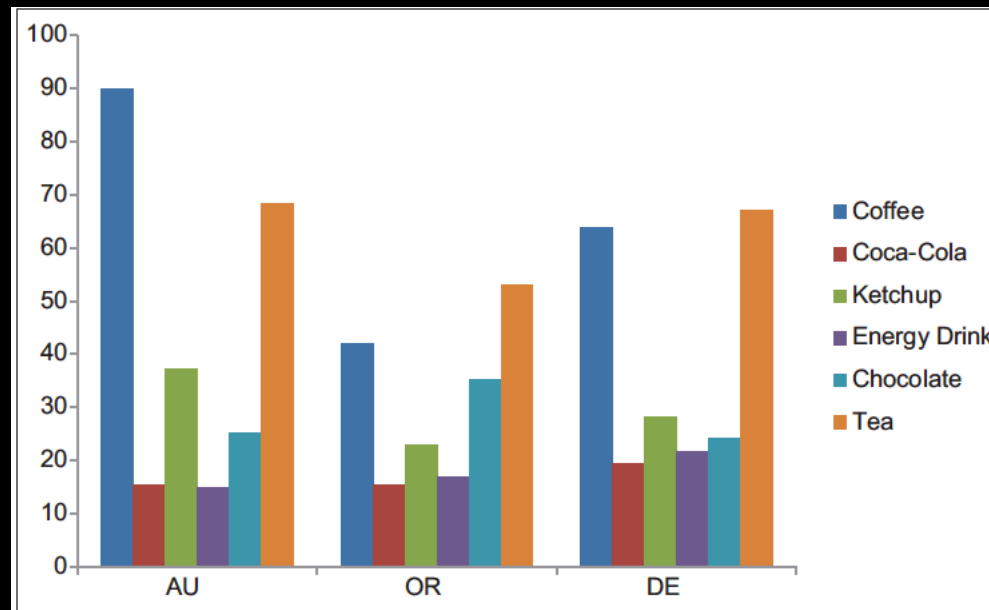
Results: Significant difference was found among the three types of modules examined in this study. OR modules showed the least mean staining ratings by the examiners. There was no statistical difference in the staining properties between AU and DE modules. Coffee and tea showed higher staining potential as compared to all staining media. Furthermore, there was no difference in the staining characteristics of coffee and black tea.

Conclusions: Coffee and tea are strong staining media that should be avoided by patients who opted to have esthetic appliances for their orthodontic treatment. Elastomeric modules manufactured by AU showed higher staining optical properties as compared to the other two companies, which could be related to the manufacturing processing of these modules.

Key words: Color, dental, elastomers, esthetics, orthodontic appliances

J Orthodont Sci 2016;5:70-3

The effect of dietary pigmentation on the esthetic appearance of clear orthodontic elastomeric modules



J Orthodont Sci 2016;5:70-3

Elastomeric Chains

- They were introduced in the 1960's
- They are used in canine retraction, diastema closure, and rotational correction



Elastomeric Chains

Advantages

Easily applied

Require no patient cooperation

Inexpensive

Elastomeric Chains

Disadvantages

Absorb water and saliva

Suffer breakdown of internal bonds

Suffer permanent deformation

Rapid loss of force

Permanently stain

Do not deliver continuous force

Deliver undetermined forces

Elastomeric Chains

- 50% of force loss during the first 24 hours
- 40% of the original force remains after 4 weeks
- When considering the amount of tooth movement, the original force decreased to 25 %



Hershey and Reynolds. Am J Orthod 1975; 67:554-662

Pre-stretching of Power Chains

- It pre-stress the molecular polymeric bonds
- Improves the molecular bonds
- Alleviate the large initial force degradation
- Improve force delivery

Pre-stretching of Power Chains

- Studies showed that this eliminates only 5-10% of the decrease in force decay
- This improvement is clinically insignificant
- Closed power chains produced more consistent force levels

Environmental Effects

Tooth movement

Temperature changes

pH variations

Oral fluoride rinses

Salivary enzymes

The effects of artificial saliva and topical fluoride treatments on the degradation of the elastic properties of orthodontic chains

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Abstract

The effect of artificial saliva and topical fluoride treatments on the force relaxation and change in force delivery by three brands of elastomeric chains over a 4 week period was studied. The effect of storage in air and in the different test media on the distraction to achieve forces of 150g and 300g was determined for the chains. The effect of the test media on load relaxation of the chains was also examined.

Elastomeric chains exhibit good elastic behavior when distracted to an initial force of less than 300g. When forces exceeded 300g, permanent deformation occurred and the force delivery was less predictable. Exposure to artificial saliva and topical fluoride affected the elastic properties of the elastomeric chains and increased the distraction required to deliver both the 150g and 300g force. The increase in distraction for a force of 150g, however, was relatively small and probably insignificant in the clinical setting. The distraction required to produce 300g was significantly larger and appeared to be clinically significant. Pre-stretching the elastomeric chains by 100% of their initial length was not found to be advantageous in terms of the load relaxation behavior. There was less load relaxation found in chains that were immersed in distilled water and Acidulated Phosphate Fluoride than in chains exposed only to air.

