

Technical Assessment of WHO-621 Periodontal Probe Made in Brazil

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This study technically assessed the WHO-621 periodontal probe made in Brazil as well as its dimensional and weight stability after sterilization. The following characteristics were measured in one hundred (100) new probes: diameter and linear area of tip sphere and beginning and ending references of its colored band by means of indirect computerized morphometric method, and weight, by means of a digital balance within 0.01 mm precision. Fifty (50) probes underwent one hundred (100) cycles of either steam or heat sterilization. The WHO-621 Trinity probe showed mean values of 0.66 mm in its longitudinal and 0.54 mm in its transversal sphere diameters; 0.40 mm² in its sphere linear area; 3.56 mm and 5.76 mm for the beginning and ending of the colored band, respectively. Its mean weight was 10.12 g with small variation. Some of the measurements showed significant changes after both sterilization procedures. Neither of the sterilization methods showed to be more advantageous (Student's t-test, $p = 0.05$).

Key Words: WHO-621 periodontal probe, periodontal instrumentation, periodontal epidemiology.

INTRODUCTION

In 1978 the World Health Organization Technical Report Series 621 (1) described the methodology for assessment of periodontal disease status and treatment needs for populations. A precise specification of the periodontal probe to be used was given and its original design was first manufactured by the Morita Company of Japan (2). The primary clinical examination method was modified giving rise to the Community Periodontal Index of Treatment Needs (CPITN) and several other manufacturers produced the specified probe, thus allowing the worldwide use of this scoring system (3).

A metanalysis report which included 236 studies using the CPITN during the period of 1989 to 1996 in Germany, Poland, Slovenia, Croatia, Italy, France, Finland, Spain, Russia, Israel, the United States, Canada, Nicaragua, Brazil, Australia, Hong-Kong, China, Thailand, Japan, India, Saudi Arabia, Turkey, Pakistan,

Bangladesh, Morocco, Ethiopia, Nigeria and Sierra Leone brought to light the ambiguity of this scoring system concerning the estimation of periodontal treatment needs among populations and the assessment of periodontal disease status (4). Despite the weakness of data obtained by means of index teeth and the usage of a cardinal system that does not adequately reflect the distribution of periodontal disease in a population, its use rendered knowledge about the high prevalence and the low severity of periodontal disease among populations (4,5).

In many countries, screening surveys have made use of a methodology largely derived from the CPITN. In the United States, Canada and, more recently, in Brazil, the Periodontal Screening & Recording (PSR) has been increasingly advertised and used (6-11). In England and New Zealand, the Basic Periodontal Examination (BPE) found its way into use (12,13), whereas the Primary Essential Periodontal Examination (PEPE) was used in Australia (14). The usage of the WHO-621

probe is a common feature in all of these methodologies.

The following specifications of this periodontal probe designed by Professor George S. Beagrie of Vancouver and Professor Jukka Ainamo of Helsinki (2) are: 1) It should be metal with a knurled handle of 3.5 mm diameter and a maximum weight of 4.5 g; 2) It should have a 0.5 mm diameter sphere at the working tip; the probe has a minimum diameter of 0.25 mm at the neck where the sphere is attached, with appropriate taper from the handle; 3) It should have a black band between 3.5 mm and 5.5 mm from the end of the probe.

In an attempt to follow the original design a national manufacturer began producing WHO-621 Trinity probe (Campo Mourão, PA, Brazil) in Brazil in 1994. This instrument represents an important tool for clinical and epidemiological studies given its cost/benefit advantages compared to the imported ones. Nevertheless, no data are available in scientific literature concerning possible probe-dependent variables of this probe, such as tip diameter, accuracy of marks and total weight as well as dimensional and weight stability when subjected to sterilization procedures. This study was designed to technically assess the WHO-621 Trinity probe and to verify its dimensional and weight stability after sterilization procedures.

MATERIAL AND METHODS

One hundred new WHO-621 Trinity commercially available periodontal probes (Campo Mourão, PA, Brazil) were used in this study. The methodology for the morphometric analysis and the weight measurement of the probes was developed in the morphometric laboratory of Gonçalo Muniz Fiocruz Research Institute in Salvador, BA. The probes were morphometrically analyzed before and after sterilization procedures. All measurements were done in triplicate by the same examiner.

