

# Gingival bleeding on probing increases after quitting smoking

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## Abstract

**Background:** Gingival inflammation associated with plaque accumulation is delayed or impaired in smokers. Anecdotal evidence suggests that smokers who quit experience an increase in gingival bleeding.

**Method:** A group of 27 subjects on a Quit-smoking programme were examined for changes in gingival health over a 4–6-week period.

**Results:** The bleeding on probing with a constant force probe increased from 16% of sites to 32% of sites, despite improvements in the subjects oral hygiene.

**Conclusion:** This provides further evidence that tobacco smoking affects the inflammatory response and that these changes are reversible on quitting.

Key words: Gingivitis; inflammation; gingival bleeding; quit smoking; tobacco.

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Bacterial plaque is the major cause of gingivitis and periodontitis, but tobacco smoking is one of the most significant risk factors for chronic periodontitis (Ismail et al. 1983, Bergstrom & Preber 1994, Barbour et al. 1997). However, it has been noted that tobacco smoking may mask the inflammatory signs of gingivitis and periodontitis, particularly the propensity of the gingivae to bleed on brushing, eating or following periodontal probing (Preber & Bergstrom 1985, Bergstrom & Bostrom 2001), and some patients have reportedly complained to their dentist or general medical practitioner of bleeding gums in the first few months following quitting smoking. The aim of this study was to monitor changes in gingival health in a group of subjects who had enrolled at a Smoking Cessation Clinic in order to test this largely anecdotal observation.

## Material and Methods

The study protocol was approved by the Institute of Psychiatry and the South London and Maudsley NHS Trust's

ethics committee. Subjects were recruited from people attending a quit-smoking programme at the Maudsley Hospital Smoking Cessation Clinic, London. Subjects had to be between 18 and 60 years, smoke more than 10 cigarettes per day for a minimum of 3 years and have no relevant medical history. They had to have a minimum of 20 teeth and no overt signs of advanced periodontal disease. They also had to agree to refrain from any professional cleaning for the duration of the study. If subjects presented with severe disease and/or were concerned about a dental problem, they were given a list of dentists in the local area who were able to provide them with necessary dental care or refer them for specialist treatment. Forty-two subjects volunteered to take part, but 12 did not return for their second visit.

Prior to the subjects attending, they had been contacted by the smokers clinic explaining the format of the quit-smoking programme. It involved at least seven visits to the clinic, the first three of which were:

- To take a smoking history and assess motivation to quit.
- To assess suitability for pharmacological treatment (nicotine replacement or Bupropion).
- To take measurements of expired air carbon monoxide (CO) levels and weight.

Measurements of the subject's weight and expired air CO levels were performed at every visit. The third visit was the quit-smoking day and subsequent visits were for monitoring progress, counselling and encouragement. Subjects were recruited for the present study at the three initial visits. The first clinical examination of their gingival status was carried out on the third visit, the quit-smoking day.

The seventh visit (4 weeks after the quit day) was the final visit of the programme. The second clinical examination was carried out at this visit or within the next 2 weeks. Subjects could make arrangements to come back to see the therapists at other time intervals if they so wished. The smoking status of

the subjects at the final visit was usually based on their expired air CO levels (Jarvis et al. 1980). If the subject was unable to attend this session, then their status was based on self-report.

The clinical dental examination was carried out in a separate room from the quit-smoking programme. The subjects were seen at about the same time of the day for both clinical examination visits, and the clinical recordings were performed in the same order. Subjects were encouraged to return for their second clinical examination regardless of the outcome of the quit-smoking programme. They were advised not to inform the examiner of their smoking status on their second visit so that the examiner was not aware of whether they had been successful in quitting.

The following clinical parameters were recorded at four sites (mesial, distal, buccal, lingual) on 10 designated representative teeth in the upper and the lower jaw (16,14,13,12,11,31,32,33,34,36 Agerholm & Ashley 1996): the presence or absence of visible plaque; the probing depth and presence of bleeding on probing using a True Pressure-Sensitive Vivacare Periodontal probe (Bergenholtz et al. 2001).

Statistical analysis was carried out using a paired *t*-test on differences recorded at baseline (quit-smoking day) and 4–6 weeks later.

