ORIGINAL ARTICLE

EVALUATION OF THE EFFECTIVENESS OF CUTTING SCALPEL BLADES AFTER USE AND CLEANING BY DIFFERENT METHODS

AVALIAÇÃO DA EFETIVIDADE DO CORTE DE LÂMINAS DE BISTURI APÓS USO E LIMPEZA POR DIFERENTES MÉTODOS

Bruno de Oliveira Sampaio[1], Lívia Maria Andrade de Freitas[1], Nilton Cesar Nogueira dos Santos[1], Francisco Xavier Paranhos Coêlho Simões[1], Ana Carolina Del Sarto Azevedo Maia[1], Ricardo Alves de Souza[1], Ana Carolina Dias Viana de Andrade[2], Matheus Melo Pithon[1]

ABSTRACT

When performing incisions during oral and maxillofacial surgical procedures, the surgeon requires a blade that ensures precise cuts which reduce unnecessary tissue injuries. After searching the literature, we realized that there is a lack of studies that assesses scalpel blades for dental use. Herein, this study aims to assess the cutting power of new scalpel blades after cleaning with different methods. Sixty sterile scalpel blades were divided into seven groups: I) new blade; II) the second insertion; III) blade cleaned with gauze; IV) blade cleaned with gauze and saline; V) blade cleaned with saline; VI) blade cleaned with cotton, and VII) blade cleaned with cotton and saline. A universal testing machine (Osvaldo Filizola, São Paulo, Brazil) was used for the insertion and measurement of the shear strength. The results revealed that cleaning the blade with gauze and saline was the method that had the greatest loss of the cutting capability. The reinsertion of the scalpel blade without any type of cleaning or the cleaning of the blade with cotton and saline were the methods that obtained the best result, which did not compromise the mechanical properties of the tested material. This study concludes that cleaning methods affect the cutting power of scalpel blades.

Keywords: Oral Surgery; Surgical Wound; Dentistry.

RESUMO

Na execução dos procedimentos cirúrgicos bucais e maxilofaciais o operador, ao realizar incisões, necessita de uma lâmina que garanta um corte preciso, diminuindo lesões desnecessárias aos tecidos. Ao fazer uma busca na literatura, constatou-se carência de estudos que avaliassem lâminas de bisturi de uso odontológico. Diante desse cenário, o objetivo do presente estudo foi avaliar o poder de corte de lâminas de bisturi novas e após limpeza com diferentes métodos. Sessenta lâminas de bisturi estéreis foram divididas em sete grupos: I) lâmina nova; II) segunda inserção; III) lâmina limpa com gaze; IV) lâmina limpa com gaze e soro; V) lâmina limpa com soro; VI) lâmina limpa com algodão e VII) lâmina limpa com algodão e soro. Para inserção e aferição da resistência ao corte utilizou-se uma máquina de ensaio universal (Osvaldo Filizola, São Paulo, Brasil). Os resultados revelaram que a limpeza da lâmina com gaze e soro fisiológico foi o método que teve maior perda de corte. Já a reinserção da lâmina de bisturi sem quaisquer tipos de limpeza ou a limpeza da lâmina com algodão e soro foram as que obtiveram melhor resultado, não comprometendo as propriedades mecânicas do material testado. Conclui-se, com a realização desse estudo, que os métodos de limpeza afetam o poder de corte das lâminas de bisturi.

Palavras-chave: Cirurgia bucal; Ferida cirúrgica; Odontologia.

[1] Health Department I - State University of Sudoeste da Bahia – UESB, Jequié, Bahia, Brazil.
[2] Health Department II - State University of Sudoeste da Bahia – UESB, Jequié, Bahia, Brazil.

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INTRODUCTION

Since the beginning of humanity, consciously, bloody therapeutical procedures also took their first steps (1). The physician, taking advantage of both traditional and cultural resources, as well as based on empiricism, which is the result of observation, did what was possible to save lives. These results operated through a bilateral sacrifice: to the patient was the suffering and to the physicians was the uncertainty of success (2-5).

When performing surgical procedures, the tissue incision is present (6-8). For this to occur, the surgeon must stick to some basic principles of surgery (9,10). However, the lack of a clear and accurate definition of the use and reuse of scalpel blades throughout the same surgical procedure raises some questions. To what extent would the lack of precision of the cut, as well as the use of materials for cleaning the blades, influence the cutting of the blades?