Morphometric Analysis

Computerized morphometry was employed using the indirect reading method through standard photographs of 100 probes. The photographs were taken in a Reichert Polyvar 2 Research Microscope (Leica Reichert Jung Products, Vienna, Austria) by means of a lucid camera (magnification, 4X) and reference points to be measured were established (Figure 1).

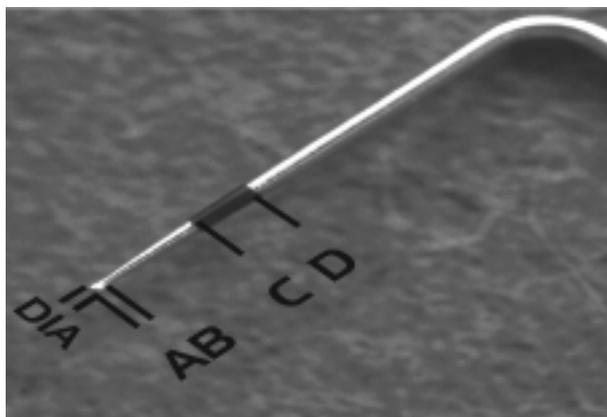


Figure 1. WHO-621 Trinity probe. DIA: Transversal sphere diameter. AB: Longitudinal sphere diameter. AC: Beginning of colored band. AD: Ending of colored band.

The morphometrical analysis was then carried out taking into account the previously set reference points and using a computerized board attached to a Zeus laptop personal computer specially calibrated for this analysis.

Weight Measurement

All 100 probes were weighed on a Sartorius digital laboratory balance, model A 200S (Göttingen, Germany).

Dimensional and Weight Stability

After obtaining the initial technical measurements of the WHO-621 Trinity probes, the 2 groups underwent 100 cycles of sterilization as follows: Group 1 - 50 probes, 100 repeated cycles of sterilization in a Mille autoclave (model 415; Campo Mourão, PA, Brazil) (21°C at 1 atm, 30-min cycle); Group 2 - 50 probes, 100 repeated cycles of sterilization in an EL 11 Odontobrás stove (Ribeirão Preto, SP, Brazil) (160°C, 2-h cycle). Once the sterilization procedures were carried out, morphometric and weight measurements were taken to verify the dimensional and weight stability of the 100 probes. The same procedures previously used for the measurements were strictly followed.

Statistical Analysis

The measurements of the WHO-621 Trinity probe taken before and after the two sterilization procedures were statistically analyzed using the Student t-test

to check the hypotheses that 1) the sterilization procedures did not alter the mean of the measurements taken before the procedures, and that 2) the sterilization procedures produced equal means for each of the features analyzed after sterilization. The statistical test for matched data allowing for 49 degrees of freedom for the first hypothesis was used whereas for the second hypothesis a statistical test of independent sampling allowing for 98 degrees of freedom was used. A p value of 0.05 was accepted for significance.

RESULTS

Technical data concerning indirect computerized morphometric analysis and total weight, both within a precision of 0.01 mm, obtained by means of triplicate assessment of 100 new WHO-621 Trinity periodontal probes are reported in Table 1. Taking into account the long axis of the probe, AB measurement belongs to the longitudinal diameter of its sphere and DIA defines the transversal one which showed mean values of 0.66 mm and 0.54 mm, respectively. AC distance refers to the first and AD to the second colored painted mark, which presented mean values of 3.56 mm and 5.76 mm, respectively. The linear area obtained from the perimeter of the sphere was found to be of 0.40 mm² and the mean value for total weight of the probe was 10.12 g.

The mean values for measurements before and after steam heat (autoclave) and dry heat (stove) sterilization procedures are shown in Table 2. After undergoing steam heat sterilization, DIA, AC, AD and weight showed significant differences ($p < 0.05$; Table 3). After undergoing dry heat sterilization, AB and DIA showed significant differences ($p < 0.05$; Table 3).

The mean value for each feature analyzed after stove sterilization was statistically equivalent to that for autoclave sterilization (Student t-test, $p > 0.05$).

DISCUSSION

The design of a periodontal probe with a

Table 1. Technical assessment of the WHO-621 Trinity periodontal probe* compared to WHO-621 standards.