## Results

Three subjects did not reach a level classified by the clinic as that of a non-smoker, or dropped-out of the programme. The 27 subjects (18 females and 9 males) that completed the study had an age range from 24 to 56 years with a mean age of 35.6 years. Twenty-five subjects were white, one was of mixed race and one was African-Caribbean in origin. The range of cigarette consumption was 10 – 40, with the median consumption of the group being 20 cigarettes/day. All subjects reported being in good general health. Of the various aids used in assisting the subjects on the quit-smoking programme, 21 had used Bupropion hydrochloride, five used nicotine replacement therapy (NRT) and one did not use anything.

Table 1 presents the clinical data at both visits. There was no change in probing depth or the number of sites probing greater than 2 mm between

Table 1. Mean probing depth, mean number of sites probing greater than 2 mm and mean proportion of sites exhibiting bleeding on probing and plaque at baseline (Visit 1) and at 4 – 6 weeks after quitting smoking (Visit 2)

	Visit 1 Mean (SD)	Visit 2 Mean (SD)	<i>p</i> -value
mean probing depth (mm)	2.5 (0.3)	2.5 (0.3)	0.676
number of sites probing > 2 mm	20.6 (5.7)	19.7 (7.4)	0.415
mean proportion of sites that bleed on probing	15.7 (7.7)	31.9 (8.7)	<0.001
mean proportion of sites with plaque present (plaque score)	38.9 (18.2)	28.1 (12.2)	<0.001

visits. There was a statistically significant increase ( $p < 0.001$ ) in the mean proportion of tooth sites that exhibited bleeding after probing, between baseline and 4–6 weeks post-quitting. In contrast, there was a statistically significant decrease ( $p < 0.001$ ) in the number/mean proportion of tooth sites with plaque present, over the same time period.

## Discussion

Gingival bleeding is related to the persistent presence of plaque on the teeth and regarded as a sign of the associated inflammatory response. Subjects who refrain from normal oral hygiene procedures have a resultant increase in plaque accumulation and demonstrate a concomitant increase in gingival bleeding as gingivitis develops over a 2 – 3-week period (Löe et al. 1965). It has also been shown that this development of gingival inflammation and the associated bleeding is delayed or impaired in smokers (Danielsen et al. 1990, Lie et al. 2001). In the present study, despite a significant decrease in plaque score, there was a two-fold increase in bleeding on probing after quitting smoking. The reduction in plaque score should have resulted in a decrease in inflammation and bleeding rather than the observed increase. This strongly suggests that the signs of inflammation were inhibited by the smoking experience. The reason for the improvement in the subject's oral hygiene may be due to the fact that they were part of a study that increased awareness of self-health and so they spent more time on oral hygiene procedures, although they were asked not to alter brushing routines for the duration of the study. The mechanisms by which smoking may exert a suppressive action on the bleeding responsiveness of the gingiva are not well understood. It can be assumed that the clinical effect of

reduced bleeding in smokers is due to the long-standing use of tobacco rather than acute events. It seems likely that the interference of smoking with this property of the periodontal tissues is not due to a vasoconstrictive action (from nicotine), but a result of a more profound influence on the vasculature and cellular metabolism (Palmer et al. 1999, Meekin et al. 2000).

People on a quit-smoking programme should be informed of the possibility of an increase in gingival bleeding associated with smoking cessation, so as to prevent any anxiety that may cause them to resume smoking. Patients experiencing gingival bleeding should be advised to improve their oral hygiene and seek treatment by a dentist or a hygienist. The findings of this study emphasise the importance of awareness of the effect of smoking in masking the signs and symptoms of the inflammatory process, as this may have implications on other systemic inflammatory disease processes.

## Zusammenfassung

*Gingivales Bluten und Sondieren vergrößert sich nach dem Aufhören von Rauchen*

**Hintergrund:** Die gingivale Entzündung ist mit Plaqueakkumulation verbunden und bei Rauchern verzögert oder verschlechtert. Anekdotische Evidenz unterstützt die These, dass das Aufhören von Rauchen zu einer Zunahme der gingivalen Blutung führt.

**Methoden:** Eine Gruppe von 27 Personen eines Raucherprogramms zum Aufhören wurden hinsichtlich der Veränderungen der gingivalen Gesundheit über 4 bis 6 Wochen überprüft.

