Journal of Materials Science & Nanotechnology
Volume 10 | Issue 1
ISSN: 2348-9812

Review Article Open Access

Chemicals Disinfections and Their Effects on The Dimensional Stability of Alginate: Systematic Review

N Thioune[1*], Kamara PI[1], Sow MM[2], Badji K[1], Toure A[1], Dabo PS[1], Cisse B[1], Gueye M, and Mbodj EB[1]

[1]Department of Dental Prosthetics Cheikh Anta Diop University (Dakar/Senegal)
[2]MSc Cheikh Anta Diop University (Dakar/Senegal)

Corresponding author: N Thioune, Department of Dental Prosthetics Cheikh Anta Diop University, (Dakar/Senegal), Tel: +221779002181, E-mail: Massaermalick.sow@ucad.edu.sn

Citation: N Thioune, Kamara PI, Sow MM, Badji K, et al (2022) Chemicals Disinfections and Their Effects on The Dimensional Stability of Alginate: Systematic Review. J Mater Sci Nanotechnol 10(1): 106

Abstract

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 databases: 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

Introduction

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 [1]. Impression procedure consist to the introduction of impression material into the oral cavity in order to record details of the oral cavity. It is a major communication element with the dental laboratory during the fabrication of an indirect restoration but it is too the main vectors of infection in the prosthetic workflow [2].

The contact between these materials and the oral environment leads to their contamination by saliva and oral flora [3]. Many microorganisms associated to several infectious diseases such as hepatitis B, AIDS, herpes infection and tuberculosis have been found on dental impressions [2]. In order to prevent cross-contamination with infectious diseases, dental impression disinfection's is required.

The first recommendations from the ADA to reduce the risk of contamination from impressions was to perform rinsing [4]. However, rinsing reduces the microbial load, but does not completely eliminate the infectious potential of impressions [4, 1]. Since then, many protocols for disinfection of impressions have been established.

Nowadays, there is no consensus on disinfection methods and no miracle solution for optimal disinfection of impressions. The difficulty in developing a single protocol is explained by the various impression material families and the several number of disinfection solutions. Moreover, each impression material families have different reactions and alterations depending on the chemical nature and the method of disinfection [2]. The possibility of damaging the dimensional stability and the surface roughness leads to the option of performing no treatment on dental impression [5]. 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, 6].

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 [5].

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.

Material and methods

Registry protocol

The Preferred Reporting Items for Systematic Review and Meta-Analyses (PRISMA) checklist was used to structure this literature review.

Eligibility criteria

Selected studies were designed in accordance with the PICO strategy:
(P) stands for population, which includes alginate dental impression;
(I) stands for intervention, which means alginate disinfected with different chemical agents by immersion and spraying;

(C) stands for comparison or control which was other disinfection methods or immersed in distilled water or no treatment;
(O) stands for outcome, which was measurement of dimensional stability.

The review question was: " What is the effect of decontamination by immersion or spray on the dimensional stability of alginate impressions?”

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.

Information sources

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).

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

The search parameters were restricted the period of publication from 2010 to 2022. In each database, studies were selected based on the title, keywords and abstract. To determine inclusion, each article was read entirely.

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 (Figure 1).