Based on this premise, it is necessary to clarify the safety and efficacy of the use and reuse of the scalpel blade during the surgical procedure, which is the object of this study, in addition to verifying the hypotheses that cleaning methods and serial insertions of the blades reduce their cutting power.

METHOD

This work is an *in vitro* laboratory study. We used 60 no.5 scalpel blades (Advantive, Xishan City, Jiangsu, China) divided into seven groups (n = 5): I) new blade (control group); II) the second insertion; III) cleaned with gauze; IV) cleaned with gauze and saline; V) cleaned with saline) VI) cleaned with cotton, and VII) cleaned with cotton and saline. After they were selected, we inserted the blades into test specimens made in addition silicone (Figure 1). A universal testing machine (Oswaldo Filizola AME-2kN, São Paulo, Brazil) was used for the insertion and measurement of the shear strength. A scalpel cable was attached to the upper claw of the machine, which remained perpendicular to the specimen during the insertion test. The insertion forces were expressed in kilograms/force (Kgf), and the established deformity pattern was 14 mm of blade insertion.

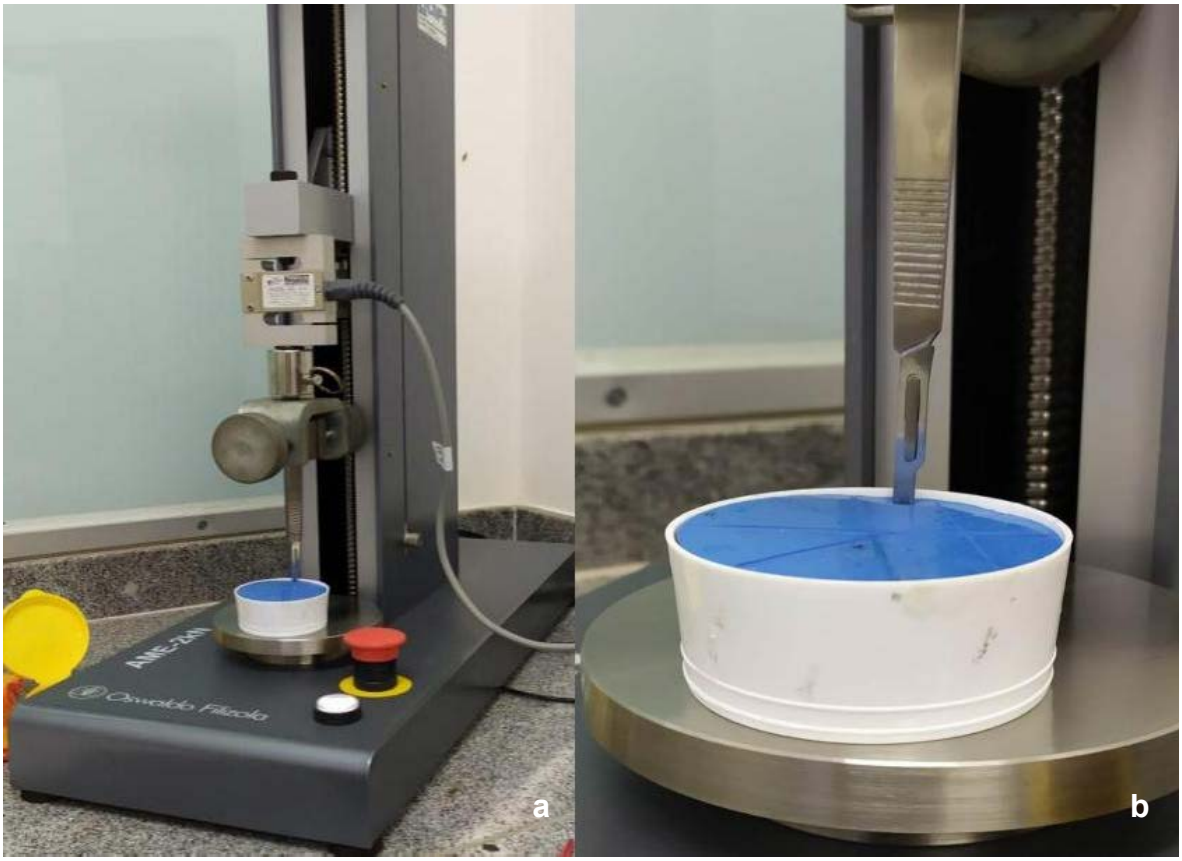

Figure 1. *The mechanical test being performed: a) scalpel blade coupled to the universal mechanical testing machine Oswaldo Filizola AME-2kN; b) approximate view of the blade being inserted in silicone.*

