

# A PILOT STUDY TO DETERMINE THE EFFECTS OF SKIN CONTACT ON TWO COMMONLY USED DENTAL IMPRESSION MATERIALS

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## ABSTRACT

Impression materials used in the analysis of bite marks are required to maintain their stability and integrity for extended periods. It has been observed that certain impressions taken of skin lose their properties with time, becoming sticky and unusable as evidence. The objective of this study was to investigate the onset of "stickiness" in two commonly used dental impression materials when brought into contact with skin. The two materials tested were Impregum and President. They were syringed into glass rings positioned on the upper arms of 28 volunteers. Changes in stickiness were monitored over a four-month period using a tensile testing machine. A metal plunger was lowered onto the impression material and then retracted measuring the adhesive force of the material to the lower surface of the plunger. Over the research period 17 of the 28 rings of Impregum became sticky and changed colour from purple to turquoise. The remaining 11 Impregum samples, all the President samples and all control samples remained unchanged over the 120 day period. The results of this study show that certain factors present in or on skin are responsible for the loss of surface integrity of Impregum. The factors responsible for these changes have not been established.

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**Key words:** Impression material, skin, stickiness

## INTRODUCTION

When analysing a skin bite mark it is often necessary to take accurate impressions of the affected area.<sup>1-4</sup> Dental impression material used in these analyses are required to maintain their dimensional stability for extended periods of time, as tooth mark evidence is often given months or years after the crime was perpetrated. The impressions are an integral link in the chain of evidence, but can also

be used in the physical comparison.<sup>3</sup> Expert dental evidence relies heavily on the accurate reproduction of the marks present on the victim's body or on inanimate products found at crime scenes.<sup>3</sup>

Two groups of dental materials are generally used to take impressions of bite marks, namely silicones and polyethers. Ciesco *et al*<sup>5</sup> state that polyether materials yield superior stability when compared to silicones and polysulfides, while Lacy *et al*<sup>6</sup> found that polyvinylsiloxanes demonstrated superior stability over polyethers but neither study investigated the medium to long-term stability of these impression materials. From experience the authors observed that Impregum\* (polyether) impressions taken of skin lose their physical properties with time, becoming sticky and unusable as evidence in court cases.

This research aimed to investigate the possible cause and onset of "stickiness" in two commonly used dental impression materials.

## MATERIALS AND METHODS

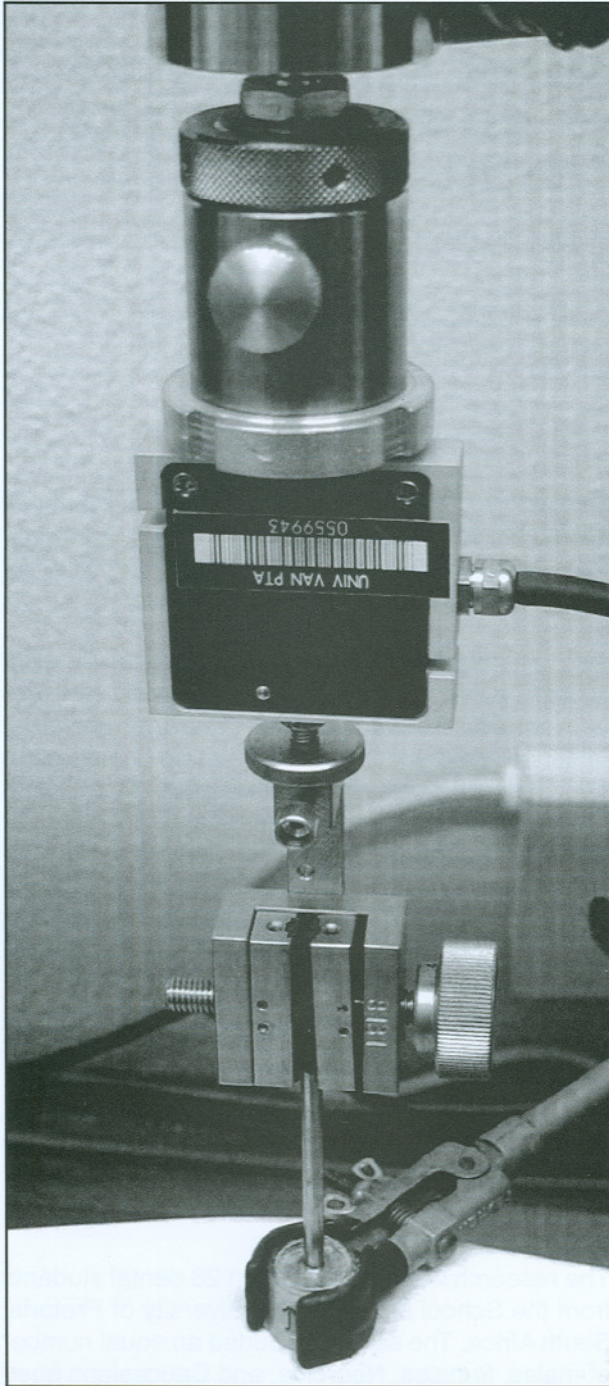
The research was carried out on 28 dental students from the School of Dentistry, University of Pretoria, South Africa. The sample included an equal number of males, females, Negroids, and Caucasians aged between 21 and 25 years of age. As the procedure was non-invasive, only oral consent was obtained.<sup>7</sup>