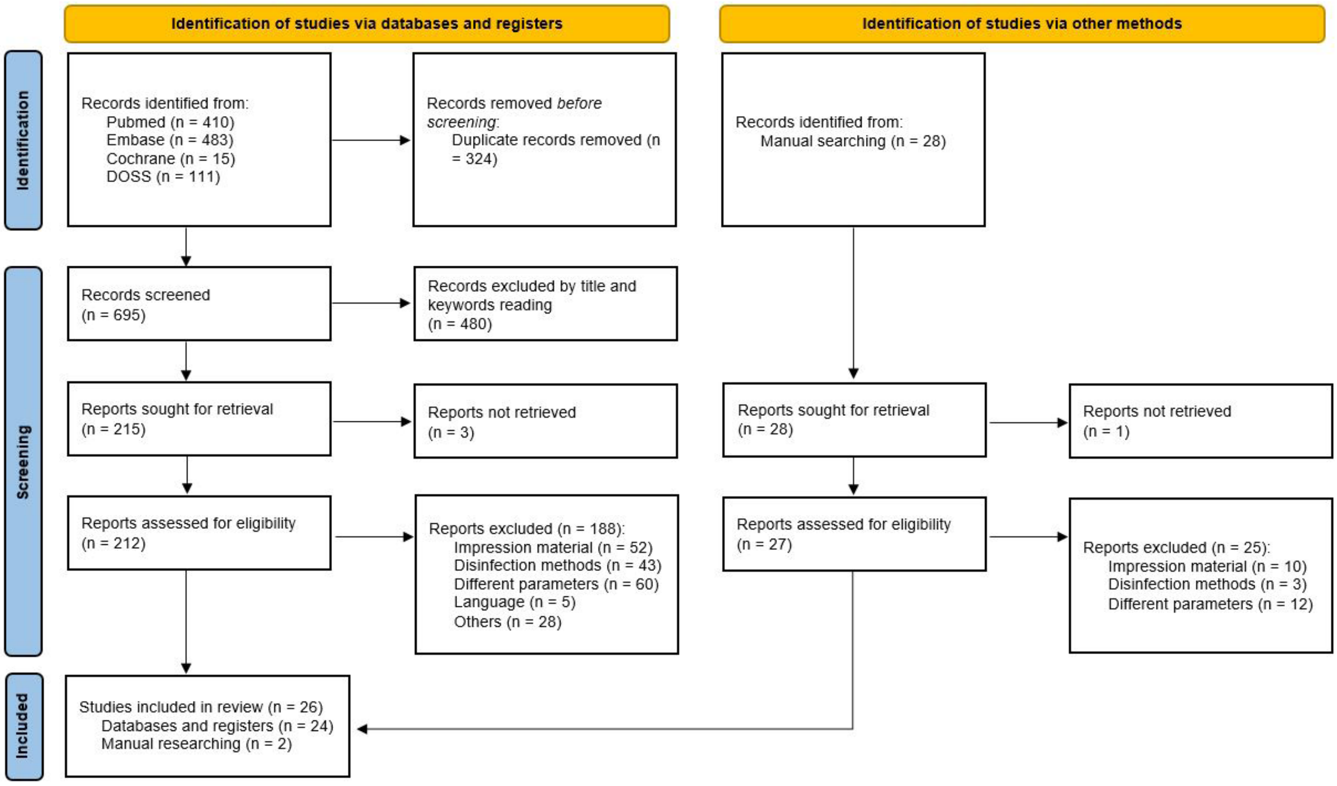

Figure 1: Flowchart describing the search and selection strategies

Data collection process

One author (MMS) collected the information from the articles, and another author (PIK) reviewed the results. A third author (NT) analysed the choices made by the two evaluators, and a consensus was agreed upon via discussion.

Data extraction

Information of the included studies was collected by one of the reviewers (MMS) and a second one (PIK) cross-checked, independently, all the retrieved data (Table 2). The following data were systematically collected from each included study:

- authors and publication year;
- type of study;
- dental impression materials;
- disinfection methods;
- chemical disinfectant;
- contact time;
- experimental condition;
- conclusion.

Authors - Publication year	Type of study	Dental impression materials	Disinfection methods	Chemical disinfectant	Contact time	Experimental condition	Conclusion
Aeran et al. – 2014 [14]	In vitro	Alginate	Immersion	GA 2% SH 1 % PI 5%	15mn	Linear measurement under microscope of gypsum models casted from disinfected and non-disinfected impressions	No significant change between gypsum models
Babiker et al. – 2018 [27]	In vitro	Alginate	Immersion Spray	SH 1 % SH 5,25 %	5mn	Linear measurement with digital calliper of gypsum models casted from disinfected and non-disinfected impressions	Significant change between gypsum models with immersion methods. No significant change between gypsum models with spraying methods
Demajo et al. – 2016 [30]	In vitro	Alginate Silicone A	Spray	MD 520® Muniten®	10mn	Linear measurement under microscope of impression before and after disinfection	No significant change between booth measurement
Dewi et al. – 2019 [31]	Ex vivo	Alginate	Immersion	Coconut oil	5mn	Linear measurement with digital calliper of impression before and after disinfection	Significant measurement changes from before and after disinfection
Dorner et al. – 2014 [32]	In vitro	Alginate	Spray	SH 1%	10mn	Linear measurement withcoordinate measuring machine of gypsum models casted from disinfected and non-disinfected impressions.	Significant measurement changes without clinical importance (less than 1,5%)
Ghasemi et al. – 2019 [35]	In vitro	Alginate	Spray	SH 0,5% Deconex® Epimax®	10mn	Linear measurement with digital calliper of gypsum models casted from disinfected and non-disinfected impressions	No significant change between gypsum models

