**EFFECTIVENESS OF DIFFERENT IMPRESSION MATERIALS USING SINGLE STEP BORDER MOULDING IN ADAPTABILITY OF DENTURES- A SYSTEMATIC REVIEW****Prosthodontics**

Anne Mary*	Post Graduate, MDS GRADUATE, KVG DENTAL COLLEGE,, SULLIA, KARNATAKA- INDIA. *Corresponding Author
Nair Sreeja Radhakrishnan	Post Graduate, MDS GRADUATE, KVG DENTAL COLLEGE, SULLIA, KARNATAKA- INDIA.
Pramodh Sadasivan Pillai	Post Graduate, MDS GRADUATE, KVG DENTAL COLLEGE, SULLIA, KARNATAKA- INDIA.
Deviprasad Nooji	Professor, KVG DENTAL COLLEGE, SULLIA, KARNATAKA- INDIA.
Suhas Rao K	Professor, KVG DENTAL COLLEGE, SULLIA, KARNATAKA- INDIA.

ABSTRACT

Border moulding is an essential part determining the retention of complete denture fabrication. Step border moulding is an effective alternative to traditional sectional border moulding, reducing chairside time, patient pain, and dentist workload. Currently, there are a number of materials used for single step border moulding. This review is done to evaluate and compare the effectiveness of different materials used in single step border molding technique. A total of 172 articles were identified, of which 7 were in-vivo studies those met the inclusion criteria to compare single step border moldings using different impression materials in terms of retention, stability or support. Within limitations of the study, it was concluded that there is a clear lack of research and more studies should be done in future on this topic.

KEYWORDS

Single step border moulding, maxillary border moulding

INTRODUCTION

Border moulding is crucial in complete denture building as it encourages the formation of the border seal required for the maintaining of contact between the denture boundary with the adjacent vestibular tissues at rest and in functional activity.[1]

Since very long, impression compound has been used for border moulding. Although it is effectively used even today there are limitations to its use compared to concurrent moulding of all tissues at once. Therefore, can the invent of new materials such as light polymerized resin, cold cure resin, perio pack, tissue conditioner and elastomers. Elastomers being the most widely used substitute of impression compound.[2]

With time newer impression dental materials such as various elastomers like poly-ether and poly vinyl siloxanes were introduced. These materials showed improved accuracy while recording denture borders. Its use not only included the property of being able to mould all tissues at once but also better handling properties, homogenous consistency, lesser chair time spent and even more precise recording of functional depth and width of vestibular sulcus.[3]

To use a material for simultaneous moulding of all borders, it must meet the following requirements: [4]

1. Possess a sufficient body to remain in place during loading,
2. Allow for reshaping of the borders without adhering to fingers,
3. Have a 3–5-minute setting time,
4. Maintain adequate flow while seating in the mouth, and
5. Allow for finger placement of the material into deficient parts after seating the tray.
6. Does not cause excessive displacement of the tissues of the vestibule,
7. Be readily trimmed and shaped so that excess material can be carved and the borders shaped before the final impression is made.
8. Be suitably stiff following setting and trimming.

MATERIALS AND METHOD

Protocol and registration- PRISMA protocol and registered under PROSPERO platform [CRD42024582911]

Focused question and search strategies- question determined according to PICO 2009 strategy

Selection Criteria

The review procedure was divided into two phases. In the first phase, the search titles and abstracts were assessed for relevance, and the full

text of relevant abstracts was obtained and accessible. A manual search of selected publications was conducted, as was a search of the selected studies' references. The articles were collected after the first step of the review process using the following inclusion and exclusion criteria. In the second phase, relevant and appropriate articles were identified for further processing and data extraction.

Population	Edentulous patients
Intervention	Single step border moulding
Comparison	- n/a
Outcome	Most retentive, stability and support impression material
Study group	Randomized controlled studies, case- control, non-randomized controlled studies

Inclusion Criteria- Clinical and randomized clinical studies that use single step border moulding, non-randomized clinical studies using single step border moulding for recording border moulding.

