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Main Article

Efficacy of Gyrus diego® microdissector at varying oscillation speeds

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Abstract

Objective: To determine the efficacy of the Gyrus diego® microdissector at increasing oscillation speeds, using an *in vitro* tissue model.

Background: It had not previously been established whether microdissectors were more efficient at higher or lower speeds.

Methods: We investigated the effect of varying microdissector oscillation speeds on the weight of material aspirated in a given time. A 4 mm straight blade was used with constant suction strength. Jelly and liver were used to simulate polyps and muscle plus connective tissue, respectively. Water was used as a control. Repeat readings were taken at speeds of 1000, 2000, 3000, 4000 and 5000 rpm. Data were analysed using linear bivariate regression.

Results: The results showed significant linear trends in the cases of liver and jelly, with faster cutter speeds being associated with higher aspiration rates.

Conclusion. These results suggest that microdissector efficacy increases with speed, up to 5000 rpm.

Key words: Surgical Instruments; Endoscopic Surgical Procedures; Nasal Polyps

Introduction

Microdissectors are used routinely in nasal surgery. They employ a combination of a rotating blade and suction to remove tissue. Two groups[1,2] have published quantitative studies comparing the *in vitro* efficacy of different microdissector and blade combinations. Both selected a specific oscillation speed for their experiments.

Our study aimed to determine the efficacy of our unit's Gyrus diego® microdissector at varying oscillation speeds, using soft and firm tissue models.

Methods

A Gyrus diego® microdissector with new, 4 mm, straight blades was used. This was set up with the suction passing through a 'sputum trap' on a digital weighing scale, to allow the weight of tissue aspirated to be measured. Irrigation was not used. Uncooked blocks of jelly and cow's liver were used to simulate polyps and muscle plus connective tissue, respectively, with water used as a control. Previous studies used oysters to represent polyps, but financial restraints required a more economical model. Jelly was felt to be a good substitute for the compressible, homogenous nature of polyps, whilst liver, with its highly vascular connective tissue structure, represented turbinate and other nasal tissues.

Preliminary experiments established the optimum microdissector configuration and the likely variation in aspirated tissue with changing speed. Repeat measurements were then taken of the weight of tissue aspirated over a period of time (10 seconds for water and jelly, 30 seconds for liver), at blade rotation speeds of 1000, 2000, 3000, 4000 and 5000 rpm. Two blades were used for each tissue model and the blades were changed halfway through testing. Increasing speeds were used for the first blade and decreasing speeds for the second blade.

The data collected were analysed using linear bivariate regression.

Results

The results showed significant linear trends, in the cases of liver and jelly, between blade oscillation speed and aspirated tissue volume. Faster cutter speeds were associated with higher aspiration rates, up to the maximum speed of 5000 rpm. The values for t (refers to the outcome value for the student's t-test) and $P > t$ (refers to the probability of this result being statistically significant) shown in Tables I and II indicate that this linear trend is very unlikely to have occurred by chance.

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TABLE I

REGRESSION TABLE FOR LIVER

	Coefficient	SE	t	P > t	95% CI
x	0.3555556	0.1236817	2.87	0.006	0.1061277–0.6049834
_cons	2.755556	0.4102057	6.72	0.000	1.928297–3.582814

SE=standard error; t=outcome value for the student's t-test; P=probability of this result being statistically significant; CI=confidence intervals; x=cutter speed/1000; _cons=constant used in the calculation of regresion table

TABLE II

REGRESSION TABLE FOR JELLY

	Coefficient	SE	t	P > t	95% CI
x	0.6	0.1499338	4.00	0.000	0.2928744–0.9071256
_cons	11.96667	0.4972743	24.06	0.000	10.94805–12.98529

SE=standard error; t=outcome value for the student's t-test; P=probability of this result being statistically significant; CI=confidence intervals; x=cutter speed/1000; _cons=constant used in the calculation of regresion table