Guiraldo et al. – 2012 [36]	In vitro	Alginate	Spray	SH 2% PA 2% CHX 0, 2%	15mn	Linear measurement under microscope of impression from a standardised test model ISO 1563	No significant change between impression disinfected and not
Hamedi Rad et al. – 2010 [39]	In vitro	Alginate	Immersion Spray	SH 0.5% GA 2% Deconex® Micro 10®	8mn	Linear measurement with digital calliper of gypsum models casted from disinfected and non-disinfected impressions	Significant change between gypsum models with immersion methods on SH, GA and Deconex® No significant change between gypsum models with spraying methods
Hiraguchi et al. – 2012 [40]	In vitro	Alginate	Immersion	HS 0.5%	15mn	Linear measurement with coordinate measuring machine of gypsum models casted from disinfected and non-disinfected impressions.	No significant change between impression disinfected and not
Hsu et al. – 2021 [43]	In vitro	Alginate	Spray	BirexSE® Opti-Cide3® COEfect-Minute-Spray® CaviCide Spray®	5mn	Linear measurement with Cone Beam Computed Tomography of disinfected impressions compared to distilled water using as spray.	No significant change between impression disinfected and the comparator
Ismail et al. – 2017 [44]	In vitro	Alginate	Immersion	HS 1% GA 2%	10mn 60mn	Linear measurement with digital calliper of gypsum models casted from disinfected and non-disinfected impressions	Significant change between gypsum models and the master models at 60mn.

Izadi et al. – 2014 [45]	In vitro	Alginate	Immersion	Sanosil 2%®	10mn	Linear measurement with digital calliper of gypsum models casted from disinfected impressions and comparator. Comparator was non-disinfected impressions immersed in water.	No significant change between impression disinfected and the comparator
Kamra et Garg – 2013 [49]	In vitro	Alginate	Immersion	GA 2% HS 1% PI 0,5%	5mn 10mn 15mn	Linear measurement under microscope of gypsum models casted from disinfected and non-disinfected impressions of a standardised test model ANSI/ADA n°19	No significant measurement changes between gypsum models
Muzaffar et al. – 2011 [56]	In vitro	Alginate	Immersion	Perform ID®	5, 10, 15, 20, 25, …,60mn	Linear measurement under microscope of gypsum models casted from disinfected and non-disinfected impressions of a standardised test model	Significant measurement changes between gypsum models
Muzaffar et al. – 2012 [57]	In vitro	Alginate	Immersion	HS 5,25 % Perform ID®	5, 10, 15, 20, 25, …,60mn	Linear measurement under microscope of gypsum models casted from disinfected and non-disinfected impressions of a standardised test model	Significant measurement changes between gypsum models
Özdemir et Pekince – 2019 [61]	In vitro	Alginate Silicone A Silicone C Polyéther	Pulvérisation	HS 1 % Zeta 7 spray®	10min pour le HS 3min zeta spray	Mesure linéaire avec une radiographie numérique de modèle en plâtre provenant d’empreinte spécifique désinfecté et non désinfecté	Pas de changement significatif entre les mesures des modèles coulés immédiatement ou après 24h sauf pour HS et l’alginate