Two commonly used dental impression materials were tested, namely Impregum\* and President\*\* (type 1, low viscosity). Sterile glass tubes measuring 20mm with a diameter of 18.4 mm and 1.8mm

\* 3M ESPE, PO Box 926, Isando, Johannesburg, South Africa.

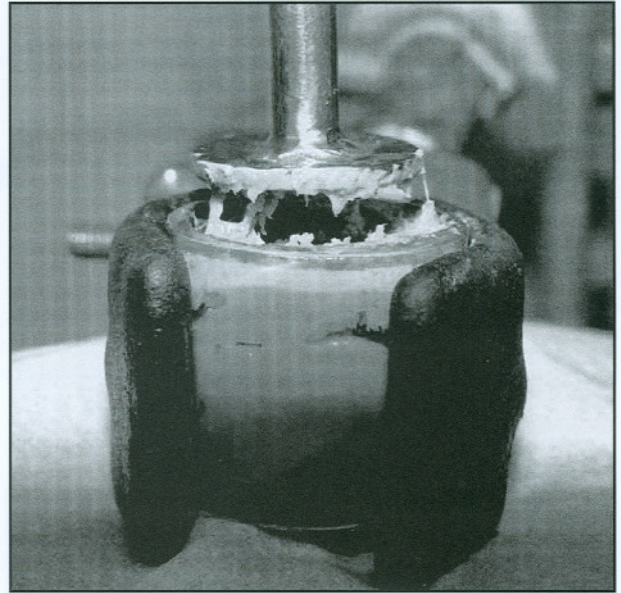
\*\*Coltene Whaledent, Altstätten, Switzerland





**Fig 1:** The specially designed metal plunger in the Zwick Z1010 compression tester.

thick were positioned on the upper arms (over the Deltoid muscle) of the volunteers. The contact areas were not cleaned in any way. The volunteers were given gloves and asked to hold the glass tubes firmly in position to obtain a flat contact surface with the skin. Each impression material was mixed according to the manufacturers instructions and injected into separate tubes. One set of impressions



**Fig 2:** The retraction of the plunger in a "sticky" Impregum sample is demonstrated at 120 days.

including each of the two products was taken from each volunteer.

Seven control samples of each impression material were taken with the glass rings positioned against cleaned and sterilised glass plates. The oils and creams that had been applied to the skin in the research area were recorded. After the recommended setting times the impressions were stored at a constant temperature of 21 degrees centigrade and a controlled relative humidity of 29%. The onset of stickiness, and colour changes were monitored at monthly intervals. The "stickiness" of the exposed surfaces of the different impression materials was initially tested at 48 hours and then again at 30, 60 and 120 days. Stickiness was measured by using a specially designed metal plunger in the Zwick Z1010\*\*\* compression tester (Fig 1) which was passively positioned on the surface of each specimen and then retracted, as illustrated in Fig 2. The onset of "stickiness" was documented when a negative force, measured in Newtons was required to retract the plunger.

## RESULTS

The control samples in both impression materials showed no colour change or development of "stickiness" throughout the research period. No "stickiness"

\*\*\*Warsaw Scientific and Precision equipment, Johannesburg, South Africa.



was measured or colour changes observed in any of the President samples within the four-month period of observation. The colour change and onset of "stickiness" observed in the affected Impregum samples commenced simultaneously from the skin contact surface of the impression material.

After the first month one Impregum sample, that of a female Caucasian showed a measurable degree of "stickiness" and colour change. Eleven of the 28 Impregum samples showed both 'stickiness" and colour change after 60 days with the number increasing to 17 after a 120-day period. The number of "sticky tubes" as a function of the volunteer profile is illustrated in Fig 3. The mean force required to retract the plunger from the affected samples ranged from 0.7N on day 30 to 2.43N on day 120 (Fig 4) The final number of "sticky" samples observed at four months in volunteers who had applied either oils or creams to their skin is illustrated in Fig 5.

At the conclusion of the research period 17 of the 28 rings of Impregum impressions had become "sticky" and changed colour from purple to turquoise. Of the 28 volunteers 18 had applied creams or lotions to their skin of which 10 had become "sticky". Nine Impregum samples remained unchanged by day 120. Seven of the ten Impregum impressions taken of volunteers who had applied no creams or lotions to their skin also became "sticky".