**Ergebnisse:** Das Bluten nach Sondierung mit einer konstanten Sondierungskraft verstärkte sich von 16 % der Flächen auf 32 % der Flächen, unabhängig von Verbesserungen der oralen Hygiene der Personen.

**Schlussfolgerung:** Dies unterstützt zukünftige Evidenz, dass das Tabakrauchen die entzündliche Antwort beeinflusst und dass diese Veränderungen beim Aufhören des Rauchens reversibel sind.

## Resumé

### *Le saignement gingival au sondage augmente après la cessation du tabagisme*

L'inflammation gingivale associée à l'accumulation de plaque dentaire est diminuée ou freinée chez les fumeurs. Une évidence anecdotique suggère que les fumeurs qui arrêtent le tabac vont subir une augmentation du saignement gingival. Un groupe de 27 sujets ayant suivi un programme pour cesser de fumer ont été examinés en ce qui concerne les changements de leur santé gingivale sur une période de quatre à six semaines. Le saignement au sondage avec une sonde à force constante augmentait de 16% des sites à 32 % des sites malgré

l'amélioration de l'hygiène buccale chez ces patients. Ceci confirme que le tabagisme affecte la réponse inflammatoire et que ces changements sont réversibles lorsque le patient arrête de fumer.

## References

- Agerholm, D. M. & Ashley, F. P. (1996) Clinical assessment of periodontitis in young adults – evaluation of probing depth and partial mouth recording methods. *Community Dentistry and Oral Epidemiology* **24**, 56–61.
- Barbour, S. E., Nakashima, K., Zhang, J. B., Tangada S, Hahn C. L., Schenkein, H. A. & Tew, J. G. (1997) Tobacco and smoking: environmental factors that modify the host response (immune system) and have an impact on periodontal health. *Critical Reviews in Oral Biology and Medicine* **8**, 437–460.
- Bergenholtz, A., Al-Harbi, N., Al-Hummayani, F. M., Anton, P. & Al-Kahtani, S. (2001) The accuracy of the Vivacare true pressure-sensitive periodontal probe system in terms of probing force. *Journal of Clinical Periodontology* **27**, 93–98.
- Bergström, J. & Boström, L. (2001) Tobacco smoking and periodontal haemorrhagic responsiveness. *Journal of Clinical Periodontology* **28**, 680–685.
- Bergström, J. & Preber, H. (1994) Tobacco use as a risk factor. *Journal of Periodontology* **65**, 545–550.
- Danielsen, B., Manji, F., Nagelkerke, N., Fejerskov, O. & Baelum, V. (1990) Effect of cigarette smoking on the transitional dynamics in experimental gingivitis. *Journal of Clinical Periodontology* **17**, 159–164.
- Ismail, A. I., Burt, B. A. & Eklund, S. A. (1983) Epidemiologic patterns of smoking and periodontal disease in the United States. *Journal of the American Dental Association* **106**, 617–621.
- Jarvis, M. J., Russell, M. A. H. & Saloojee, Y. (1980) Expired air carbon monoxide: a simple breath test of tobacco smoke intake. *British Medical Journal* **281**, 484–485.
- Lie, M. A., Loos, B. G., Henskens, Y. M. C., Timmerman, M. F., Veerman, E. C. I., van der Velden, U. & van der Weijden, G. A. (2001) Salivary cystatin activity and cystatin C in natural and experimental gingivitis in smokers and non-smokers. *Journal of Clinical Periodontology* **28**, 979–984.
- Löe, H., Theilade, E. & Jensen, S. B. (1965) Experimental gingivitis in man. *Journal of Periodontology* **36**, 177–187.
- Meekin, T. N., Wilson, R. F., Scott, D. A., Ide, M. & Palmer, R. M. (2000) Laser Doppler flowmeter measurement of relative gingival and forehead skin blood flow in light and heavy smokers during and after smoking. *Journal of Clinical Periodontology* **27**, 236–242.
- Palmer, R. M., Scott, D. A., Meekin, T. N., Poston, R. N., Odell, E. W. & Wilson, R. F. (1999) Potential mechanisms of susceptibility to periodontitis in tobacco smokers. *Journal of Periodontal Research* **34**, 363–369.
- Preber, H. & Bergström, J. (1985) Occurrence of gingival bleeding in smoker and non-smoker patients. *Acta Odontologica Scandinavica* **43**, 315–320.

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