

INTRODUCTION

Resin-matrix composites are widely used as restorative materials, due to their mechanical, optical and aesthetic properties. However, some concerns have emerged due to polymerization shrinkage, the release of monomers from the organic matrix and material degradation over time. Bisphenol A (BPA) derivatives, have been implicated in potential toxicity according to scientific evidence [1-3]. Several factors hinder the monomer conversion during light-curing, but the size of the inorganic particles and the composition of the organic matrix itself also matter [1,4]. It is essential to emphasize that previous studies have demonstrated the potential toxicity of resin-based materials, which can occur at both local and systemic levels. Therefore, a thorough understanding of the factors is necessary.

OBJECTIVES

- To comprehensively explore the factors contributing to the toxicity associated with resin-matrix composites;
- To determine the potential local and systemic effects of resin-matrix composite restorations in individuals
- To establish a clinical protocol to reduce the release of residual monomers.

MATERIALS AND METHODS

A systematic review was performed according to the **PRISMA criteria**. A **PICO question** was established: Which factors (**C**) influence the toxicity (**O**) of dental composite resins (**I**) in humans (**P**), and what are their local or systemic adverse effects (**O**)?

Three databases, PubMed, Cochrane Central and Web of Science were selected to run this research. Filters were established to retrieve articles in the last 20 years and in English. The inclusion criteria were *in vivo* studies/Humans, Randomized Controlled Trial (RCT) and Toxicity Studies. The exclusion criteria were *in vitro*/animal studies, non-resin-matrix composite materials, reviews and clinical case reports. The characteristics of the included articles were recorded in a predefined Excel file.

RESULTS AND DISCUSSION

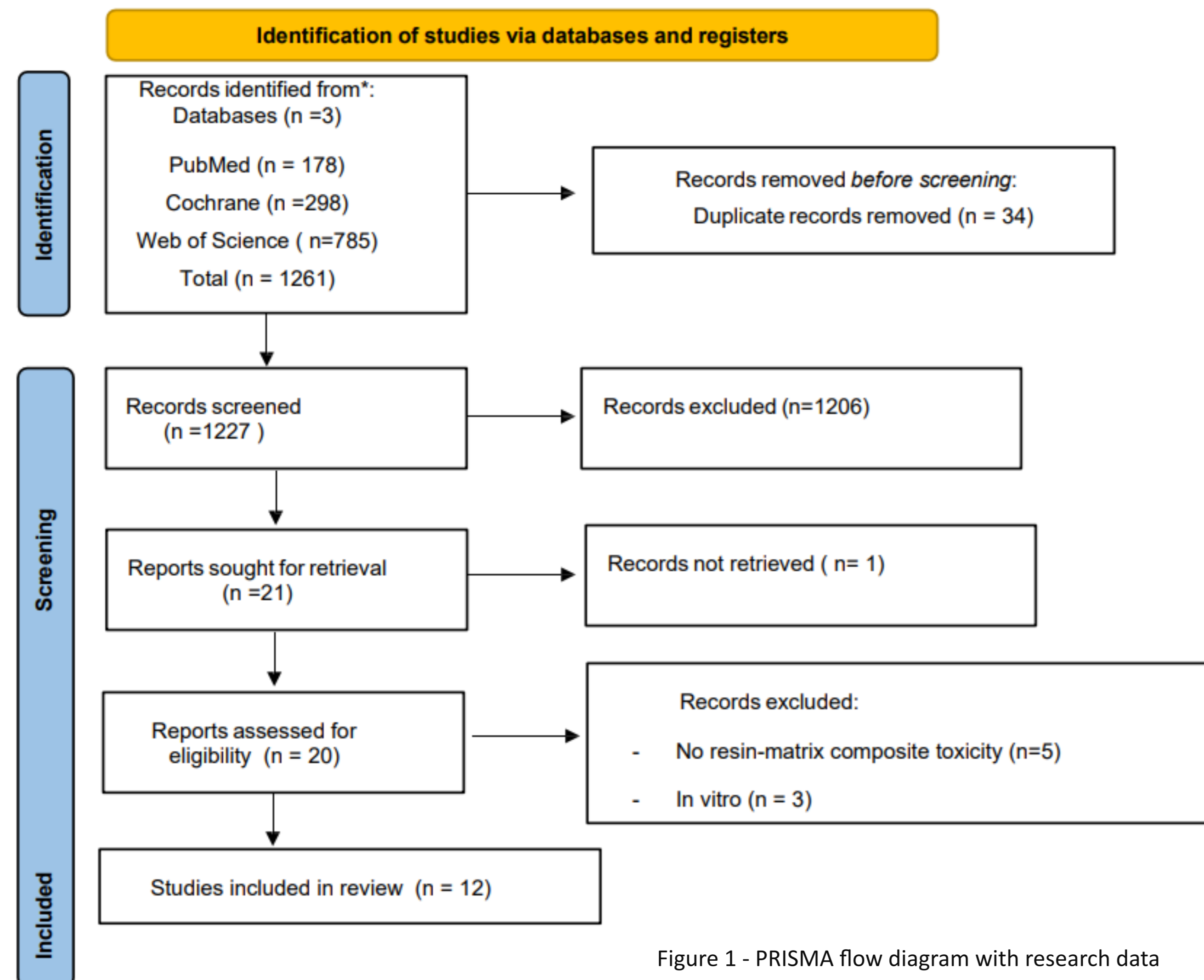


Figure 1 - PRISMA flow diagram with research data

1. Sensitization to Methacrylate Monomers (skin patch testing)

- MMA and TEGDMA: dental students with an average aged of 22 years old may be susceptible.
- Potential cross-sensitization between MMA and formaldehyde.
- Risk of cross-sensitization between formaldehyde and certain methacrylic monomers in dental patients [5].

