

# LITERATURE REVIEW

## Evolution of Impression Tray and Materials- A Literature Review

Brintha Jei J <sup>a</sup> , Anitha KV <sup>b</sup>

### ABSTRACT

Dentistry, as a specialty is thought to have begun around 3000 B.C. The study of dental history consistently reveals each age's indebtedness to its immediate and distant predecessors. Nowhere has this been more strikingly revealed than in the field of prosthetic dentistry, dependent as it has been upon material and mechanical development and invention. Dentistry like the allied arts and sciences took full advantage of mechanical developments of the last twenty centuries. During this period applied mechanics was recognized as an essential supplement to biological principles of dentistry. Dentistry got established as a science and industrial development had a definite impact on dentistry. This article thus explains in depth the development of impression trays and materials.

**Keywords:** Impression tray, Impression material, Digital impression

**How to cite this article:** Brintha Jei J, Anitha KV. Evolution of Impression Tray and Materials- A Literature Review. *J Clin Prosth Impl* 2021;3(2):37-41

### INTRODUCTION

In India, dentistry was considered to be of divine origin, as in most of the ancient world traditions dating from as early as 5000 B.C. Most of our knowledge of early Indian dental treatment comes from the Sushruta Samhita. Dentistry was believed to have begun about 3000 B.C. According to GPT 9, "impression tray is a receptacle into which suitable impression material is placed to make a negative likeness or a device that is used to carry, confine, and control impression material while making an impression. Whereas impression material is defined as any substance or combination of substances used for making an impression or negative reproduction". In the year 1500 impression of patient's edentulous jaw was taken in bees wax and a model was made of wood, and false teeth were made of marble chips or animal bones and natural human teeth.<sup>1</sup>

### DISCUSSION

#### 1648-1800:

A German surgeon, Matthaus Purmann (1648-1711), seems to have mentioned making drawings

and wax models from which prosthetic devices were copied. Matthias Gottfried Durmann recorded the use of wax in 1711 (*Fig-1*). Another German, Frederick the Great of Prussia's dentist Philipp Pfaff (1713-1766), was the first to define a technique of



Figure 1: Matthias Gottfried Durmann

<sup>a</sup> Reader, Department of prosthodontics, SRM dental college, Ramapuram, Chennai.  
<sup>b</sup> Professor, Department of prosthodontics, SRM dental college, Ramapuram, Chennai

taking impressions of sealing wax softened in hot water and pouring Plaster of Paris into the impression to create a rigid cast. In 1756 bees wax was introduced to use as impression material. The concept of impression making began in the mid 1800s (Fig-2).



Figure 2: Impression trays used during mid 1800s

**1801- 1844:**

In 1820, Christophe Francois Delabarre invented a metal impression tray, used to keep the wax material pressed against the gums when an impression was taken. After the silver or white metal cast has been pressed on firmly, it was carefully taken off and submerged in cold water in the direction of the teeth. The excess is then removed by a spring blade and replaced momentarily once again.<sup>1</sup> In the year 1830, a collection of impression trays was illustrated by F. A Maury of France (Fig-3), and in 1843, reported the use of modelling wax, composed of 10 parts of wax and one part of turpentine, for taking impressions. In 1836 Phillip Pfaff of Germany used Plaster of Paris casts and described a procedure for recording maxillomandibular relation and used wax for making impressions (Fig-4). Plaster of Paris was first used in 1844 as an impression material, the credit for its implementation is shared between three dentists Westcott, Dwinelle and Dunning. Paul Goddard in the year 1844 prepared the impression tray or box based on the anatomy, physiology and pathology of the human teeth (Fig-5).