Pinheiro et al. – 2018 [62]	In vitro	Alginate	Pulvérisation	HS 1 %	10min	Linear measurement with digital calliper of gypsum models casted from disinfected and non-disinfected impressions	Pas de changement significatif entre les mesures des modèles coulés immédiatement
Rentzia et al. – 2011 [66]	In vitro	Alginate	Immersion	Cidex opa ® HS 1%	30s, 60s 90s, 120s 140s,180s 240s,300s	Linear measurement under microscope of gypsum models casted from disinfected and non-disinfected impressions	No significant measurement changes between gypsum models
Samra et Bhide – 2018 [68]	In vitro	Alginate	Immersion	HS 1 % GA 2%	10min	Linear measurement under microscope of gypsum models casted from disinfected and non-disinfected impressions	Changement significatif entre les mesures des modèles en plâtre d'empreinte désinfecté et celle non désinfecté. Changement plus important selon la provenance du matériau à empreinte
Sharif et al. – 2021 [69]	In vitro	Alginate	Immersion Spray	HS 5,25 % GA 2%	10mn	Linear measurement of gypsum casted from disinfected compared to non-disinfected impression from ADA n°25 standardised test model under microscope	No significant change between gypsum models
Suprono et al. – 2012 [72]	In vitro	Alginate	Spray	HS 5,25 % Chloramine-T	10mn	Linear measurement of gypsum casted from disinfected compared to non-disinfected impression from ANSI/ ADA n°19 standardised test model under microscope	No significant change between gypsum models

Trivedi et al. – 2019 [73]	In vitro	Alginate	Immersion Spray	Aloe vera	3mn 7mn	Linear measurement under microscope of gypsum models casted from disinfected and non-disinfected impressions	Significant change between gypsum models for immersion No significant change between gypsum models for spray
Tun et al. – 2019 [74]	In vitro	Alginate	Immersion	AQ 1% HS 0,5%	3mn 10mn	Linear measurement with digital calliper of gypsum models casted from disinfected and master model	No significant change between impression disinfected and master model
Ulgey et al. – 2020 [75]	In vitro	Alginate	Immersion	Zeta 7 solution®	15mn 30mn	Linear measurement with digimatic caliper of gypsum models casted from disinfected and non-disinfected impressions	No significant change between impression disinfected and not
Vrbova et al. – 2020 [76]	In vitro	Alginate	Immersion	Aseptoprint® Zeta 7 solution® Silosept® Dentaclean form®	2mn 10mn 15mn	Linear measurement of gypsum casted from disinfected impression compared to ISO 21563 and ISO 4823 standardised test model under microscope	Significant change on measurement between of gypsum model casted from disinfected impression compared to standardised test model.
Zahid et al. – 2017 [77]	In vitro	Alginate	Immersion	HS 5,25% Practice safe®	30mn 24h	Weight measurement using an electronic balance of disinfected impressions compared to control those immersed in artificial saliva	Significant change of weight between impression disinfected and control. Change according to the disinfectant solution

mn: minute; h: hour; GA : Glutaraldehyde ; HS : Sodium Hypochlorite; PI : Povidone iodine; Al : Alcohol ; AQ : Quaternary ammonium; IP : Iodophor ; CHX : Chlorhexidine; PA: peracetic acid

Table 2: Summarizing of included studies

Risk of bias

The risk of bias in these studies was analysed using the JBI Critical Appraisal Checklist for Quasi-Experimental Studies (non-randomised experimental studies), which provides a critical analysis of the methodological quality of the studies. Each study was evaluated individually and JBI provided nine questions that were selected based on the characteristics of the studies in which the answers were "Yes," "No," "Not clear" or "Not applicable". The analysis was conducted by two examiners, and subsequently, a union score of all studies was obtained (Table 3).

