



ESTHETIC APPLIANCES IN ORTHODONTICS

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ESTHETIC APPEARANCE OF AN APPLIANCE



Reducing the size of the stainless steel brackets



ESTHETIC APPEARANCE OF AN APPLIANCE



Lingual orthodontics



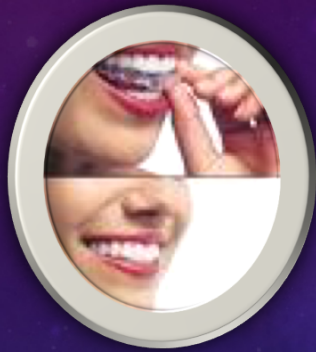
LINGUAL ORTHODONTICS

A prospective study of 22 patients evaluated comfort, function, and oral hygiene

- 76-91 % of patients reported restriction of tongue space and tongue lesions after three months into treatment
- 10-20 % considered these effects significant
- Speech problems were the greatest problem
- 43% reported severe problems in chewing
- 50% reported problems with oral hygiene

(Hoff et al, J. of Orofacial Orthopedics, 2003)

ESTHETIC APPEARANCE OF AN APPLIANCE



Invisible removable appliances

ESTHETIC APPEARANCE OF AN APPLIANCE

Changing the bracket material

■ Resin

Polycarbonate

Polyurethane Composite

Metal and polycarbonate

Metal and ceramic

■ Ceramic

Polycrystalline alumina

Monocrystalline alumina

■ Semi-esthetic



The base and body are made of reinforced resin. The bracket slot and the self-ligating mechanism is made from metal (Damon 3)

PLASTIC/POLYCARBONATE BRACKETS



Esthetically acceptable initially

Appearance deteriorate with time

Prone to staining and odorous

Lack of strength and stiffness

Do not transmit torque

Prone to permanent deformation (creep)

PLASTIC/POLYCARBONATE BRACKETS

- Reinforced with ceramic, fiberglass fillers, metal slots
- Demonstrated less creep
- Loss of torque is still a problem

HIGH GRADE MEDICAL POLYURETHANE/ POLYCARBONATE BRACKETS

Metal slot reinforced brackets

Were subjected to the lowest degree of deformation

Pure polyurethane

Pure polycarbonate

Fiberglass reinforced polycarbonate bracket

Ceramic reinforced polycarbonate brackets showed the highest deformation under torque stresses

Sadat-Khonsari et. al. (2004)

CERAMIC BRACKETS

- They were first available in 1986
- The ceramic bracket comes in its polycrystalline (PCA) or monocrystalline (MCA) form

POLYCRYSTALLINE (PCA) VS. MONOCRYSTALLINE (MCA)

- Monocrystalline brackets are machined from long extrusions of synthetic sapphire using diamond tools
- Polycrystalline ceramic brackets are manufactured either by an injection molding process or by milling or machining with diamond tools

POLYCRYSTALLINE (PCA) VS. MONOCRYSTALLINE (MCA)

- The most apparent difference between the two is their optical clarity: monocrystalline ceramic brackets being noticeably more translucent.

CERAMIC BRACKETS

Advantages

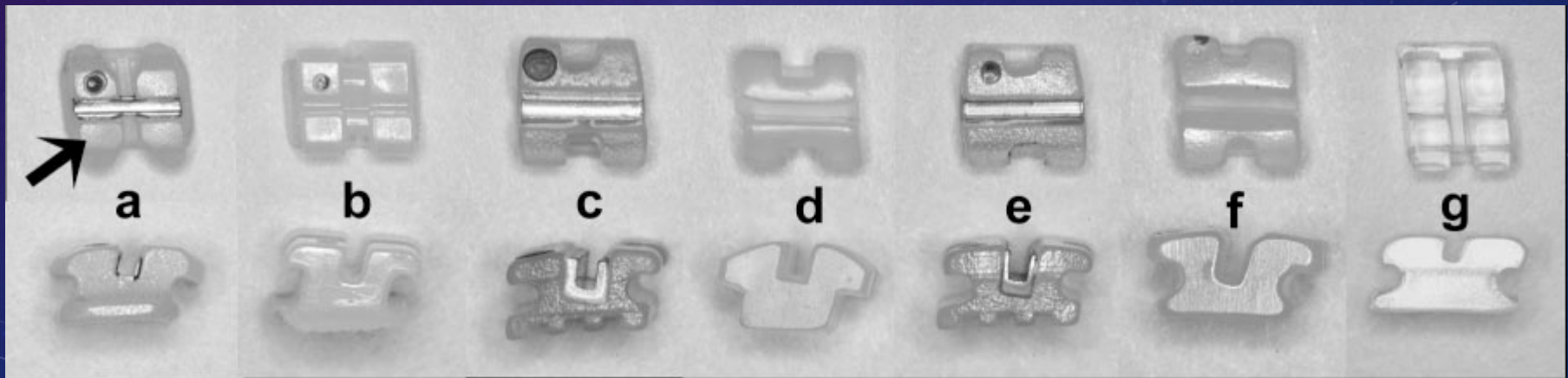
- Esthetic appearance
- Biocompatible
- Strong material

