Knowledge and awareness of polycaprolactone and its applications as provisional material in general dental practice - A questionnaire-based survey

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ABSTRACT:

INTRODUCTION: Polycaprolactone is a hydrophobic block of amphiphilic synthetic block copolymers used to form the vesicle membrane of polymersomes. A variety of drugs have been encapsulated within PCL beads for controlled release and targeted drug delivery. Polycaprolactone can be used as a special tray, muscle deprogrammer, denture base, temporary crown and bridge, occlusal splints, etc. **AIM:** The aim of the study was to find out about the knowledge, awareness of polycaprolactone and its applications as a provisional material in general dental practice. **MATERIALS AND METHODS:** The present study was a cross-sectional survey conducted among dental students to analyze their knowledge, awareness and practice about bonding procedures for fixed orthodontic appliances. A questionnaire of 10 questions was prepared and was circulated among the students through google docs electronic media. The data were collected and examined using Microsoft Excel software for statistical evaluation. **RESULTS:** The use of polycaprolactone was known only to 20% of the dental students. Moreover, its application and indications are known to only <1% of the study participants. Pattern resin was found to be commonly used in splinting implant impression copings. **CONCLUSION:** Various uses of polycaprolactone suggest that it can be used as a temporary denture base, custom tray, implant impression splinting. Furthermore studies should be performed to know the various use of PCL in dentistry.

Keywords: polycaprolactone, dental practice, questionnaire-based survey

INTRODUCTION:

Polycaprolactone (PCL) is a biodegradable polyester with a variety of applications. It's commonly used in the medical field for drug delivery systems, wound care products, due to its biocompatibility and slow degradation rate(1). Additionally, PCL finds use in 3D printing and as a component in certain plastics and adhesives. Polycaprolactone is widely used in dentistry such as Scaffold for Tissue Engineering, Drug Delivery Systems, Temporary Prosthetic Devices, PCL can be employed in the fabrication of temporary prosthetic devices, such as crowns or bridges, due to its moldability and biodegradable nature(2). The adaptability and biodegradability of PCL make it a promising material in advancing various aspects of dental treatments and therapies(3). Polymers are mostly used in different dental applications such as denture bases, denture teeth, custom trays, impression materials, splints, maxillofacial prostheses, soft liners, core buildup materials, temporary restoratives, and luting material(4).

Property of PCL is that it is hydrophobic and semi crystalline in nature. The crystallinity of PCL tends to decrease with increasing molecular weight. PCL has a low melting point and extraordinary blend compatibility has stimulated extensive research in biomedical education(5). PCL and its copolymers were used in various drug-delivery devices. Various other groups were also added to make the polymers. Dental tissues are made up of stem cells with multiple differentiation potencies in recent decades(6).

Polycaprolactone is a well-known biomaterial that has been used in the engineering of many tissues for more than a decade because of its excellent tailorability and availability(7). Wide variety of studies have been done to analyze the use of PCL on dental applications, including implants. Our team has extensive knowledge and research experience that has translated into high quality publications. This vast research experience has inspired us to perform a study to assess the knowledge and awareness of polycaprolactone and its applications as provisional material in general dental practice.

MATERIALS AND METHODS:

A cross sectional survey was conducted among undergraduate students of Saveetha dental college in the form of a questionnaire that was circulated online. The students were of the age group 18 to 25 years. The study protocol was approved by the institutional review board and the questionnaire was validated. The sample size of this study was 100. The questionnaire consisted of 10 questions that mainly focused on knowledge, awareness of polycaprolactone and its applications as provisional material in general dental practice.

The questionnaire was distributed among the students through an online platform called google forms. The data was collected and tabulated in google sheets which was later copied to SPSS software. The output was derived and was represented in the form of pie charts and bar graphs. The Pearson Chi Square test was also done in association with the year of study. The confidence interval was found to be 95% and statistical significance of $p<0.05$. The independent variable of the study was the year of study. The results were then represented in the form of pie charts and bar charts.

RESULTS AND DISCUSSION:

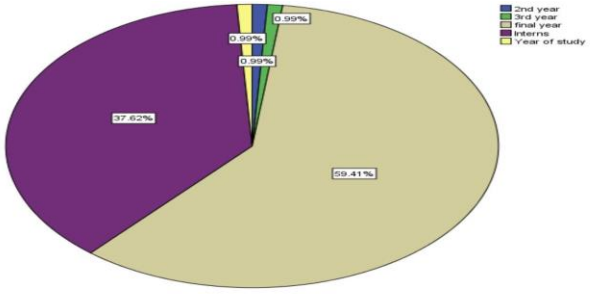

Figure 1: Pie chart represents the frequency distribution of the year of study of undergraduate students where 59.41% were final years, 37.62% were interns, 0.99% were second years and 0.99% were third years.