Exclusion Criteria- Studies without single step border moulding

Studies with partially edentulous patients

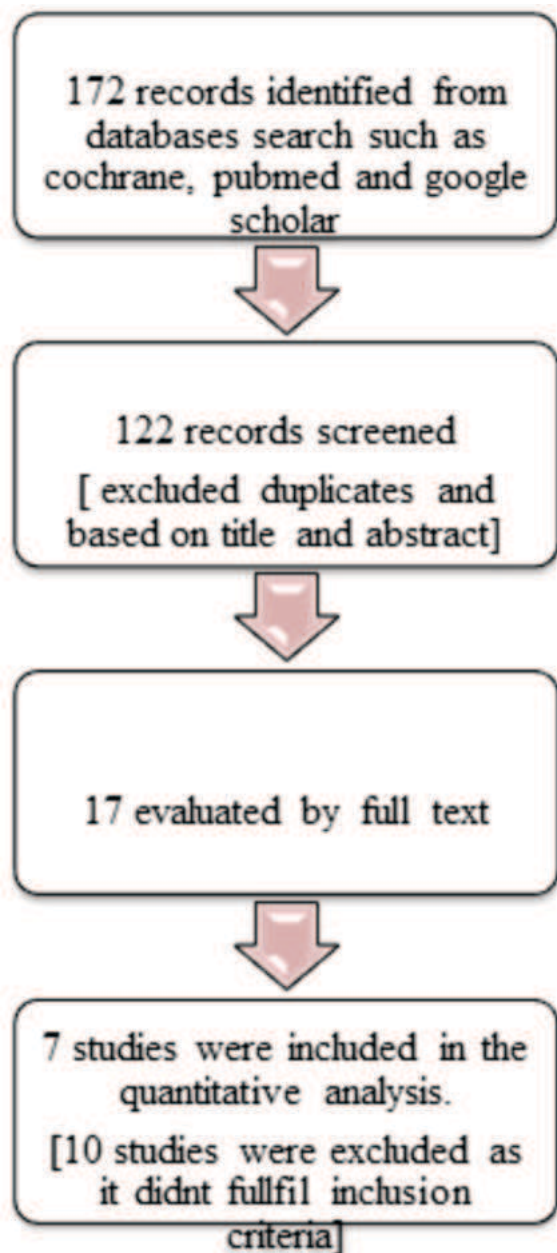
Studies published in other languages other than English

Search Methods –

- Two independent authors systematically searched the indexed literature in July 2024. An electronic search of literature related to subject between 2010 and 2024 was performed in Cochrane Library, PubMed/MEDLINE and Google Scholar using the search terms such as, single step border moulding, materials used for single step border moulding, border moulding materials, retention of different border moulding materials
- Combinations of medical subject heading terms (MeSH) and non-MeSH terms, along with Boolean operators, were utilized to perform the search. A manual search of the available literature was also performed without any language or publication restrictions. The following journals were manually checked: Journal of Prosthetic Dentistry, Journal of Prosthodontics, and Advanced Journal of Prosthodontics.

Study selection and data extraction-Independent electronic search by two investigators yielded 172 articles. Subsequently, duplications were removed. Titles and abstracts were filtered (by authors) according to the inclusion and exclusion criteria. Records were screened according to the title and selected [n=122]. Records after duplicates were n=17. Any disagreements between reviewers were resolved

through discussion. Full-text screenings were performed, and data related to single step border moulding included in qualitative assessment was n=7. The characteristics of each classification are summarized in Table 1.



Technique of single step border moulding

- The tray border has to be painted with a tray adhesive and allowed to dry.
- The border moulding impression has to be injected onto the tray borders and across the posterior palatal seal area. Labial/buccal borders and posterior palatal seal has to be molded in a manner similar to sectional border molding technique.
- The tray was removed after the impression material had completely polymerized and the borders were examined for accuracy. Excess material has to be trimmed off using a sharp Bard-Parker blade.
- Holes were made following removal of the wax spacer. A tray adhesive has to be applied to the inner surface of the tray.
- After the adhesive had dried up, the tray was loaded with light viscosity secondary impression material to complete the definitive impression.

DISCUSSION

Of the 32 titles on single step border moulding impression materials

found in Cochrane/PubMed/Google Scholar, only a very few were classified as clinical trials, and even fewer as RCTs. In a review of changes in the prosthodontic literature over time, it was reported that not only RCTs but also other types of clinical studies were extremely rare. Opinion papers and publications on technical and material for 2 stage aspects dominated. This may be one of the reasons why so little research has focused on the clinical outcomes of different materials.

Border moulding the impression tray before making the final impression is a traditional process in the production of a complete denture.[5] Low-fusing compound was first introduced by Green Brothers in 1907 and has since become widely utilized for this purpose. However, border moulding with low-fusing impression compound frequently necessitates placing the material in different portions of the tray borders separately, resulting in a messy technique.[5] Manipulation of denture border is solely dependent on the operator when using a thermoplastic material.[5] Hence, to prevail over the disadvantages of incremental border moulding technique, came in the use of single-step border molding. Along with that, other advantages of single step border moulding compared to 2 stage are better material handling properties, less time-consuming, and improves the patient's comfort. Single step border moulding is when the border molding and impression taking are performed at the same time using one material. The simple one-step technique was found to be as effective as the traditional two-step procedure with respect to patients' ratings of satisfaction, comfort and function. This well conducted RCT provides good support for the authors' conclusion "that the quality of complete dentures does not suffer when manufacturing techniques are simplified to save time and materials". [6]

Most commonly used materials for border moulding in single step border moulding is polyvinyl siloxane and polyether.[7] Renu Gupta et al. [8] found that border moulding with heavy-bodied polyvinyl siloxane in a single step produced better retention than border moulding with modelling compound in an incremental technique.