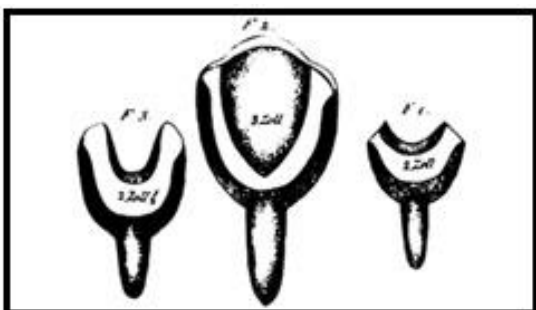


Figure 3: Impression trays by F. A Maury of France (1830)



Figure 4: Phillip Pfaff

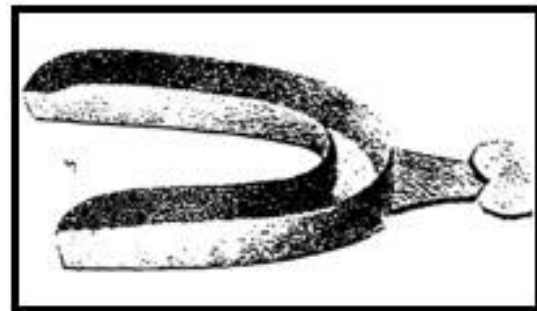


Figure 5: Impression tray by Paul Goddard (1844)

**1845- 1870:**

In 1848, Gutta percha was first used to make impressions. It was soaked, kneaded and put directly into a tray in boiling water, which was then inserted into the mouth until it hardened, at which point it was removed. American dentists used Plaster of Paris for impressions and Chapin Harris introduced the technique to the profession at large in 1853. This material was rarely used until 1876. By the introduction of modelling plastic in 1856, many changes in impression procedures became evident during this era. A single impression technique became significant during this period and later advanced by making preliminary impression using gutta-percha, beeswax, or compound modelling impression and it was followed by secondary wash impression by plaster within the preliminary impression and it was explained by White and Essig.<sup>2</sup> The first impression compound, a substance that can be softened in hot water and that hardens when removed from the mouth, was introduced by Charles Stent in 1857. But it was widely thought in the late 1870s that, for many years to come, plaster would be the most important impression material.

The methods of impression of this time were an open mouth type. Upper and lower metal trays came in three sizes and were used with plaster in 1870.<sup>3</sup>

#### 1871- 1900:

S.S. White also marketed porcelain impression trays in 1876 (*Fig 6*). They were available as the metal ones in the same sizes and patterns. All impression trays were made of metal which were durable, strong and rigid. The most commonly used were Britannia metal or similar alloys and sheet aluminum. These permitted trimming and bending to conform to the shape of the ridge and possessed adequate rigidity to preserve its shape even under severe pressure. Other metals used were lead, copper, tin, silver and German silver. Three types of stock trays were developed they were 1. Caulk's edentulous rim lock tray for average mouth 2. McGown-Winkler for flat mandibular ridges and 3. Arthey J Krol impression trays based on square, round and tapering ridge shapes. Most of the non-metallic trays produced during this time were made of gutta-percha or vulcanite. These non-metallic trays were used to make final wash impression with plaster after a preliminary impression had been made. Green proposed the pressure group of impressions. Green's all compound technique was documented by Liberthal during this era.<sup>4</sup>

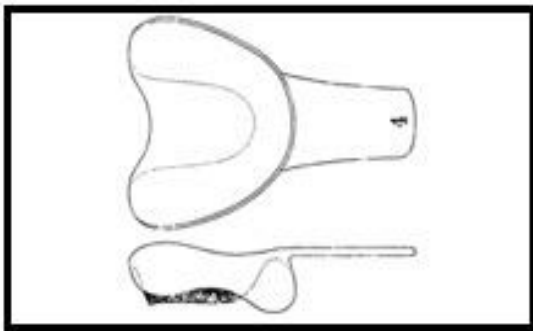


Figure 6: Impression tray by S.S White(1876)