This manuscript was submitted July 1991. It was revised and accepted April 1992.

Key Words

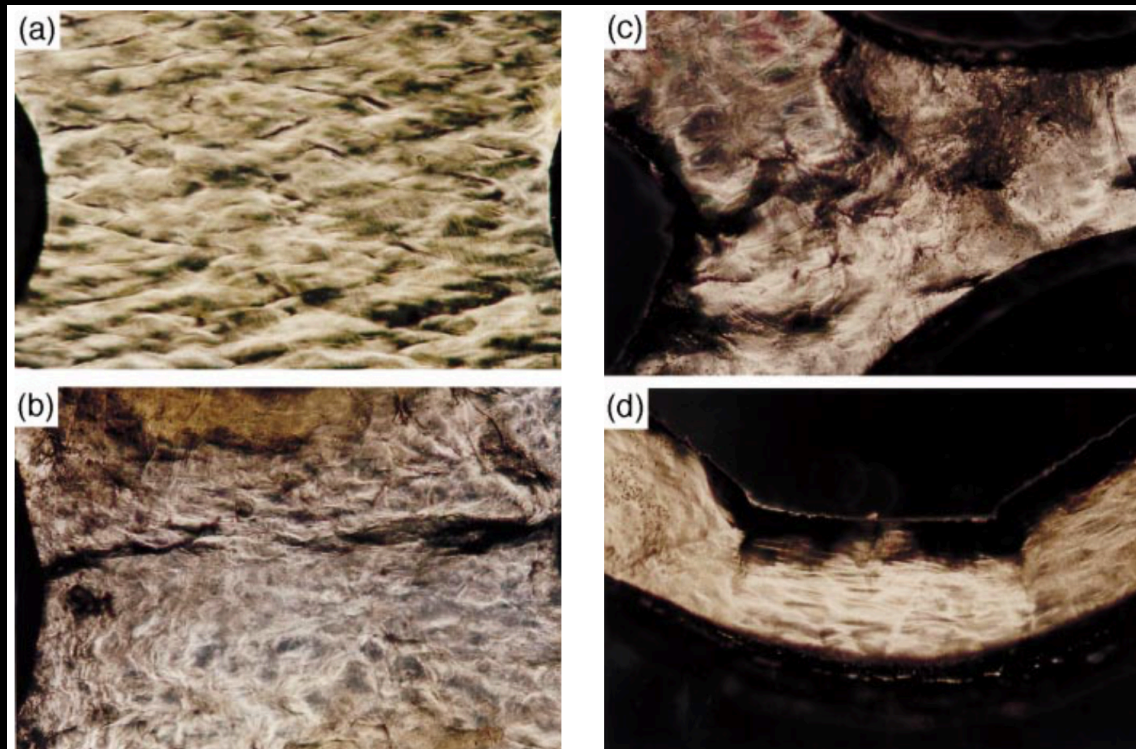
Elastomeric chains • Elastic properties • Load relaxation • Fluoride • Artificial saliva

Structural conformation of *in vitro* and *in vivo* aged orthodontic elastomeric modules

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Deminerlization and Caries in Orthodontic Treatment

Enamel Dynamics

- Enamel is a dynamic tissue that can respond to changes in its environment
- Enamel demineralization process can be extremely rapid

Caries and Orthodontic Treatment (Bonded Appliances)

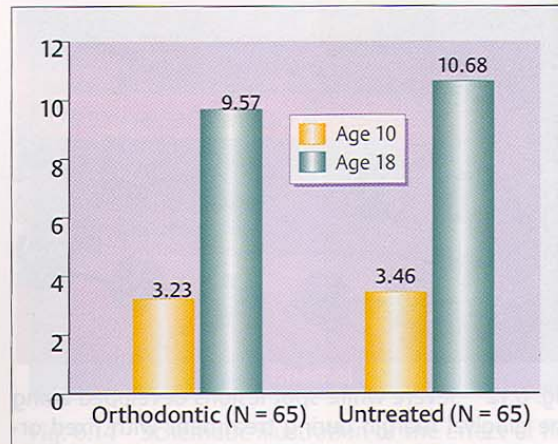
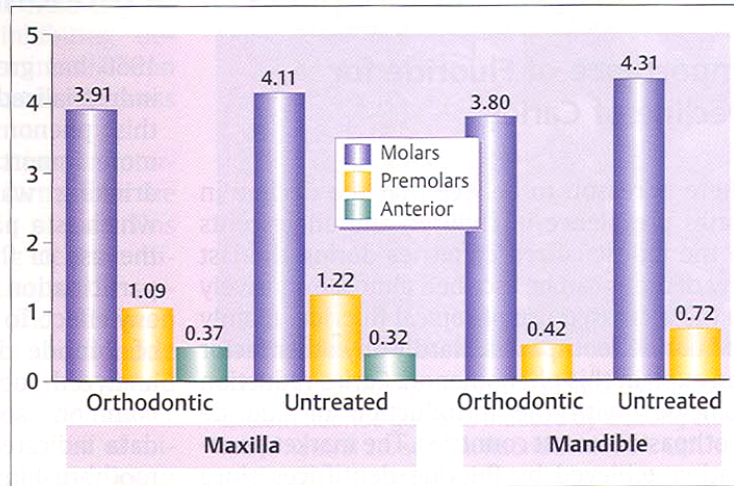