Disadvantages

- Lack of ductility
- Expensive
- Brittle

Property	MCA	PCA	Stainless Steel
Hardness	97	82	5-35
Tensile Strength	260	55	30-40
Fracture Toughness	2-4	3-5	80-90

Brand	Manufacturer	Crystalline structure
Clarity	3M Unitek	Polycrystalline
InVu	TP Orthodontics	Polycrystalline
Luxi II	Rocky Mountain	Polycrystalline
Fascination	Dentaurum	Polycrystalline
Virage	American Orthodontics	Polycrystalline
Mystique	GAC International	Polycrystalline
Inspire	Ormco	Monocrystalline



BRACKET STRENGTH

Most to least resistant to tensile fracture of the tie wing:

- Ormco: Inspire (monocrystalline)
- Dentaurum: Fascination
- GAC: Mystique
- TP : InVu
- 3M/Unitek: Clarity
- American Orthodontics: Virage
- Rocky Mountain: Luxi

(Johnson et al 2004)

ADVANCES IN THE DESIGN OF CERAMIC BRACKETS

- ◆ Bond strength
- ◆ Bracket strength
- ◆ Debonding
- ◆ Frictional resistance

BOND STRENGTH

- Ceramic brackets cannot bond chemically with acrylic bonding adhesives due to their inert aluminum oxide composition
- Early ceramic brackets used a silane-coupling agent
- This chemical retention resulted in extremely strong bonds

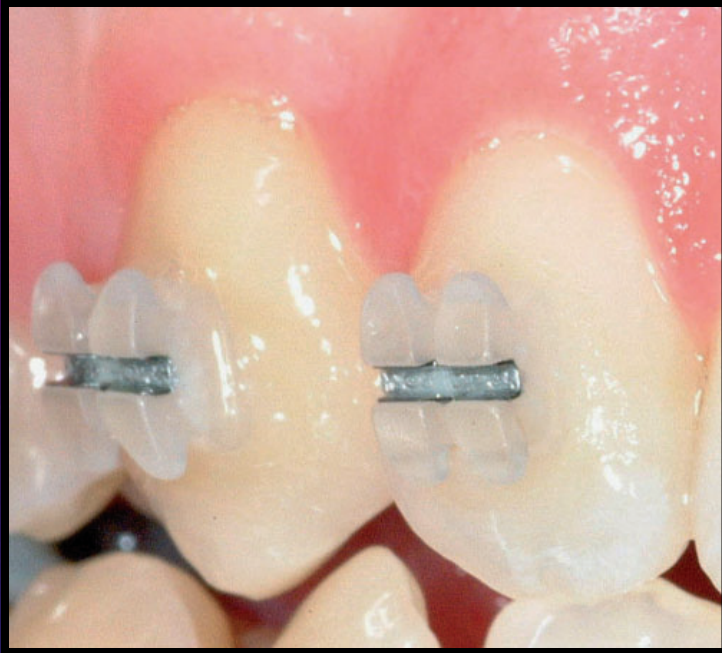
BOND STRENGTH

- ▶ Brackets with chemically treated bases have higher bond strength than metal and ceramic brackets with mechanical interlocking
- ▶ Higher bond strength showed some enamel fractures (Wang et al, 1997)

BOND STRENGTH

- **Mechanically retained brackets have adequate bond strength and appear to cause less enamel damage at debonding compared to the chemically retained brackets**

