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Is Volumetric Quantification in Dental Prosthesis Possible?

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Dear Editor,

A constant challenge in dentistry is to recover or replace teeth that have been lost due to various causes. When this destruction no longer allows the use of partial restorations, whether direct or indirect, we must go for full restoration of the dental crown.[1]

New materials have been developed for the manufacture of prosthesis infrastructures. However, these materials should be studied and evaluated mainly for their resistance, cervical adaptation and correctness with the preparation walls,[2] factors that will determine your clinical longevity.[3]

The adjustment between the crown preparation walls and the infrastructure directly influences the retention and stability of these restorations. The lack or deficiency in cervical adaptation is of paramount importance in marginal micro infiltration, recurrent caries, and in cement dissolution, leading to accumulation of dental plaque as a consequence of marginal infiltration and periodontal disease.[3,4]

Several in vitro works have tried to determine and compare the amount of these maladjustments in the various types of total crowns, using the technique of fluid silicone replicas stabilized with heavy silicone, simulating a cementation,[5,6,7,8,9,10,11,12,13] or by evaluating the marginal and internal fit through sections of crowns after cementation,[14,15,16,17] all through large and exhaustive two-dimensional measurements of these spaces through an optical microscope always showing considerable discrepancy between the results.

If used in the methodology of measuring the proposed volume on top of each cemented crown on the master preparation using as "cement" an ultra low viscosity hydrophilic silicon molding material quadrafunctional based on siloxane (Aquasil ULV, Dentsply Detrey GmbH, Konstanz, Germany) under constant pressure of 20 N using a dynamometer (DDK, Kratos, São Paulo, Brazil), and when polymerized, the silicone in external excess removed with scalpel blade being then carefully separated from the master preparation and the crown. In this way replicas of the space between the internal walls of the crown and the preparation walls can be obtained (Figures 1 and 2).

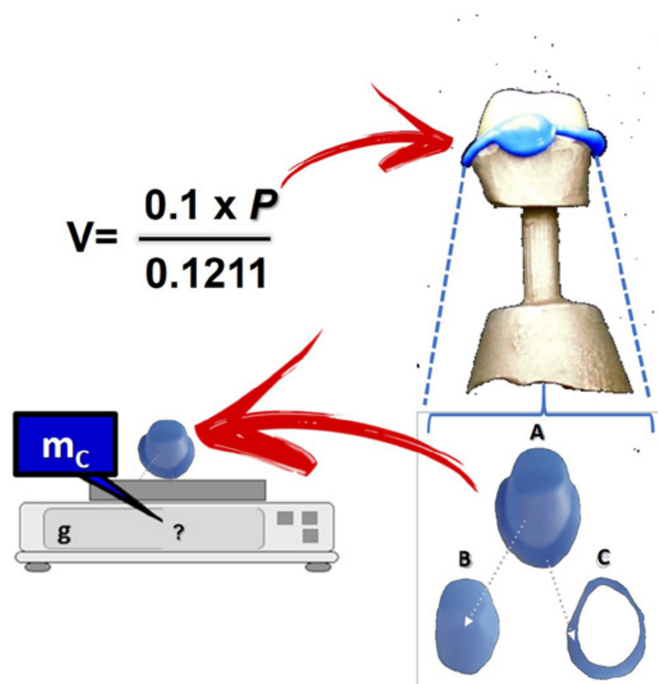

Figure 1. Schematic of the cemented infrastructure on the master die, using ultrafine density addition silicone. Photograph of the replicas corresponding to the volume of the entire staging walls/infrastructure walls interface (A). Portion corresponding to the occlusal-axial interface (B) and the portion corresponding to the cervical interface (C). M_C = mass of the specimen.

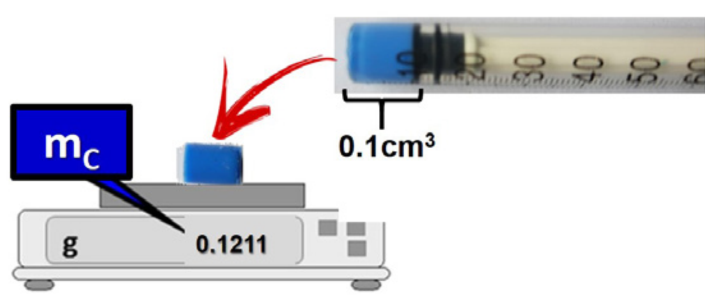

Figure 2. General scheme for measuring the silicone mass using a precision scale. M_C = mass of the specimen.

Keys (2002)[18] and Kokubo *et al.* (2005)[19] reported that the thickness of the low-viscosity elastomer film used to simulate a conventional cementation is very close to the zinc phosphate cement film when mixed in the standard consistency.

Each of these replicas when weighed on a precision scale, to four decimal places (Sartorius BL 2105, Sartorius AG, Göttingen, Germany). After this initial weighing, the portion corresponding to the cervical wall interface on the silicone replica was cut from the portion corresponding to the occlusal wall interface, and then measured mass separately (Figures 1 and 2). It is common in works that use volume quantification (example: stereology), especially those that study small organs, the conversion of mass into volume where the volume is determined according to the method of submersion in isotonic saline solution whose displacement determines the volume of the registered organ by weighing (P).[20]

As the specific gravity (s) of the isotonic saline is ≈1.00 , the volume (V) is obtained by the equation: V = P (g) / (s), (Figure 3) or simply V = P. [21,22] In this correspondence, the volume data of the silicone replicas, from their weight, were estimated as follows: a 0.1cm^3 cylinder of silicone, polymerized (Figures 1 and 2), used in cementation was obtained and weighed, to serve standard in converting (by rule of three) the mass of the silicone replica, by volume.

Figure 3 indicates the final formula to be used, where 0.1211 is the value in grams of 0.1cm^3 of silicone used in "cementation" and P the weight of each replica of silicone.

The volume quantification proposal can promote a methodological tool to investigate the internal adaptation of crowns for the different materials applied in dental prosthesis between the space corresponding to the interface between the internal crown walls and the walls of the infrastructures, with special attention to the interface corresponding to cervical staging wall / cervical wall of infrastructures.

$$V(cm^3) = W(g)/s, \quad = \quad V(cm^3) \cong W(g) \quad \Rightarrow \quad V = \frac{0.1 \times P}{0.1211}$$

Figure 3. General equation used for the volumetry method.
Legend: Specific gravity (s) of isotonic saline is ≈1.00, volume (V) is obtained by the equation: V = P/(s)

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Mini Curriculum and Author's Contribution

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