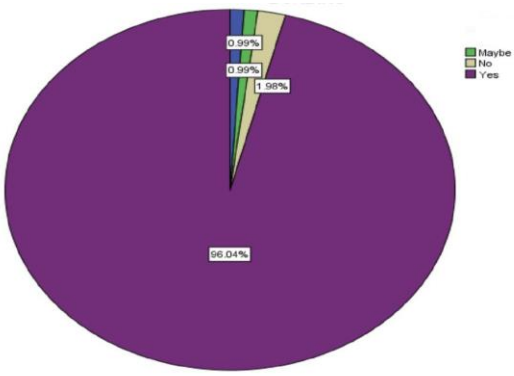

Figure 2: Pie chart representing the frequency distribution of awareness on the use of polycaprolactone as a provisional material in general dental practice where, 96.04% were aware, 1.98% were not aware and 0.99% were not sure.

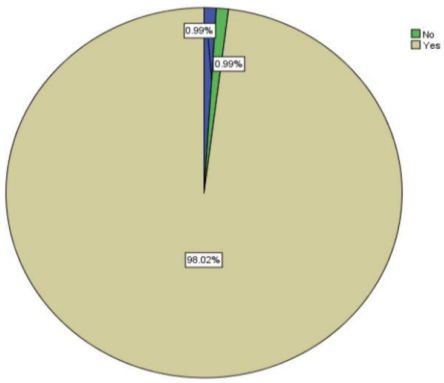

Figure 3 Pie chart representing the frequency distribution of the application of PCL in dentistry. 98.02% said yes and 0.99% of the students no.

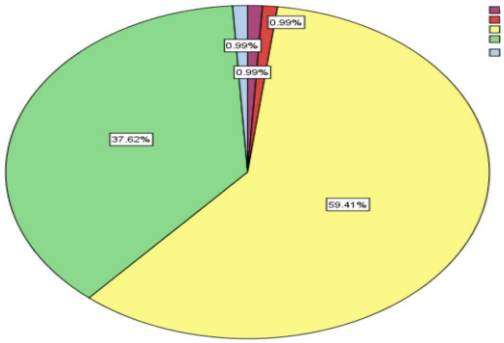

Figure 4: Pie chart representing the frequency distribution of frequently used material for fabrication of custom tray, where 59.41% students say Autopolymerising resin, 37.62% said light cure resin,0.99% said heat cure resin and 0.99% said shellac base plate.

The present study shows that 59.41% were final years, 37.62% were interns, 0.99% were second years and 0.98% were third years. The study showed that 96.04% of the students were aware about the use of PCL in dentistry and 1.98% were not aware and 0.99% were not sure. 98.02% of the students said that PCL was used as a provisional material in dentistry and 0.98% said no. 59.41%

of the students said that Autopolymerizing resin is used as a material for fabrication of custom tray, 37.62% said heat cure resin, 0.99% said heat cure resin and 0.99% said shellac base plate.
PCL has several superior properties compared to self-cure acrylic resin-such as light molecular weight, hydrophobicity, low melting point, and biocompatibility. There are different provisional materials used in dentistry, especially in the field of prosthodontics such as self-cure acrylic resins, composite resin, light-cured resins, BISGMA, and PMMA(8). There are no *in vivo* or *in vitro* studies available in the literature, which justified the improved properties of PCL as a provisional material. Hence, this questionnaire-based survey was used to evaluate the knowledge and awareness of different provisional materials, especially PCL and its applications in prosthodontic practice(9).
Polycaprolactone (PCL) is a biodegradable polymer that has found applications in prosthodontics, particularly in the fabrication of temporary or provisional prostheses. Its ease of use and ability to be molded make it suitable for creating custom interim restorations for patients while more permanent solutions are being developed(10). PCL's biocompatibility and adjustable degradation rate contribute to its utility in prosthodontic practice(11).

Limitations of the study is that the studies population includes only 100 students. It needs a large population that can be widely extended to create more knowledge, awareness and practice on fixed orthodontic appliances among non-orthodontic residents. So when the study is widespread more results on students' awareness can be analyzed.

CONCLUSION:

The present study concludes that there was adequate knowledge, awareness of polycaprolactone and its applications as a provisional material in general dental practice. PCL, despite its good handling properties, is not well known to prosthodontists and is a forgotten polymer. Its use as a temporary denture base, custom tray, muscle deprogrammer, implant impression splinting, provisional for crown and bridge, and templates should be encouraged and incorporated to get benefits of its characteristic properties.

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