Measurements (mm)	Total mean	Range	WHO-621
AB	0.66	0.41 - 0.86	0.5
AC	3.56	3.24 - 4.44	3.5
AD	5.76	5.40 - 5.82	5.5
DIA	0.54	0.40 - 0.68	0.5
Area (mm ²)	0.40	0.30 - 0.50	-
Weight (g)	10.12	9.98-10.22	Max. 4.5

*After two processes of sterilization.

Table 2. Measurements of the probes before and after sterilization.

Measurements (mm)	Autoclave		Stove	
	Before	After	Before	After
AB	0.64 ± 0.09	0.63 ± 0.08	0.68 ± 0.07	0.64 ± 0.07
AC	3.51 ± 0.09	3.62 ± 0.09	3.62 ± 0.18	3.60 ± 0.06
AD	5.67 ± 0.09	5.79 ± 0.12	5.86 ± 0.28	5.81 ± 0.11
DIA	0.52 ± 0.05	0.54 ± 0.04	0.57 ± 0.05	0.54 ± 0.06
Area (mm ²)	0.40 ± 0.05	0.38 ± 0.04	0.40 ± 0.05	0.38 ± 0.09
Weight (g)	10.12 ± 0.05	10.12 ± 0.05	10.13 ± 0.05	10.12 ± 0.05

Table 3. Frequency, means, standard deviation, standard error, and t₀ and p values for the differences after and before autoclave and stove procedures for each measurement.

Measurements	Mean	SD	SE	t ₀	p
AB (mm)					
Autoclave	0.004	0.106	0.015	0.29	0.771
Stove	0.040	0.111	0.016	2.56*	0.013
AC (mm)					
Autoclave	-0.113	0.130	0.018	-6.12*	0.000
Stove	0.054	0.465	0.046	0.82	0.414
AD (mm)					
Autoclave	-0.122	0.161	0.023	-5.34*	0.000
Stove	0.023	0.199	0.028	0.82	0.414
DIA (mm)					
Autoclave	-0.023	0.063	0.009	-2.61*	0.012
Stove	0.031	0.075	0.011	2.87*	0.006
Area (mm ²)					
Autoclave	0.011	0.066	0.009	1.21	0.233
Stove	0.018	0.068	0.010	1.91	0.063
Weight (g)					
Autoclave	-0.0008	0.003	-	-2.06*	0.044
Stove	-0.0004	0.002	-	-1.43	0.159

Number of pairs = 50.

*significant value.

sphere end aims to facilitate the detection of subgingival calculus and irregularities in restoration edges, besides providing the patient with more comfort. The World Health Organization recommends that the sphere end should be 0.5 mm in diameter to work well (2,15). Keagle et al. (16), in experimental studies in dogs, showed a high significance for inflamed tissues discrimination for all studied ball-ended probe diameters: 0.4 mm, 0.6 mm, 0.7 mm and 0.8 mm using controlled forces of 0.05 N, 0.10 N, 0.20 N, 0.75 N, 0.90 N. In their study, the highest F values found were for the 0.6 mm diameter probe with a 0.20 N applied force.

Results from the present morphometric analysis showed that the mean diameter measurements of the sphere of the WHO-621 Trinity probe was 0.54 transversely and 0.66 mm longitudinally, taking into account the long axis of the rod. The tip of the WHO-621 Trinity probe is not a perfect sphere. It possesses a regular pattern that, however, does not exactly match the WHO recommendations. It may be hypothesized that there may be occurring systematic changes during the manufacturing process, likely to take place in the final stages (polishing), where loss of material is known to occur. The lateral pressure exerted at that moment is likely to be greater than that exerted on the long axis of the rod.

Other studies intended to verify the dimensional precision of the tip of ball-ended probes of different brands. Van der Zee et al. (17), analyzing 6 previously unused probes of each brand [WHO 88 SE Ash/Dentsply (UK), WHO 550B LM-Dental (Finland) and WHO Hu-Friedy (USA)] by means of direct microscopy using a stereomicroscope (Wild, Heerbrugg, Switzerland), found mean tip diameters, defined as the greatest diameter of the ball, of $0.59 \text{ mm} \pm 0.01 \text{ mm}$, $0.54 \text{ mm} \pm 0.03 \text{ mm}$, and $0.50 \text{ mm} \pm 0.01 \text{ mm}$, respectively.