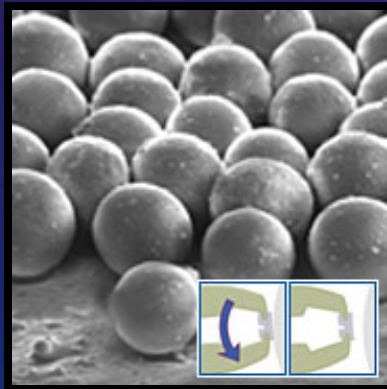
CLARITY (3M UNITEK)



ICE BRACKETS (ORMCO)



Has a bracket base with a monolayer of zirconia balls



FASCINATION 2 (DENTAURUM)



Super smooth surfaces



Innovative "button structured base"

Special silane coated base



Perfectly rounded contours of tie wings



Easy debonding

MYSTIQUE (GAC)



DEBONDING OF CERAMIC BRACKETS

- ◆ Due to lack of ductility it may lead to adhesive failure between the composite and enamel surface which may cause enamel loss
- ◆ In 1989 Ogaard reported that out of 576 debonded brackets, three had a significant enamel loss
- ◆ In 1991 Winchester reported that out of 210 debonded brackets, four had enamel fracture *in vitro*

DEBONDING OF CERAMIC BRACKETS

Methods of debonding ceramic brackets:

- Air rotor
- Electrothermal debonding
- Laser-aided debonding
- Specific debonding pliers

ELECTROTHERMAL DEBONDING

- Its not used anymore
- It was available for the A company Starfire brackets only
- Patients felt thermal sensation and mild discomfort
- Inter-pulpal temperatures raised 6.7 to 7 degrees using the Dentaureum Ceramic Bracket Debonding Unit

CLARITY (3M UNITEK)

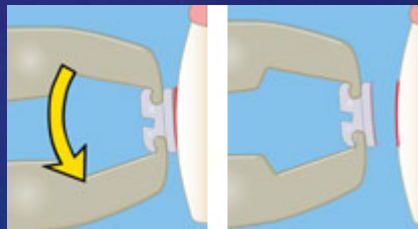
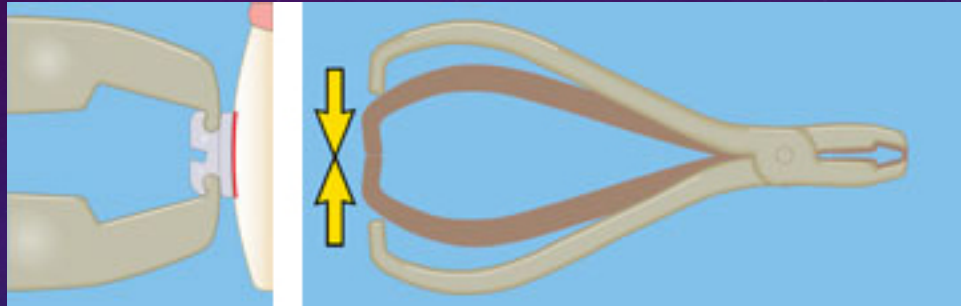


Fascination 2 (Dentaurum)

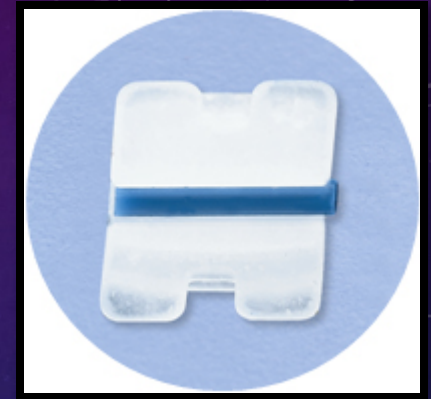


Easy Debonding

INSPIRE (ORMCO)



MYSTIQUE (GAC)



DEBONDING

1 Clean-up Before Debonding



2 Debonding with Mystique 346RT



3 Post Debonding



355 Knickerbocker Avenue, Bohemia, NY 11716 • 1-800-645-5530
www.gacmystique.com

U.S. Patent #6,305,932 B1
Other U.S. and foreign patents
pending and/or approved

DEBONDING OF CERAMIC BRACKETS

- Theodorakopolou et al (2004) compared the debonding characteristics of inspire and Clarity brackets.
- Over 90% of the brackets debonded at the bracket-adhesive interface
- No enamel fractures were observed
- They recommend following manufacturers instructions