Authors (Year)	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9
Aeran et al. – 2014	Yes	Yes	Yes	Yes	Yes	NC	Yes	Yes	Yes
Babiker et al. – 2018	Yes	Yes	Yes	Yes	No	NC	Yes	Yes	Yes
Demajo et al. - 2016	Yes	Yes	Yes	Yes	Yes	NC	Yes	Yes	Yes
Dewi et al. - 2019	Yes	No	No	Yes	Yes	NC	Yes	Yes	Yes
Dorner et al. - 2014	Yes	Yes	Yes	Yes	No	NC	Yes	Yes	Yes
Ghasemi et al. - 2019	Yes	Yes	Yes	Yes	No	NC	Yes	Yes	Yes
Guiraldo et al. - 2012	Yes	Yes	Yes	Yes	No	NC	Yes	Yes	Yes
Hamedi Rad et al. – 2010	Yes	Yes	Yes	Yes	No	NC	Yes	Yes	Yes
Hiraguchi et al. - 2012	Yes	No	No	Yes	No	NC	Yes	Yes	Yes
Hsu et al. – 2021	Yes	Yes	Yes	Yes	Yes	NC	Yes	Yes	Yes
Ismail et al. - 2017	Yes	Yes	Yes	Yes	No	NC	Yes	Yes	Yes
Izadi et al. - 2014	Yes	Yes	Yes	Yes	No	NC	Yes	Yes	Yes
Kamra et Garg - 2013	Yes	Yes	Yes	Yes	No	NC	Yes	Yes	Yes
Muzaffar et al. - 2011	Yes	Yes	Yes	Yes	No	NC	Yes	Yes	Yes
Muzaffar et al. - 2012	Yes	Yes	Yes	Yes	No	NC	Yes	Yes	Yes
Özdemir et Pekince - 2019	Yes	Yes	Yes	Yes	No	NC	Yes	Yes	Yes
Pinheiro et al. - 2018	Yes	Yes	Yes	Yes	Yes	NC	Yes	Yes	Yes
Rentzia et al. – 2011	Yes	Yes	Yes	Yes	No	NC	Yes	Yes	Yes
Samra et Bhide – 2018	Yes	Yes	Yes	Yes	No	NC	Yes	Yes	Yes
Sharif et al. – 2021	Yes	Yes	Yes	Yes	No	NC	Yes	Yes	Yes
Suprono et al. - 2012	Yes	Yes	Yes	Yes	No	NC	Yes	Yes	Yes
Trivedi et al. - 2019	Yes	Yes	Yes	Yes	No	NC	Yes	Yes	Yes
Tun et al. – 2019	Yes	Yes	Yes	Yes	No	NC	Yes	Yes	Yes
Ulgey et al. - 2020	Yes	Yes	Yes	Yes	No	NC	Yes	Yes	Yes
Vrbova et al. - 2020	Yes	Yes	Yes	Yes	No	NC	Yes	Yes	Yes
Zahid et al. - 2017	Yes	Yes	Yes	Yes	No	NC	Yes	Yes	Yes

Table 3: Qualitative evaluation by JBI Critical Appraisal Checklist for Quasi-Experimental Studies

Results

Literature search

The electronic search provided 1019 articles:

- 410 from PubMed/ Medline,
- 111 from DOSS
- 15 from Cochrane
- 483 from Scopus.

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.

Description of studies

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. The data collected from the articles are shown in Table 2.

Quality assessment of the studies

The risk of bias analysis between the studies was low because a majority of the selected items were evaluated as "yes"; therefore, the quality of the included studies was high. Notably, the question on the follow-up period was "not applicable" for the selected studies because all selected studies were considered in vitro (Table 3).

Discussion

The objective 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.

Limited access to other databases and the lack of references to use a periodical delimitation for electronic search guide were the main limitations encountered during this work.

After reading the titles and abstracts of an initial total of 1047 articles retrieved for inclusion in the study, 26 articles were selected, as ratio of 5.4%.

The articles not included were duplicates or did not meet the selection criteria.

The risk of bias in the selected studies was low as the majority of the selected studies had a score that ranked them as such.

Alginates are generally subject to dimensional changes during disinfection. These modifications are due to the hydrophilic nature of the material and its chemical nature. Alginates are made up of alginic acid (15%), calcium sulphate which acts as a reactor (16%), zinc oxide (4%), titanium and potassium fluoride (3%), and diatomaceous particules (60%), and sodium phosphate and colouring or flavouring agents (2%) [33]. After gelification, the final product is in the form of a three-dimensional network of polymannuronic acid chains linked by calcium bonds. Between the different layers of this structure are the unreacted alkaline alginate sol, the free water, the inert charge particles, and the by-products of the reaction. The Na+, SO42-, PO43- etc. ions in the alginate will create an osmotic potential which, on contact with a solution, will produce a diffusion of ions. The ions can diffuse from the impression to the disinfection solution or vice versa depending to the osmotic potential. The water contained in the impressions will also diffuse [7]. The diffusion of water is always from the less concentrated solution to the most concentrated one. These transfers will happen until an equal balance, a buffer solution, is established. 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 [9, 10, 12, 13, 14, 15, 17, 22, 23, 26, 27, 28].