Tissue conditioner was utilized to record the functional border moulding. Custom trays laced with tissue conditioner were left in patients' mouths for 24 hours to properly shape the borders.[9] Ideally, physiologic and functional boundaries should be documented using materials that can flow continuously for an extended length of time. Of the materials available, only tissue conditioner has this potential.[9] McCarthy and Moser in his study proved tissue conditioner to be ideal functional impression material.[10]

Polyvinyl Siloxane, a heavy-bodied elastomeric material, outperformed the other materials due to its ease of manipulation and good initial flow properties, rigidity, and adequate working time are necessary for simultaneous border moulding.[4,11] This is also supported by the Jone et al statement which obtained results on the border molding using putty polyvinylsiloxane with functional techniques having a greater average retention compared to the low fusing compound material.[12] Kinra *et al.* presented an innovative impression technique for complete dentures. A single stage border molding using putty silicone impression material is presented as an alternative to conventional border molding. [13]

Polyether has also been material of border molding in a study done by Smith., et al. [14] and Tan HK, Hooper PM [17]. Pachar RB., et al. [18] have obtained satisfactory results by using polyether in a single step in their studies. This approach allows for the simultaneous moulding of all impression borders with a single tray insertion. It was seen that border surface area of polyether (211.452 mm) was closest in dimension to that of tissue conditioner (216.528 mm), which is considered an ideal material for border moulding due to its flowability.[9] This observation could be due to the fact that the polyether gives optimum working time and exhibits good flow characteristics which help in recording the borders accurately.[5]

In the review conducted, according to Pridana et al, the functional technique of putty polyvinylsiloxane is a choice of border molding material because it has the best retention measurement result. Manual border molding technique is an option when the patient's condition does not allow for functional border molding techniques, such as a decrease in motor function due to systemic neurological disease and geriatric patients.[15] Kheur M et al [16], Renu Gupta et al [8] and Raina Dominica Dsouza et al [3], polyvinylsiloxane border moulding material gives better retention compared to other materials.

Given such results of the search, had our intention been to perform a systematic review, the conclusion would have had to be that the available literature failed to provide a definitive answer to the study question. Essentially, many of the long-standing recommendations on the question of the preferred impression procedure for single step border moulding fabrication, lack strong scientific support. For example, there is only one RCT that directly compares the outcome of a one-step impression using three different border moulding impression materials for fabrication of dentures. With no convincing data available regarding the superiority of any one border moulding

impression material for single step border moulding.

CONCLUSIONS

Although these studies provided valuable contributions to our knowledge, they were not able to answer the central question relating to a generally expedient method for complete denture impressions. There was no strong scientific evidence that different clinical situations require different combinations of materials and techniques for impressions. The results of the review warrant serious consideration in prosthodontic teaching and clinical practice.

Table 1

Author	Year	Sample size	Study type	Materials used	Tested parameter	Inference
J R Patel and et al	2010	30	Randomized control study	Tissue conditioner, Addition Silicon, Low Fusing Impression Compound, Pattern resin.	Area of sulcus	Resin gives the best border morphology followed by low fusing impression compound. Putty addition silicon gives large borders and may not be suggested as suitable material for border molding
Aman Kumar Arora et al	2014	15	Randomized control study	Low fusing impression compound, polyether, Pattern resin and Peripheral wax	Sulcus width height and area	Polyether was the best material for border molding which will give most accurate borders to a denture.
Kheur M et al	2015	10	Randomized control study	Low -fusing impression compound, heavy-bodied elastomeric material – polyvinyl siloxane, zinc oxide eugenol impression paste	Tissue contact, Tissue displacement, Bond to the tray and overall peripheral seal	Heavy Bodied Elastomeric Material- Polyvinyl siloxane proved to be most efficient amongst the three
Renu Gupta et al	2015	20	Randomized control study	Modelling compound, heavy bodied polyvinyl siloxane	Retention	Retention of denture bases obtained by using heavy bodied polyvinylsiloxane and single step border molding technique was more and among materials heavy bodied polyvinyl siloxane was better.
Renu B Pachar et al	2018	30	Randomized control study	Green stick impression compound, putty consistency addition silicone, polyether impression	Retention	polyether final impression material showed the highest mean values of complete denture retention
Silvia Pridana et al	2019	10	Randomized control study	heavy body, putty polyvinylsiloxane	Peripheral tissue morphology and retention	Putty polyvinylsiloxane with functional technique has the best retention measurement
Raina Dominica Dsouza et al	2022	100	Randomized control study	Green stick impression compound, Polysulphide elastomer material, Polyether elastomer material, Polysiloxane elastomeric impression material	Retention	Polyvinyl siloxane was found to be superior to other materials for border moulding.
Ruttonji Zarir et al	2022	20	Randomized control study	Low fusing compound, putty addition silicone and pattern resin.	Border morphology of the sulcus	Tissue conditioner was the best material that could be used for border molding followed by pattern resin and low fusing compound.

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