(AJODO. 2004; 125:329-336)

FRICTIONAL RESISTANCE



- Polycrystalline ceramics have a higher coefficient of friction
- Monocrystalline ceramics and stainless steel are comparable
- Polycrystalline ceramic brackets manufactured by an injection molding process produces a smooth surface texture than those manufactured by machining with diamond tools

FRICTIONAL RESISTANCE



- Researchers have shown promising results with stainless steel reinforced brackets, demonstrating competitive frictional forces to conventional stainless steel brackets (Kusy et al, Angle Orthod. 2001)
- Other research showed that the addition of stainless steel inserts to polycrystalline brackets did not considerably improve the resistance to sliding (Thorstenson and Kusy, Angle Orthod. 2003)

FRICTIONAL RESISTANCE

- To reduce friction GAC used silica-lined slot to increase aesthetics and decrease friction. The diamond cut bracket slot is glazed with a silica treatment to eliminate imperfections.



Mystique (GAC)

POLYCRYSTALLINE ZIRCONIA BRACKETS

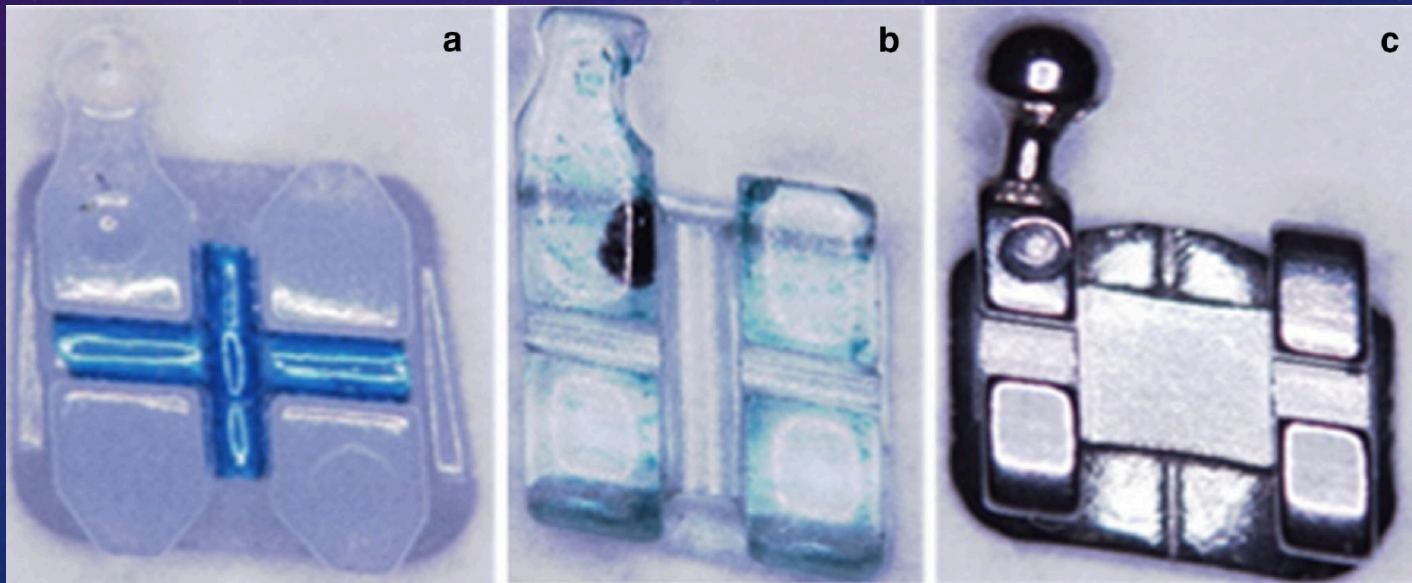
- Have the greatest toughness amongst all ceramics
- They are cheaper than the monocrystalline ceramic brackets
- They are very opaque, making them less aesthetic