The data obtained were analyzed using the SPSS software version 21.0 (Statistical Package for Social Sciences SPSS. 21.0, 2012, Armonk, NY: IBM Corp.). For assessing normality and homoscedasticity, the Shapiro-Wilk and Levene tests were used, respectively.

Descriptive statistics were calculated and the mean and interquartile range parameters were adopted for all intra- and intergroup insertion force evaluation data (in Kgf). Firstly, each measure insertion force successively assessed on each blade was allocated into two test groups: 1st to 5th and 6th to 10th. The paired t-test or the Wilcoxon test were adopted as inferential statistics in the intragroup comparisons to assess whether there are differences between the means/medians of each scalpel blade between the 1st to 5th and 6th to 10th tests.

To assess the effect size and clinical relevance, Cohen's d effect size was adopted, and interpreted as small (< 0,20), medium (> 0,20 or 0.4.9), and high (> 0.80)(11). The intergroup comparison was performed through the Kruskal-Wallis test and the pairwise analyses through the Mann-Whitney test. For all inferential analyses, a level of significance of 5% was adopted.

RESULTS

The mean and interquartile range values of the groups were described in Tables 1 and 2. In the intragroup comparison, blades cleaned with gauze and saline showed a significant loss of performance ($p < 0.05$), with an increase in the means in Kgf. Such losses may be considered clinically relevant since they have a high effect size (d = 4.50).

TABLE 1. COMPARISON OF THE INSERTION FORCE OF THE SCALPEL BLADES BETWEEN THE GROUPS.

Groups	Insertions		p (Value)*	Effect size (Cohen's d)	Effect size's interpretation
	From 1st to 5th	From 6th to 10th			
I	0.173 + (0.010)	0.171+ (0.015)	0.749	0.28	Low effect
II	0.179 + (0.015)	0.181 + (0.015)	0.374**	0.22	Low effect
III	0.171 + (0.010)	0.173+ (0.015)	0.861**	0.50	Medium effect
IV	0.157+ (0.025)	0.175+ (0.005)	0.037**	4.50	High Effect
V	0.171 + (0.005)	0.165+ (0.005)	0.468**	1.50	High Effect
VI	0.159 + (0.047)	0.181+ (0.015)	0.207	1.10	High Effect
VII	0.179 + (0.020)	0.179 + (0.010)	1.000**	0	Not relevant

*Insertions were represented by interquartile mean/amplitude; *p values were represented by the Wilcoxon test** or paired t-test.*

TABLE 2. POST-HOC PEER REVIEW.

Comparisons	p value**
Group I x Group VII	0.006
Group II x Group III	0.048
Group II x Group IV	0.009
Group II x Group V	0.016
Group III x Group VII	0.012
Group IV x Group VII	0.018
Group V x Group VII	0.007

***p value referring to the Mann-Whitney test, with a significance level of 5%*

As for the intergroup assessment, Figure 2 presents the box-plot graph and measures of dispersion, asymmetry, tail length, and outliers (extreme values). Thus, in Table 1, significant differences were found between medians of all groups through the Kruskal-Wallis test (*P* = 0.039). After peer review (post-hoc), differences were observed between 14 comparisons (Table 2). No significant differences were found between the blades from the control group and the one that was only inserted for the second time I and II (P > 0.05). The most expressive findings are revealed by group II (second insertion), which revealed significant differences (p<0.05) with three cleaning methods: blade cleaned with gauze (group III), blade cleaned with gauze and saline (group IV), and blade cleaned with saline only (group V).