Fig. 6.10 Mean number of filled surfaces (FS) at the ages of 10 and 18 in orthodontically treated patients and non-treated individuals. (From Øgaard, 1989a)

Caries and Orthodontic Treatment (Bonded Appliances)



White Spots and Orthodontic Treatment

- Fixed appliances causes an increase in the number of S. mutans and lactobacilli in the saliva and plaque
- This may increase the risk of white spots and caries
- It was shown that resin remnants following debonding is a potential risk for plaque accumulation



White Spots



White Spots

- Gorelick *et al.* found white spot lesions for nearly 50% of patients that underwent orthodontic treatment.

Am J Orthod Dentofacial Orthop 1982;**81**: 93 8.

- In addition, Ogaard *et al.* reported that these lesions can develop as quickly as only 4 weeks or the average time between orthodontic visits

Am J Orthod Dentofacial Orthop 1998;**94**: 68 73.

Demineralization ↔ Remineralization

■ Changes in early enamel lesions

9 years of age



72 white spots



15 years of age



37 no lesion (51%)

26 no change (36%)

9 cavitation (12%)

Backer-Dirks: J Dent. Res., 1966

Prevention of White Spots and Caries

Plaque control

Fluoride toothpaste

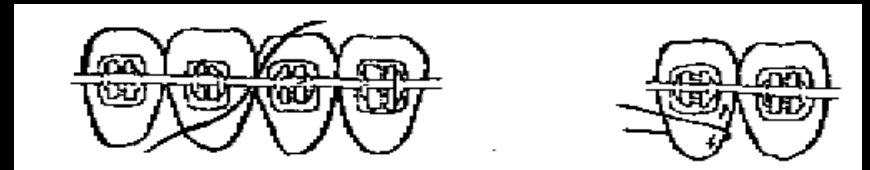
Fluoride mouthrinse

Fluoride varnishes

Fluoride releasing bonding agents

Prevention of White Spots and Caries

- Plaque accumulation on intact premolars leads to white spots within one month
- Tooth brushing at least twice/day



Fluoride Toothpaste



- Most toothpastes contain sodium fluoride, monofluorophosphate, stannous fluoride, or amine fluoride
- Fluoride concentration below 0.1% is not recommended for orthodontic patients
- Stannous fluoride has plaque inhibiting effect in addition anti-caries effect

Fluoride Supplements

- Toothpastes do not stop the development of lesions alone
- It is recommended for orthodontic patients to use 0.05% NaF mouth rinse daily



Fluoride Varnishes

- They contain high fluoride concentration in an adhesive vehicle that can be applied and dried onto the surface of the teeth
- It achieves prolonged contact of fluoride with the teeth

Fluoride Varnishes

- The most common product is Duraphat, contains 5% NaF
- After its applied it remains on the tooth surface for up to 12 hours
- Two application of fluoride varnish per year were more effective in caries inhibition than weekly rinse with 0.2% NaF

Fluoride-Releasing Elastomerics

- Some studies showed that these elastomerics decreased the *S. Mutans* colonies
- Increase the micro-hardness of enamel at the 20 μm depth level for a 2 weeks period

Fluoride-Releasing Elastomerics

- Some studies showed steep decline of fluoride release after three weeks
- 50% of the total release occurs in the first 24 hours
- 90% of fluoride leach out in the first week
- Others showed measurable release after six months

Fluoride Releasing Elastomeric Chains

- They deliver only 14% of the initial force after 1 week
- They deliver 6% after 3 weeks

Effect of Fluoridated Elastomeric Ties

- Fluoridated elastomers do not affect the quantity of disclosed plaque around an orthodontic bracket
- The individual patient's level of oral hygiene is the most important factor determining the area of surfaces covered with disclosed plaque.



White Spots Management

- Remineralization starts immediately after debonding
- Complete remineralization depend on the depth of the lesion
- Let the patient continue using fluoridated toothpaste and daily rinse with 0.05% NaF

White Spots Management

- The use of high concentrations of fluoride arrest lesion progression to caries but prevents lesion repair
- Enamel microabrasion: the use of pumice and acid solution
- Composite fillings
- Ceramic veneers

Use of Casein Phosphopeptide Amorphous Calcium Phosphate (CPP-ACP)

- Water based mousse
- Chewing gum
- Mouth rinses
- The material is marketed under the name of GC Tooth Mousse, Recaldent



Courtesy of Dr. Reynolds

Semin Orthod 2008;14:209-219