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Présentateur : PAPA IBRAHIMA KAMARA

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Chemicals disinfections and their effects on the dimensional stability of alginate: a systematic review

Auteurs : KAMARA P.I, SOW M.M, THIOUNE N, MBODJ E.B.

Adresse et email : pikasso2000@hotmail.com

Résumé

Background: Dental practice involves a risk of exposure to microorganisms causing many infectious diseases. The risk of contamination starts at the beginning of the prosthetic workflow through impressions. Various chemical disinfection protocols for dental impressions are reported in the literature.

Objective: This study aimed to systematically review the literature regarding the dimensional stability of alginate impressions, disinfected with different chemical agents.

Methods: The Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) checklist was used to structure this systematic review. The inclusion criteria were as follows: clinical trials, in vitro studies, studies in English or French, papers published from 2010 to 2022, disinfection done by immersion or spray and studies focusing on the effects of chemical disinfection products on the dimensional stability. An electronic search was performed in the following data- bases: PubMed/ MEDLINE, Scopus, Cochrane and Dentistry & Oral Sciences Source. we also conducted a manual search for articles published in specific journals of dental prostheses and references from selected electronic articles.

Results: Twenty-six studies included in this systematic review. According to the findings, Alginates are generally subject to dimensional changes during disinfection. The most widely used disinfectant was sodium hypochlorite. Immersion methods were the most studied in 19 studies, while spay methods were used in 12 studies.

Conclusion: Spraying is the disinfection method with the least dimensional alteration for alginates. The duration of disinfection and the concentration of the disinfectant are essential parameters leading to a change for immersion disinfection method.

Keywords: Dental Impression Materials; Alginate; Chemical disinfection; Immersion; Spraying; Dimensional stability.

Effect of chemical disinfection on the dimensional stability of dental impression : a systematic review.

KAMARA Papa Ibrahima, SOW Massaer Malick, THIOUNE Néné, MBODJ El Hadj Babacar.

Service de Prothèse dentaire, Institut d'Odontologie et de Stomatologie, Faculté de Médecine, Pharmacie et d'Odontologie de Dakar.

Introduction

The possibility of damaging the dimensional stability and the surface roughness leads to the option of performing no treatment on dental impression [1]. Indeed, disinfection methods lead to physicochemical changes in impression materials. However, several studies show that chemical disinfection induces dimensional and surface changes which can be compatible with the clinical applications and still provide sufficient disinfection [3, 5]. Chemical disinfection is the gold standard for the disinfection of dental impressions with two methods, immersion and spraying. Disinfection remains an essential step to reduce the risk of cross-contamination [1]. The emergence of new infectious pathologies particularly contagious should encourage dentists to be more careful in the treatment of impressions. If no decontamination procedures are applied to transferred items from dental clinic to dental laboratory, the latter may become a significant place in cross-contamination chain by getting and sending contaminated items [1, 4]. The aim of this study was to examine the effect of immersion or spray disinfection on the dimensional stability of alginate impressions through a systematic review from papers published from 2010 to 2022.

Materials et Methods

The Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) checklist was used to structure this literature review. Selected studies were designed in accordance with the PICO strategy.

The inclusion criteria were as follows:

- clinical trials (randomised controlled trial, prospective, retrospective);
- in vitro studies;
- studies in English or French;
- papers published from 2010 to 2022;
- disinfection by immersion or spray;
- studies focusing to the effects of chemical disinfection on the dimensional stability.

An electronic search was independently performed by two authors (MMS and PIK) in the following databases: PubMed/MEDLINE, Scopus, Dentistry & Oral Sciences Source and Cochrane Library, using MeSH and keywords with the following search strategy (Table 1). The choices made by the two authors (MMS and PIK) were analysed by a third author (NT), and a consensus was reached through discussion. A manual search for articles published in specific journals of dental prostheses and dental materials was conducted using resources such as the International Journal of Prosthodontics, Journal of Dental Research, Journal of Oral Rehabilitation, Journal of Prosthodontics, The Journal of Prosthetic Dentistry, Dental Materials, and Materials Science & Engineering. Also, prosthetic books were used and pertinent references from selected electronic articles.

MeSH	Keywords
Dental Impression Materials Disinfection Decontamination Dental Disinfectants Fixed Prosthodontics	Chemical disinfection Immersion Spraying Dimensional stability

Table 1: MeSH and keywords used for databases queries

Results

The electronic search provided 1019 articles. After removing duplicate articles, 695 articles remained. The titles, keywords and abstracts of the articles were read, which led to the removal of 480 articles. The full article of each study was read except 3 studies. Then, the eligibility criteria were applied to the 215 articles remaining. The articles were read and 188 were excluded for the following reasons: impression material not matched, another disinfection methods used or a combination of several methods of disinfection, an article written in others language, evaluation of the antimicrobial effect only, evaluation of surface roughness only. In parallel, the manual search resulted in the inclusion of 2 articles.

In total, 26 in vitro studies were included in this systematic review. The flowchart in Figure 1 details the search strategy.