The computerized method adopted in this study for the morphometry of the WHO-621 Trinity tip sphere made it very easy to obtain the measurement of its linear area that was found to be 0.40 mm^2 . No data were found in the literature as to the linear area of sphere ball-ended probes. However, it is interesting to note that periodontal soft tissue displacement and hard objects such as calculus and detection of restoration edges during probing procedures may be more likely influenced by the three dimensional shape of the tip of the probe rather than only by one dimension.

The colored band on the periodontal probe is designed to make periodontal exam readings more ob-

jective and faster (3,15). The first mark of WHO-621 Trinity colored band in this study had mean values of 3.56 mm (range 3.24-4.44 mm). The second mark of the colored band was found to be of 5.76 mm (range 5.40-5.82 mm). The variation that occurred among the 100 examined probes allows us to conclude that the studied WHO-621 Trinity probe does not exactly fit the established pattern in its first and second marks, but that it is probably adequate for clinical and epidemiologic screening investigations since it has been advocated that $\pm 1 \text{ mm}$ of variation on probing procedures is acceptable (18).

Previous studies verified the precision of marks of different commercially available periodontal probes and found that the marking was exactly coincident with the manufacturer's designated specification to within 0.01 mm in only few cases (17,19). Van der Zee et al. (17) also concluded that the 4 studied Williams probes were on average twice as accurate ($x=0.08 \text{ mm}$) as the three WHO designs studied ($x=0.16 \text{ mm}$).

One of the most important variables of probing depth and bleeding on probing is the applied probing force. Examiner exerted force and probe dependent variables such as its weight and its tip diameter play an important role for achieving the recommended limited pressure of 20 to 25 g during insertion of the probe into the gingival sulcus (14,20). The recommended lightness of 4.5 g for the WHO design probe besides aiming at achieving the mentioned goal intends to be of particular importance for subgingival calculus detection and to ensure minimal trauma (2). The weight of all 100 probes averaged 10.12 g with a variation among them.

It is interesting to comment about the importance of studies verifying precision of instruments because the manufacturer of WHO-621 Trinity probe managed to modify its weight launching a lighter one in the year 1995. There were no data in the scientific literature concerning technical assessment of the weight of periodontal probes.

Dimensional and weight stability after sterilization procedures is highly relevant for biosafety criteria because the probes are not meant to be disposable. This study showed that there were significant changes in several features after both sterilization procedures. However, there were no statistical differences between the sterilization methods. Winter (19) investigated technically 129 Williams and Goldman-Fox probes used by 5 different periodontists and the result of 387 measurements showed accuracy in only 130 of them; wear tip

was not considered to influence this inaccuracy. Van der Zee et al. (17) analyzed the kind of marks and concluded that irrespective of the probe type engraved bands were the most accurate followed by engraved grooves which were on average twice as inaccurate and that painted and etched markings were the least accurate.

We suggest that more studies are needed to analyze the stability of dimensional parameters of periodontal probes after sterilization procedures as well as to verify their precision.

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RESUMO

Rapp GE, Barbosa Jr AA, Mendes AJD, Motta ACF, Bião MAA, Garcia RV. Aferição técnica da sonda periodontal OMS-621 de fabricação brasileira. *Braz Dent J* 2002;13(1):61-65.

O presente estudo objetivou verificar, tecnicamente, a sonda periodontal OMS-621, de fabricação brasileira, bem como a sua estabilidade dimensional e de peso após esterilização. Cem (100) sondas novas foram triplamente medidas nas seguintes características: diâmetro e área linear da esfera da ponta, assim como referência inicial e final da faixa colorida, através de método morfométrico indireto, e peso, com auxílio de balança de precisão em 0.01mm. Cinquenta (50) sondas foram submetidas a cem (100) ciclos de esterilização por meio de método úmido ou seco. A sonda OMS-621 Trinity apresentou valores médios de 0,66mm para o diâmetro longitudinal, 0,54mm no diâmetro transversal e 0,40mm² na área linear de sua esfera; 3,56mm e 5,76mm no início e no final de sua faixa colorida, respectivamente. O peso médio foi de 10,12g com pequena variação. Alguns parâmetros variaram significativamente frente aos dois processos de esterilização. Nenhum método de esterilização mostrou-se superior (teste t-Student, p=0,05).

Unitermos: sonda periodontal OMS 621, instrumentação periodontal, epidemiologia periodontal.

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