

**Effects of cyanoacrylate adhesives and their occupational hazards in prosthodontics - A review**N. Nilofer Nisha<sup>1</sup>, Jafar Abdulla Mohamed Usman<sup>2</sup><sup>1</sup>Postgraduate, Dept. of Conservative dentistry and Endodontics, Raja Muthiah Dental College, Annamalai University, Chidambaram, Tamilnadu, India<sup>2</sup>Assistant Professor, Substitutive Dental Sciences, College of Dentistry, King Khaled University, Abha, Kingdom of Saudi Arabia**\*Corresponding author e-mail:** maharshan@rediffmail.com**ABSTRACT**

The application of cyanoacrylate adhesives in dentistry has served a boon for many dentists, dental students and dental technicians. Cyanoacrylates have been widely used in various applications in dentistry particularly in the field of Prosthodontics as a repair adhesive and sealing glue. Its biocompatibility and histotoxicity has increased concerns regarding its potential toxic nature among the dental personals. The working room or area should be maintained with more levels of relative humidity, sufficient room airflow and appropriate ventilation to minimize the dental professionals and technicians from exposing to the volatile toxicity of cyanoacrylate adhesives. This article discusses the potential occupational hazard due to cyanoacrylates in the field of Prosthodontics.

Key words: Prosthodontics, Toxicity, occupational hazards, cyanoacrylates

**INTRODUCTION**

Many dentists are confronted with the problems of fractured or damaged dental prostheses. Denture repair became in evident to prevent the dentists from making new prosthesis and save cost. Cyanoacrylate which were first described in 1949 and commercially used from 1958 their potential as adhesives was quickly recognized <sup>[1,2]</sup> Cyanoacrylates are solvent free adhesives that cure rapidly when pressed into a thin film between two surfaces. Apart from that, they have clinical applications in medicine, especially as tissue adhesives and sealing materials. Despite being very popular and widespread use, toxicity released by these substances and their occupational hazards in Prosthodontics is unknown <sup>[2]</sup>

**History of cyanoacrylates:** Cyanoacrylates were discovered by Dr. Harry coover at Eastman Kodak during world war II. It was first marketed in 1955 as flash glue. In 1964 Eastman submitted an application to use cyanoacrylate's to seal wounds to United

States food and drug administration [FDA]. Dr. Harry cover used this in 1966 during Vietnam War. But only in 1988 FDA approved 2-octyl cyanoacrylate for use in closing wounds and surgical incisions <sup>[3]</sup>

**Properties of cyanoacrylate:** Cyanoacrylate adhesive is a compound synthesized by condensation of an cyanoacetate with formaldehyde in the presence of catalyst <sup>[4]</sup>. Application of an adhesive film of cyanoacrylate develops by rapid polymerization (-5 to 60 secs) triggered by hydroxyl groups on the surface to be glued. Exposure to moisture makes the glue unstable over time. To prevent this cyanoacrylate's should be stored in airtight containers. Cyanoacrylate sets faster (less than a minute) and a normal bond reaches full strength in two hours. Accelerator's such as toluidine can trigger much faster setting by 2 to 3 secs with some loss of strength <sup>[1]</sup>.

**Cyanoacrylates in dentistry:** Cyanoacrylates are a popular material of choice in many divisions of

dentistry. In Endodontics it is used to do pulp capping and as a retro filling material in endodontic surgeries. It has been used to seal the dentine of endodontically treated teeth as it was found to control micro leakage of oral fluid at the tooth/filling interface<sup>[5, 6]</sup>. In Periodontics it is used to desensitize teeth. N-butyl cyanoacrylate is an effective tissue adhesive which is haemostatic and bacteriostatic. It can be considered an alternative to conventional sutures in soft-tissue surgery<sup>[7]</sup>. N-butyl cyanoacrylate, which is biocompatible material is an effective tissue adhesive which displays haemostatic properties and a bacteriostatic action. N-butyl cyanoacrylate has several advantages over conventional suture materials in soft-tissue surgery: it saves time, is haemostatic and bacteriostatic, and doesn't need to be removed during post-operative follow-up

It is used as a pit and fissure sealant in preventive dentistry, to prevent caries on the occlusal surfaces<sup>[8]</sup>. In orthodontics, cyanoacrylate has been successfully used to bond orthodontic brackets to reduce time while bonding<sup>[9]</sup>.