2. Changes in children's immune responses after resin composite treatment

- Decrease in the B-cell and monocyte responsiveness in the initial six-month period, particularly in children with a higher prevalence of BisGMA-based composite restorations [6].

3. Lipid peroxidation and DNA oxidation

- Increase in the free radical-induced oxidative lesion indicators, 8-OHdG/10⁶ dG ratio, in the composite filling cohort, suggesting that Bis-GMA and TEGDMA are involved in the lipid peroxidation and DNA oxidation [7].

Despite concerns, the concentrations of BPA and monomers in resin-matrix restorations remain below levels that would induce local or systemic toxicity. As a result, there is limited potential for adverse effects from exposure to these materials. Moreover, no significant association was found between concentration levels and the quantity of resin restoration surfaces or substantial alterations in evaluated variables across studies.

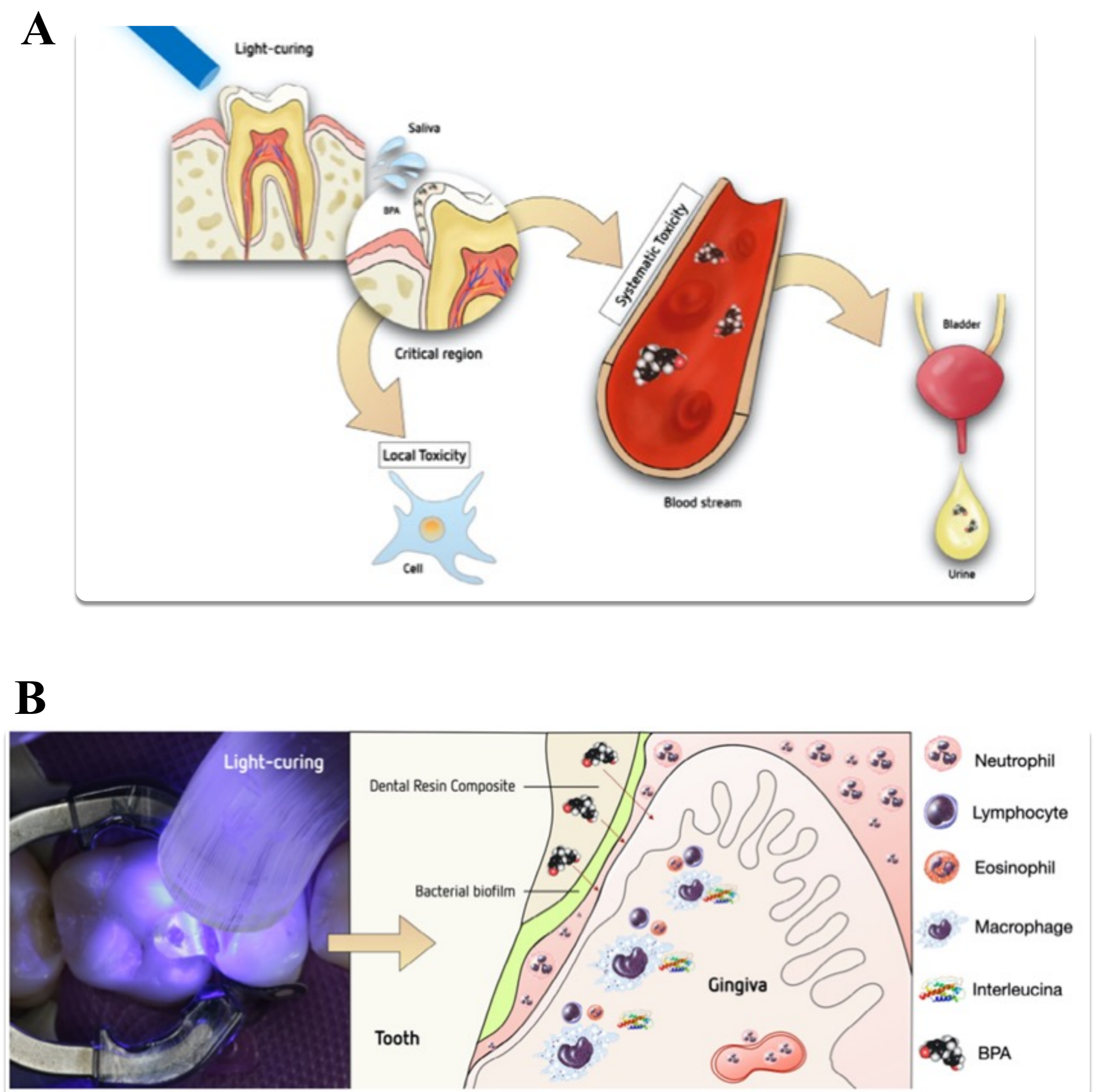


Figure 2: (A) - Schematics on the release of BPA and its derivatives from resin-matrix composites to the surrounding soft tissues; (B) Chemical interaction with cells. Figures adapted from [8].

CONCLUSION

This systematic review shows that the detection of low levels of free monomers among participants with resin-matrix restorations, depends on adherence to manufacturer instructions. Despite variability in outcomes across studies, it remains challenging to identify discernible and statistically significant changes attributing to composite resins. Multiple factors may contribute to this ambiguity, including the potential association of BPA with dietary and environmental exposures, which could confound results. Further research is required to establish causality, considering exposure to dental and non-dental sources containing BPA.

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