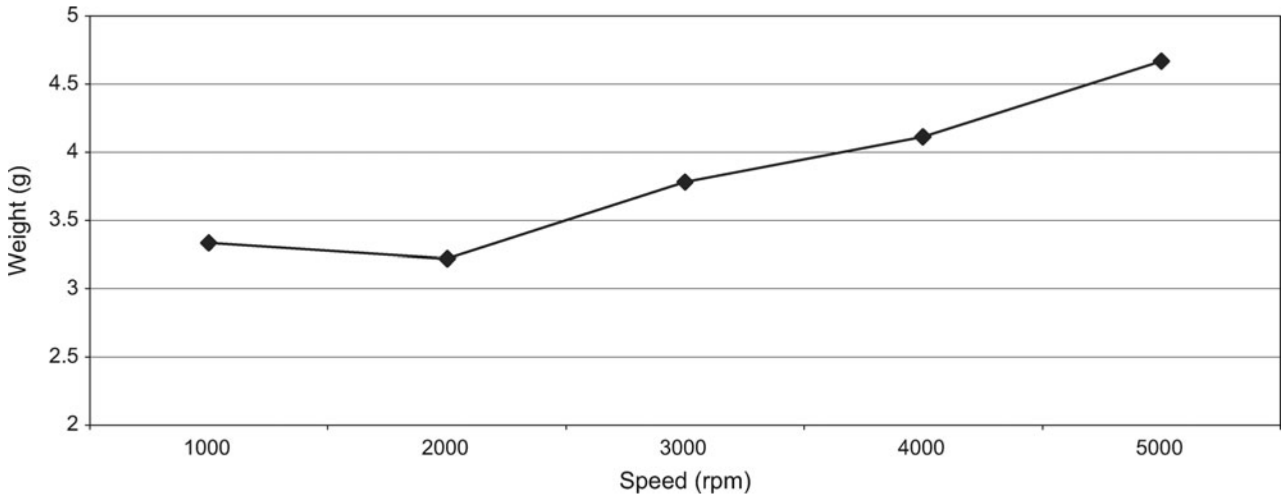

Fig. 1

Mean weight of liver aspirate, by microdissector oscillation speed.