ORIGINAL ARTICLE

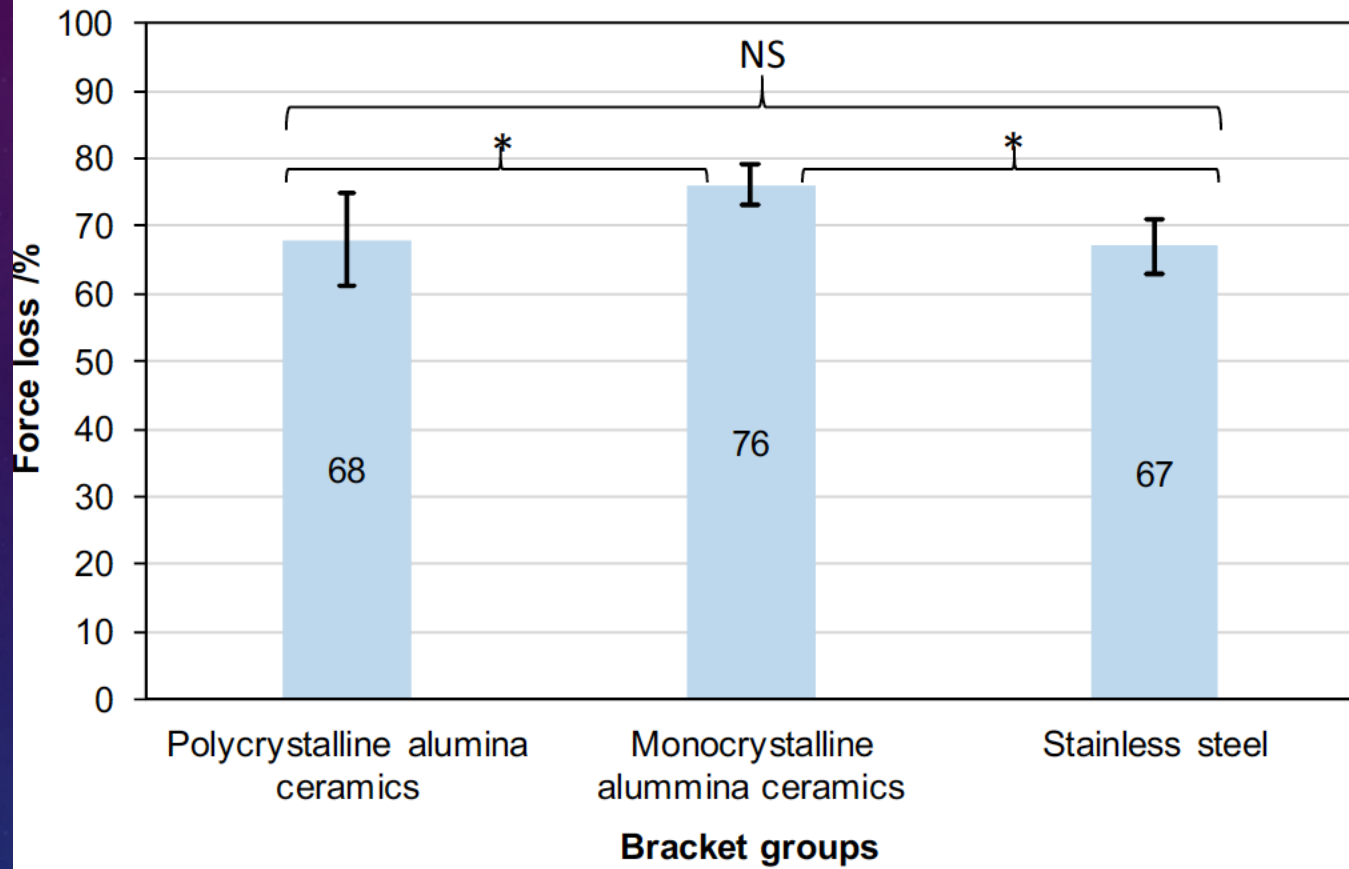
Study of force loss due to friction comparing two ceramic brackets during sliding tooth movement

Vergleichende Studie zum reibungsbedingten Kraftverlust während der bogengeführten Zahnbewegung durch zwei Keramikbrackets

Mai AlSubaie¹ · Nabeel Talic¹ · Said Khawatmi² · Ahmad Alobeid² ·
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Conclusion

There was no significant difference in the amounts of force loss during the sliding movement between PCA ceramic brackets with a YSZ coating on the surface of the slots and SS metal brackets, indicating that the two types have similar frictional properties. MCA ceramic brackets, on the other hand, revealed significantly higher amounts of force loss than both PCA and SS brackets. Frictional resistance caused more than 60 % of the applied force to be lost.