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 [9, 11, 15, 17, 7, 21, 25, 28, 31, 32]. The studies lead by BABIKER et al., DEWI et al., HAMEDI RAD et al. or TRIVEDI et al. concluded that these changes were due to immersion in high concentration disinfection solutions.

Indeed, these studies with HS disinfectant with a concentration higher than 1% concluded that there were changes in dimensional stability. In contrast, in the seven studies that concluded that there were no significant dimensional changes [1, 16, 19, 20, 24, 25, 29, 30], the concentration of HS did not exceed 1% except for the study by SHARIF et al where HS at 5.25% was used.

Other products used were 1 or 2% GA, AQ or other products. AQ for example are salts of quaternary ammonium cations with an anion which are generally not very reactive.

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% [1, 9, 10, 12-30].

Conclusion

A qualitative and quantitative synthesis of the data reported in the included studies led to the following conclusions:

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.

References

1. Powell Gl, Runnels Rd, Saxon Ba, Whisenant BK (1990) The presence and identification of organisms transmitted to dental laboratories. J Prosthet Dent. 64: 235-7.

2. Bezerianos J (2009) Cross-sectional study on the asepsis of articles transférés entre la clinique et le laboratoire dentaire et de l'instrumentation de laboratoire M. Sc. en médecine dentaire : option réhabilitation prosthodontique. Thèse Sci Odonto ; Montréal.

3. Yilmaz H, Aydin C, Gul B, Yilmaz C, Semiz M (2007) Effect of disinfection on the dimensional stability of polyether impression materials. J Prosthodont. 16: 473-9.

4. ADA Council on Dental Practice (1985) Guidelines for infection control in the dental office and the commercial dental laboratory. J Am Dent Assoc 110: 969-72.

5. Missika P, Drouhet G (2001) Hygiène, asepsie, ergonomie : a challenge permanent. Paris : CdP ; 118p.

6. Pizzardini P, Muller M, Fosse T, Bolla M (2004) Disinfection of irreversible hydrocolloid impressions: antibacterial efficacy, dimensional stability and state of surface. Rev Odonto Stomato 33: 99-109.

7. Muzaffar D, Braden M, Parker S, Patel MP (2012) The effect of disinfecting solutions on the dimensional stability of dental alginate impression materials. Dent Mater 28: 749-55.

8. Aeran H, Agarwal A, Kumar V, Seth J (2014) Study of the effect of disinfectant solutions on the physical properties of dental impressions. Ind J Dent Sci 6: 1-6.

9. Babiker GH, Khalifa N, Alhajj MN (2018) Dimensional accuracy of alginate impressions using different methods of disinfection with varying concentrations. Compend Contin Educ Dent 39: 17-20.

10. Demajo JK, Cassar V, Farrugia C, Millan-Sango D, Sammut C et al**.** (2016) Effectiveness of Disinfectants on Antimicrobial and Physical Properties of Dental Impression Materials. Int J Prosthodont 29: 63-7.

11. Dewi RS, Kusumaningati H, Thalib NA (2019) 12.5% Virgin Coconut Oil Solution as an Alginate Impression Material Disinfectant. J Int Dent & Med Res 12: 443-7.

12. Dorner AR, Ferraz Da Silva JM, Uemura ES, Borges ALS, Fernandes Junior VVB et al. (2014) Effect of disinfection of irreversible hydrocolloid impression materials with 1% sodium hypochlorite on surface roughness and dimensional accuracy of dental stone casts. Eur J Gen Dent 3: 113-9.

13. Ghasemi E, Fathi AH, Parvizinia S. (2019) Effect of Three Disinfectants on Dimensional Changes of Different Impression Materials. J Islam Dent Assoc IRAN 31: 169-76.

14. Guiraldo RD, Borsato TT, Berger SB, Lopes MB, Gonini Jr A et al. (2012) Surface detail reproduction and dimensional accuracy of stone models: influence of disinfectant solutions and alginate impression materials. Braz Dent J 23: 417-21.

15. Hamedi FR, Ghaffari T, Safavi SH (2010) In vitro evaluation of dimensional stability of alginate impressions after disinfection by spray and immersion methods. J Dent Res Dent Clin Dent Prospects 4: 130-5.

16. Hiraguchi H, Kaketani M, Hirose H, Yoneyama T (2012) Effect of immersion disinfection of alginate impressions in sodium hypochlorite solution on the dimensional changes of stone models. Dent Mater J. 31: 280-6.