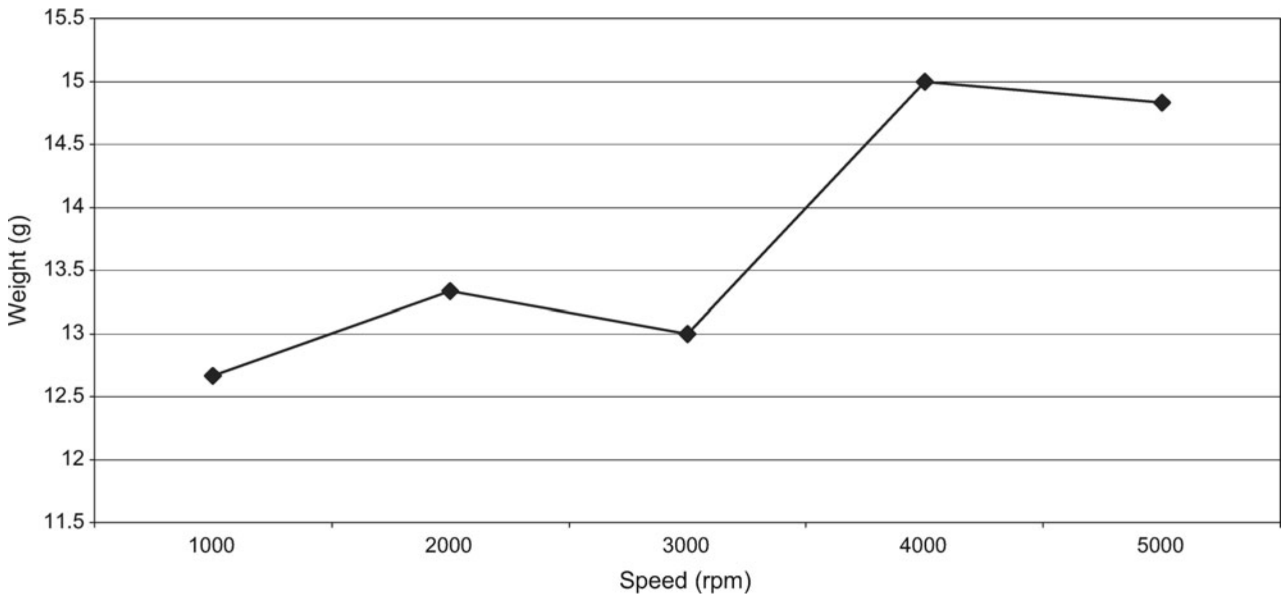

Fig. 2

Mean weight of jelly aspirate, by microdissector oscillation speed.

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TABLE III

TISSUE WEIGHT ASPIRATED AT VARYING MICRODISSECTOR SPEEDS

Weight aspirated* (g)	Oscillation speed (rpm)				
	1000	2000	3000	4000	5000
Water					
	216	199	202	207	216
	214	203	212	206	210
	216	208	222	215	216
Jelly					
	12	15	13	14	14
	14	14	14	15	14
	13	14	14	15	16
	11	11	13	17	16
	13	13	13	14	15
	13	13	11	15	14
Liver					
	3	3	3	5	6
	4	3	4	4	5
	3	3	4	3	5
	5	5	4	4	7
	4	3	5	6	5
	3	5	5	6	6
	2	2	4	3	2
	3	2	2	3	3
	3	3	3	3	3

*Results are shown for repeated measurements of aspirate weight, at the five oscillation speeds.

Water was used as a control in order to assess any difference in aspiration attributable to the relative suction port opening time, at differing oscillation speeds. No change was seen, comparing 1000 with 5000 rpm.

The results are shown in Figures 1 and 2 and Tables I to III.

Discussion

Our study found a linear relationship between blade oscillation speed and aspirated tissue volume, for the tissue models used. Faster cutter speeds were associated with higher aspiration rates, up to the maximum speed of 5000 rpm.

The first quantitative analysis of microdissectors used in endoscopic nasal surgery was reported by Ferguson *et al.* in 1999.[1] These authors reported preliminary tests to determine the optimal oscillation speed for each microdissector. They then compared microdissectors at their respective optimal oscillation speeds; however, they did not include oscillation speed data in the published paper.

Dave *et al.*[2] compared two microdissectors, using a combination of blade types. Both microdissectors were run at the manufacturers' recommended oscillation speed (5000 rpm) with 70 per cent irrigation. These authors developed an aspiration efficiency score incorporating tissue aspiration, clog frequency and clearance time. They found no clogging problems with straight blades, using an oyster model, but some clogging occurred when curved blades or a scallop model were used.

In our experiment, we did not experience any problems with clogging. This may be due to our use of straight blades and different tissue models.

- **This study aimed to determine the efficacy of the Gyrus diego® microdissector at increasing speeds of oscillation, using an *in vitro* tissue model**
- **Using liver and jelly as *in vitro* tissue models, faster oscillation speeds were associated with higher aspiration rates**
- **These findings suggest that faster oscillation speeds may be more efficient during clinical use of micro-debriders in endoscopic nasal surgery**

In our experience, two schools of thought exist with regard to optimal microdissector oscillation speed. One theory is that slower speeds allow more tissue to be aspirated and removed per blade oscillation. The other is that a faster moving blade allows more tissue to be removed. In our study, we found that faster speeds resulted in the removal of more tissue, for both tissue models. There is no reason why these results should not recur *in vivo*. There may be an indication for using slower speeds in areas of high risk or during sinus surgery training. It is possible that other microdissectors may give different results; a plateau effect is particularly possible for those capable of higher speeds.

References

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Mr R Sim takes responsibility for the integrity of the content of the paper.
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