**DISCUSSION**

The results demonstrated that a substantial number of Impregum impressions which came into contact with skin during their setting period underwent rapid

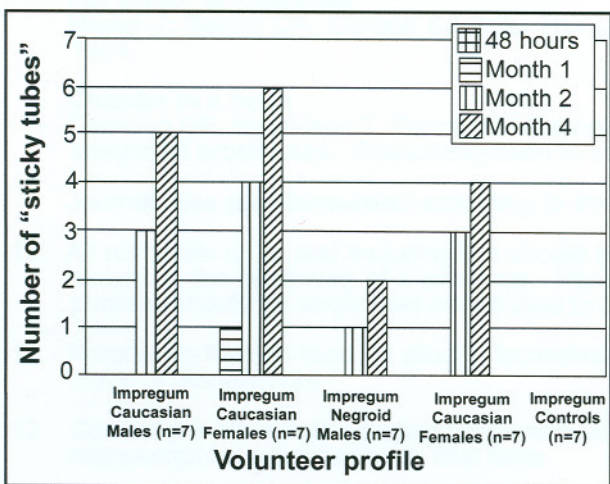


Fig 3: Number of samples showing sticky formation at four time intervals

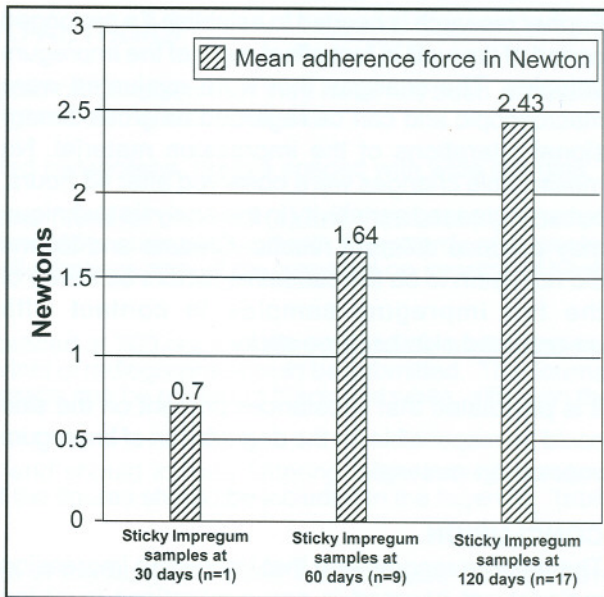


Fig 4: The mean Newton force required to retract the plunger from the affected samples at four time intervals

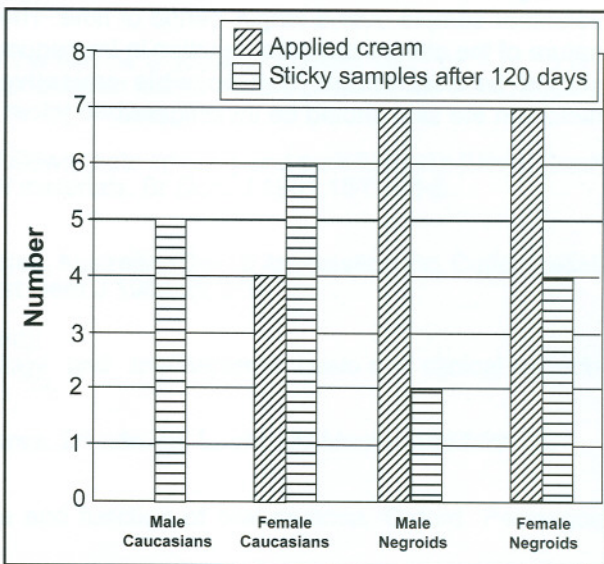


Fig 5: The number of sticky Impregum samples and oils/creams applied, in the volunteer profile after 120 days

changes in their physical properties, while the control samples of both impression materials remained unaffected, as did the President samples exposed to skin. The changes that took place were observed on the impression surfaces that were in contact with the volunteer's skin surface. The force required to retract the plunger in the affected sample increased with time, indicating a progressive deterioration and increase in stickiness.



Further research is needed to establish if a prolonged period of time will in fact affect more of the Impregum samples. The changes that were evaluated were macroscopic and can be regarded as gross dimensional alterations of the impression material. No measurable changes were observed after 48 hours, but an increased sensitivity in the analysis technique may produce different results. Creams and lotions did not seem to be the causative factors as seven of the ten Impregum samples in contact with un-creamed skin became sticky.

It is postulated that substances present on the skin could be responsible for the degradation of Impregum impression material.

### CONCLUSION

The authors recommend that Impregum impression material not be used in any applications involving skin impressions e.g. forensic investigations. The contact of Impregum impression material with un-gloved hands in general dentistry should also be investigated. Further research should involve a larger volunteer sample over a longer period of time. The nature of the altered chemical reaction in Impregum should be determined, and possible causative factors in the skin should be investigated.

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