#### 1901- 1921:

Well after 1900, closed mouth impressions were introduced. During border molding, the idea of 'muscle trimming' ranged from pushing the cheeks downwards by the operator to making the patient himself move the cheeks in a downward direction. An English chemist Stanford discovered at the end of the last century that some brown seaweed (algae) yielded peculiar mucosal extract. He gave it the name "Algin". This natural compound was later classified with various carboxyl acid groups as a linear polymer and called as hydro-p-d-mannuronic acid, also referred to as alginic acid. Some advantages are that it is easy to manipulate,

convenient for patients, relatively inexpensive and does not require elaborate equipment.<sup>5</sup> Compound modelling became popular in America when compound technology courses were provided by Peter and Jacob Greene of Chillicothe, Mississippi, around 1910. They seem to be the first to teach the technique of closed-mouth compound impression used in the construction of full dentures. Peter Greene also taught the use of combinations of plaster and compound, called a "plaster wash". In order to avoid undue pressure build-up, Turner and Campbell called for an escape vent inside the final impression tray. In 1921 Trench introduced trays with compound rims and tissue stops and used closed mouth method and the post -dam was added to the impression by wax.<sup>6</sup>

#### 1922- 1937:

In 1925, Stansbery described a negative pressure technique. Liberthal R.H. introduced a closed mouth impression technique. Pendelton, Swenson, Nagle, Sears, Heartwell and Rahn had introduced border moulding methods to capture tissue anatomy related to denture borders. Techniques were developed to handle flabby ridge Green J.W recorded flabby ridge by compressive type of impression compound which displaced the flabby ridge palatal.<sup>7</sup> The reasoning behind this was that the denture would move forward, restoring the tissues to their natural state as the patient works. The other method by Richardson, advocated the capture of tissues in a passive form and developed a technique accordingly. William H. Filler described the technique of using two trays to record hyperplastic tissue. Hobkirk identified a rubber-based material technique. In addition to other methods, Green, Clapp, Campbell, Liberthal described sucking and swallowing for border moulding. Another method was described by Wilson G.H by manipulating musculature against the direction of muscle fibres, which resulted in the shortening of the final denture borders. But the need to cover the retromolar pad for stability was supported by Neil, Fish, Swenson and Craddock. There was emphasis on immediate denture impression technique by Nichols and Sears. Several new impression materials were introduced, like reversible hydrocolloid in 1930 and zinc oxide eugenol in 1930. But still modelling compound and plaster was largely used.<sup>8</sup> Neil in 1932 felt open mouth impression technique was more controlled and produced uniform result. In 1933, Fish introduced the dynamic impression method. It takes into consideration the polished surface of mandibular denture. The introduction of newer impression procedures and the concept of mucostatics by H.L. Page came in this era. In 1937, Sears first used agar hydrocolloids to record crown impressions.

**1938- 1999:**

In the early 1940s, irreversible hydrocolloids were developed. Rubber base impression materials like mercaptan, Thiokol, polyether and silicon's were introduced. Silicon's were developed which are hydrophilic with good flow characteristics. Walter, Aruiri, Mercard and Tyson recommended a technique with the use of sectional custom-made trays for the patients with restricted mouth opening.<sup>9</sup> Page proposed the mucostatic technique in 1944. From synthetic rubber, elastic impression materials were developed by S.L.Pearson at the University of Liverpool in 1955. The advent of rubber-based, polysulfide impression materials in the late 1950's was followed by silicone-based materials in 1960, both of which are still in use. Elastic polyether impression materials were subsequently introduced in 1970, followed recently by polyvinylsiloxane impression materials.<sup>10</sup> In dentistry, digital impressions using scanner devices have recently been adopted. During the 1970s, research in the field of digital impression was conducted, but Chuck Hull coined the term in 1984 when he applied for a patent on the method that was issued in 1986.<sup>11</sup> Optical impressions were introduced by Dr. Francois Duret in 1971. But the first patency and the design of hand-held intraoral scanner was obtained by professor Mormann from Switzerland. By milling or stereolithography, they create a model that is later used. Late 1980s dual arch impression method came into existence by using closed mouth technique. First commercial based digital impression was developed by Dr.Mormann and Dr.Brandestini in the year 1985.<sup>12</sup>

**After 2000:**

The Ceramic Reconstruction or Chairside Economical Restoration of Esthetic Ceramics (CEREC) was introduced in the year 2003. The Lava Chairside Oral Scanner was launched officially in 2008. TRIOS in Denmark introduced the 3-shape scanner in 2011.<sup>13</sup> True definition scanner was produced by 3M ESPE IN 2013, it used 3D video imaging technology. In the year 2017 The Innovative Enterprise announced the world's first wireless intraoral scanner in the International dental show. As demonstrated by the number of new scanner systems with more functionality and advantages, the area of digital impressions is rapidly growing.<sup>14</sup>