All included studies were performed in vitro, only one was ex vivo. The most widely used disinfectant was sodium hypochlorite. Immersion methods were the most studied in 19 studies, while spay methods were used in 12 studies. The immersion times of the samples in the solution ranged from 30 seconds to 24 hours. The dimensional stability in all studies was measured by linear measurement (distance) except one who used the weight.

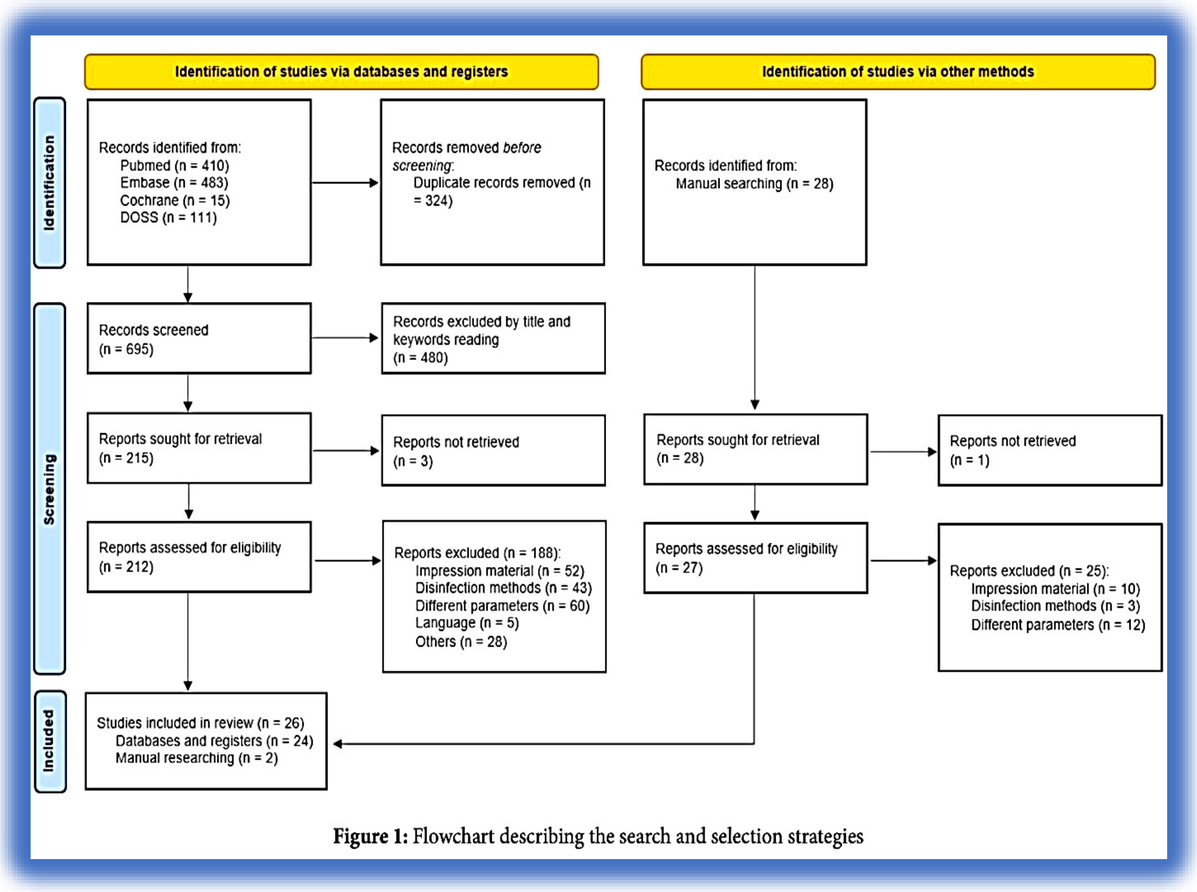


Figure 1: Flowchart describing the search and selection strategies

Comments / conclusion

Alginates are generally subject to dimensional changes during disinfection. These modifications are due to the hydrophilic nature of the material and its chemical nature. So, depending on the chemical nature or the concentration of the disinfectant and the method of disinfection, there will be exchanges: imbibition (if the exchanges are in favour of the impression) or syneresis (if the exchanges are to the detriment of the impression). This could explain the observation that all the studies investigating spray disinfection of alginates concluded that there were no significant dimensional variations [2,3,4].

Spray disinfection does not allow ion or water transfer leading to dimensional variations, in opposite to the immersion disinfection method. Of eighteen studies reported on the disinfection of alginate impressions by immersion, ten concluded that there were significant dimensional variations [2,3]. Certain studies concluded that these changes were due to immersion in high concentration disinfection solutions [2,4,5]. Indeed, these studies with HS disinfectant with a concentration higher than 1% concluded that there were changes in dimensional stability. In contrast, concentration of HS didn't exceed 1% except by SHARIF's et al study where HS at 5.25% was used [5]. From these studies it was found that the chemical composition of the alginate, the immersion time, the chemical nature of the disinfectant as well as its concentration were the factors of dimensional variations of the alginates. Spraying is the disinfection method with the least dimensional alteration. For immersion, the immersion time should not exceed 15min and the concentration of the disinfectant for HS should be less than 1%, for GA less than 2% [2,3,4].

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