17. Hsu KL, Balhaddad AA, Martini Garcia I, Collares FM, Dhar V et al. (2021) 3D cone-beam C.T. imaging used to determine the effect of disinfection protocols on the dimensional stability of full arch impressions. Saudi Dent J 33: 453-61.

18. Ismail HA, Mahross HZ, Shikho S (2017) Evaluation of dimensional accuracy for different complete edentulous impressions immersed in different disinfectant solutions. Eur J Dent 11: 242-9.

19. Izadi A, Badamchizadeh S, Kahnamouyi HM, Marefat H (2014) Dimensional stability of polyether, alginate, and silicone impression materials after disinfection with 2% sanosil through the immersion technique. Avicenna J Dent Res 6: 49-52.

20. Kamra M, Garg SK (2013) Role of disinfectants on dimensional accuracy and reproduction details of irreversible hydrocolloid-an in-vitro study. Indian J Dent Sci 5: 4-6.

21. Muzaffar D, Ahsan SH, Afaq A (2011) Dimensional changes in alginate impression during immersion in a disinfectant solution. J Pak Med Assoc 61: 756-9.

22. Özdemir H, Pekince KA (2019) Evaluation of the effect of storage time and disinfectant solutions on the dimensional accuracy of impression materials with digital radiography. Dent Med Probl. 56: 67-74.

23. Pinheiro LOB, Ayala AS, Pomini MC, Da Cruz VT, Del Farias IV et al. (2018) Linear dimensional stability of irreversible hydrocolloids with and without disinfection at different storage times. Rev Sul-Bras Odontol 15: 77-83.

24. Rentzia A, Coleman DC, O'donnell MJ, Dowling AH, Sullivan MO (2011) Disinfection procedures: their efficacy and effect on dimensional accuracy and surface quality of an irreversible hydrocolloid impression material. J Dent 39: 133-40.

25. SAMRA RK, BHIDE SV (2018) Comparative evaluation of dimensional stability of impression materials from developing countries and developed countries after disinfection with different immersion disinfectant systems and ultraviolet chamber. Saudi Dent J. 30: 125-41.

26. Sharif RA, Abdelaziz KM, Alshahrani NM, Almutairi FS, Alaseri MA et al. (2021) The accuracy of gypsum casts obtained from the disinfected extended-pour alginate impressions through prolonged storage times. BMC Oral Health 21: 296.

27. Suprono MS, Kattadiyil MT, Goodacre CJ, Winer MS (2012) Effect of disinfection on irreversible hydrocolloid and alternative impression materials and the resultant gypsum casts. J Prosthet Dent. 108: 250-8.

28. Trivedi R, Sangur R, Bathala LR, Srivastava S, Madhav S et al. (2019) Evaluation of efficacy of Aloe Vera as a Disinfectant by Immersion and Spray methods on Irreversible Hydrocolloid Impression Material and its Effect on the Dimensional Stability of Resultant Gypsum Cast - An in Vitro Study.
J Med Life 12: 395-402.

29. Tun Y, Hein AT, Hlaing S, Swe T (2021) Effects of Chemical Disinfections on Dimensional Stability of Irreversible Hydrocolloid Impression.
J Dent Sci UDMY. 1: 65-71.

30. Ulgey M, Gorler O, Yesilyurt G (2020) Importance of disinfection time and procedure with different alginate impression products to reduce dimensional instability. Niger J Clin Pract 23: 284-90.

31. Vrbova R, Bradna P, Bartos M, Roubickova A (2020) The effect of disinfectants on the accuracy, quality and surface structure of impression materials and gypsum casts: A comparative study using light microscopy, scanning electron microscopy and micro computed tomography. Dent Mater J. 39: 500-8.

32. Zahid S, Qadir S, Bano NZ, Qureshi S, Kaleem MM (2017) Evaluation of the Dimensional Stability of Alginate Impression Materials Immersed in Various Disinfectant Solutions. Pakistan Oral & Dent J 37: 371-6.

33. Anusavice KJ, Phillips RW, Shen C, Rawls HR (2013) Phillips' science of dental materials (12th ed.). Elsevier/Saunders.