**CONCLUSION**

Dentistry as a whole is continuing a vigorous, dynamic and active search for materials to replace those now in-service. The only guide to the future is the study of the past. Today the profession of dentistry is looked upon by the public with respect and admiration. In addition to impression materials,

a range of new impression trays and impression taking techniques have evolved. With an understanding of the evolution, the clinician can better appreciate both the complexity of and similarities among the wide variety of materials in prosthodontics available today. The search continues throughout the contemporary arts and sciences, as well as with in the dental profession for ways to make dentistry more acceptable and serviceable to the patient and convenient for the operator. In the dental world, technical advances are taking root. In reality, intraoral scanners and 3D printers are being used increasingly by dentists. New impression materials and impression-taking methods will be created in the future that will make the work of a dentist easier.

**CONFLICT OF INTEREST**

There is no conflict of interest

**REFERENCES**

1. Donovan JE, Chee WW. A review of contemporary impression materials and techniques. *Dent Clin N Am* 2004;48:445-70.
2. Roberts AC. Principles of full denture impression making and their application in practice. *J Prosthet Dent* 1951;1:213-28.
3. Papadiochos I, Papadiochou S, Emmanouil I. The Historical Evolution of Dental Impression Materials. *J Hist Dent*. 2017;65(2):79-89.
4. Edgar N. Starcke, A historical review of complete denture impression materials, *J Am Dent Assoc* 1975;91(5):1037-41.
5. Donovan TE, Chee WW. A review of contemporary impression materials and techniques. *Dent Clin North Am*. 2004;48(2): 445-70.
6. Cervino G, Fiorillo L, Herford AS, Laino L, Troiano G, Amoroso G, Crimi S, Matarese M, D'Amico C, Nastro Siniscalchi E, Cicciù M. Alginate Materials and Dental Impression Technique: A Current State of the Art and Application to Dental Practice. *Mar Drugs*. 2018;17(1):18.
7. Hansson O, Eklund J. A historical review of hydrocolloids and an investigation of the dimensional accuracy of the new alginates for crown and bridge impressions when using stock trays. *Swed Dent J* 1984;8(2):81-95.
8. Rubel BS. Impression materials: a comparative review of impression materials most commonly used in restorative dentistry. *Dent Clin North Am*. 2007;51(3):629-42.
9. Mandikos MN. Polyvinyl siloxane impression materials: an update on clinical use. *Aust Dent J*. 1998;43(6):428-34.

10. Massad JJ, Cagna DR. Vinyl polysiloxane impression material in removable prosthodontics. Part 1: edentulous impressions. *Compend Contin Educ Dent.* 2007;28(8):452-9.
11. Goyal G. History of Impressions, Impression Materials and Impression Techniques in Complete Dentures. *J Adv Med Dent Sci* 2014;2(2):116-9.
12. Punj A, Bompolaki D, Garaicoa, J. Dental impression materials and techniques. *Dent Clin N Am.* 2017;61:779-96
13. Mistry GS, Borse A, Shetty OK, Tabassum R. Digital Impression System–Virtually Becoming a Reality. *J Adv Med Dent Science* 2014;2(1):56-63.
14. Marques S, Ribeiro P, Falcão C, Lemos BF, Ríos-Carrasco B, Ríos-Santos JV, Herrero-Climent M. Digital Impressions in Implant Dentistry: A Literature Review. *Int. J. Environ. Res. Public Health* 2021;18:1020.

**Corresponding Author:** Dr.J.Britha Jei, Reader, Department of Prosthodontics, SRM dental college, Ramapuram, Chennai- 600089.

E-mail: [brinthajei@yahoo.co.in](mailto:brinthajei@yahoo.co.in) Ph.No.: +919486452225

*Copyright by the Editorial board for The Journal of Clinical Prosthodontics and Implantology*