**In Prosthodontics:** Acrylic prosthesis such as removable partial dentures and complete dentures can be problematic for patients when it fractures and when patients attempt to repair the denture rather than having a new one made as shown in Figure 1, 2. Patients often repair their own dentures using commercial cyanoacrylate (CA) adhesive or 'super glue'. CA adhesive is a compound synthesized by condensate of a cyanoacetate with formaldehyde in the presence of a catalyst<sup>[10]</sup>

**Toxicity of cyanoacrylates:** Toxicity of cyanoacrylates can affect the dental technicians who fabricate or repair acrylic dentures, the prosthodontist who adjust, correct and insert the dentures and finally the patient who wears the dentures.

**The dental technicians:** they are often exposed to their occupational hazards due to inhalation of chemical activity of the cyanoacrylates. Various dermatologic reaction like urticarial reactions and irritant dermatitis and non dermatologic reactions have been reported<sup>[11]</sup>. Cyanoacrylates readily react with water, polymerising to less volatile polymers. When the relative humidity is high, they react with water vapour in the air and the atmospheric concentration of cyanoacrylate monomer is reduced. Calnan reported an outbreak of irritant dermatitis associated with the use of ethyl cyanoacrylate glue<sup>[12]</sup>. Also the technicians repair broken acrylic dentures and, more recently, isocyanocrylate has

been proposed as a dental adhesive. Of concern was the possible releases of substances that may be harmful to the oral mucosa<sup>[13]</sup>. Studies have also shown that cyanoacrylates have also induced asthma<sup>[14]</sup>. Low molecular weight acrylic monomers are irritant to the eyes and mucous membranes, and have reported to produce and pulmonary oedema<sup>[15]</sup>

**The Prosthodontist:** The prosthodontist deliver the denture to the patients. During delivery procedure often they have to trim, cut or adjust the repaired dentures. Cyanoacrylate and methyl methacrylate monomers can cause asthma in those who work with them. Sometimes they do repair and handle cyanoacrylates on their own making them vulnerable to exposure. Contact dermatitis with exposure to cyanoacrylates has been reported<sup>[16]</sup>. A higher incidence of toxicity has been associated with lower humidity with outbreaks of asthma and irritant dermatitis in dental staffs<sup>[11]</sup>

**The patient:** If commercial CA adhesive is used for repair of broken dentures, it will release substances which are toxic to human oral fibroblasts. Of concern was the possible release of substances that may be harmful to the oral mucosa. These released substances may persist for at least two weeks. During polymerization of CA, heat is released, which may cause cell damage when used as a tissue adhesive or whenever CA comes into direct contact with cells<sup>[17]</sup>

**Information of occupational hazards and exposure:** The dental technician and the prosthodontist should be informed of the various hazards of cyanoacrylate and its exposure. Direct contact should be avoided with all sorts of protective gadgets are recommended. Cyanoacrylates causes vaporisation of monomer under conditions of low relative humidity; Cyanoacrylate and methyl methacrylate monomers can cause asthma in those who work with them. Possibly less volatile, longer chain alkyl cyanoacrylate homologues could be substituted in many adhesives, where the bond strength currently obtained is many times that required. The risk of inhalation of acrylates can be reduced by appropriate ventilation and, in the case of cyanoacrylate monomers, by maintaining relative humidity above 55%<sup>[18]</sup>

## CONCLUSION

The application and use of cyanoacrylates has been practiced for many years, but the adverse effects have been widely neglected. Appropriate usage of cyanoacrylates and its handling should be followed strictly, and preventing their availability as a counter

product to the patients. Even though there is no evidence that cyanoacrylate is carcinogenic to humans, still it can cause adverse effects to the dental technician and prosthodontist. Patients should be

instructed and advised not to use or repair dentures using cyanoacrylate on their own. Furthermore cyanoacrylates should be investigated since the widespread use and application are increasing.



**Fig. 1, 2 – Repair of acrylic dentures with cyanoacrylates**

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