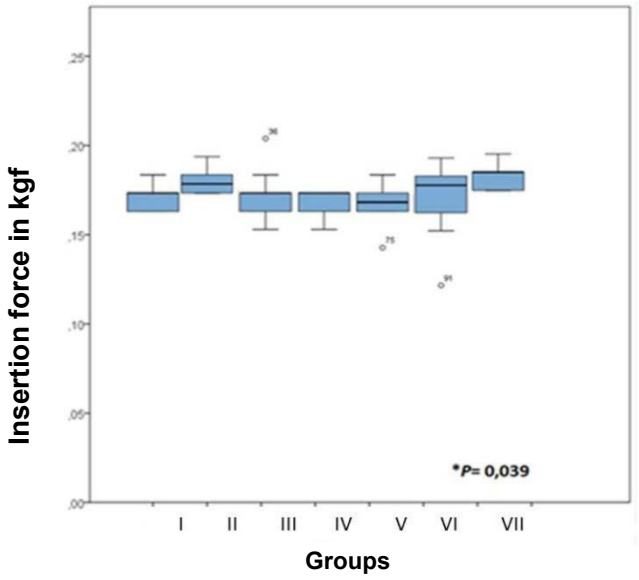

Figure 2. *Box-plot graph for the comparison of the incision force between groups. *p value referring to the Kruskal-Walis test, with a significance level of 5%.*

Another compelling finding lies in the fact that new blades (group I) present statistically significant differences with the medians of the insertion forces of blade in group VII (cleaned with cotton and saline). Blades of group VII also revealed differences regarding blades cleaned with gauze (group III), blades cleaned with gauze and saline (group IV), and blades cleaned with saline (group V).

DISCUSSION

This study aimed at assessing the efficacy of the use and reuse of scalpel blades throughout surgical procedures, as well as verifying, through a laboratory experiment, the influence of some materials commonly used for cleaning scalpel blades for dentistry use.

The desire to have an effective method that does not change the cutting power of the instruments is not exclusive to dentistry (12,13). Refractive surgeons are often confronted with recommendations for cleaning their scalpels. The problem encountered lies in the maximization of cleaning, which would maintain the longevity of these instruments. Beran carried out a study whose aim was to assess ophthalmological scalpel cleaning methods and it revealed that a systematic multilevel process is necessary for the maintenance of the longevity of diamond scalpels, a result that corroborates the findings of our study (14).

After observing the results obtained in our study through intragroup comparison, it is understandable that the blades cleaned with gauze and saline presented a significant loss of performance, which can be considered clinically relevant. The gauze, which has a higher cut resistance than cotton, acted directly on the tested material, diminishing the cutting power of the scalpel blade. This result is of clinical importance since many professionals repeat this act during surgical procedures. The loss of the cutting power not only causes economic losses, but also increases the surgical time, inaccuracy of the cuts, and greater tissue damage.

Interestingly, there were no relevant differences between the insertion of the new blade and its reinsertion. Hence, reusing a blade without cleaning it does not lead to clinically relevant losses to perform the procedure.

Pithon *et al*. when assessing the insertion and reinsertion of anesthetic needles, observed that the Terumo needle was the only one that did not endure a loss of performance throughout its five insertions; needles of all other brands tested, contrastingly, had a loss of performance, and those of Septoject XL, Carpule, and Procare, showed an increase in the force required for penetration from the second insertion, while the Injex needle showed acted likewise from its third insertion (15). Although our study assessed the penetration of a scalpel and not needles, the values achieved with the scalpel from the second insertion were similar.

Moreover, the results revealed that the new blades showed statistical differences with the median insertion forces of the blade of group VII (cleaned with cotton and saline). This group also presented differences regarding blades cleaned with gauze (group III), blades cleaned with gauze and saline (group IV), and blades cleaned with saline (group V). Since there shall not be loss in the cutting performance, the professional may opt for cleaning the blade with cotton and saline before reinserting it. The cotton, as it is a more fragile material, does not compromise the blade's mechanical properties.

It is important to emphasize the need for clinical studies that verify the preliminary results presented here.

CONCLUSION

By performing this study, we conclude that cleaning a scalpel blade with gauze and physiological saline was the method that had the greatest cutting capability loss. The hypothesis that cleaning methods and serial inserts of the blades reduce their cutting power have been confirmed.

The authors declare no conflict of interest.

Corresponding author
Matheus Melo Pithon
Address: Av. Otávio Santos, 395/705, Centro Odontomédico Dr. Altamirando da Costa Lima, Bairro Recreio, 45020-750 – Vitória da Conquista – Bahia, Brazil
Email: matheuspithon@gmail.com

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