

# Long-term Use of Nicotine Chewing Gum

## Occurrence, Determinants, and Effect on Weight Gain

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Among 538 clients of a Smokers Clinic who were treated with 2-mg nicotine chewing gum, 34 (6.3%) were still using the gum at one-year follow-up. This group represented 25% of lapse-free abstainers. At one-year follow-up, long-term gum users were using an average of 6.8 pieces of gum per day. Long-term gum users were similar to treatment failures in cigarette consumption and tobacco dependence, while "gum-free" successes were significantly lighter and less-dependent smokers. Long-term gum users used more gum during the four weeks of treatment than treatment failures, who in turn used more than the gum-free successes. It is suggested that for many the long-term use of gum was an essential ingredient of their success. Long-term gum users gained significantly less weight than other long-term treatment successes.

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NICOTINE chewing gum can be an effective aid in helping people to stop smoking.<sup>1</sup> It appears to be especially helpful to more dependent heavier smokers.<sup>2-5</sup> However, there has been concern about those who find it difficult to stop using the gum.<sup>6</sup> Studies evaluating the efficacy of the gum report

**See also pp 1565, 1570, 1575, 1581, and 1613.**

that 2% to 9% of all those offered the gum were still chewing it at one-year follow-up.<sup>2,7-10</sup> This represents 5% to 23% of treatment successes. Two studies of long-term gum users<sup>6,11</sup> showed that withdrawal of the gum induced symptoms and effects similar to those of cigarette withdrawal.

Little is known about how common long-term gum use is in routine clinic

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programs and about the characteristics of long-term gum users. This information is somewhat difficult to come by. The two studies of gum withdrawal<sup>6,11</sup> found only six and eight subjects, respectively. More information is also needed on the effect of long-term gum use on postcessation weight gain. Three studies<sup>7,9,12</sup> found no significant difference in weight gain between nicotine gum users and control groups after short-term gum use, while three other reports<sup>13-15</sup> indicate that using the gum reduces weight gain. The difference between long-term gum users and other long-term ex-smokers has not been examined.

This article looks at gum use at one-year follow-up in 538 clients of a Smokers Clinic. Pretreatment and treatment differences between long-term gum users, other long-term treatment successes, and treatment failures were investigated and weight gain in the two groups of treatment successes was compared.

### METHODS

#### Subjects

The subjects were 538 smokers treated in 50 groups at the Maudsley Hospital Smokers Clinic between 1982 and 1985 who were offered nicotine chewing gum. The patients were self-referred or sent by their physicians. Sixty-seven percent had a nonmanual occupation, 64% were women, and the average age was 38 years. Average cigarette consumption was 25 cigarettes per day and expired-air carbon monoxide levels averaged 34 ppm.

There were 14 subjects who were abstinent at the end of treatment but not available for establishing gum use status at one year. These are not included in the sample of 538. Eleven group participants who were not offered the gum because of health contraindications are also not included. Otherwise, the sample represents consecutive group participants.

#### Procedure

Before attending the clinic, all subjects filled in two questionnaires. The Addiction Research Unit Questionnaire contains items on demographic and smoking characteristics, including smoking history, perceived dependence, motivation for giving up smoking, and confidence in succeeding. The Smoking Motivation Questionnaire provides scores on seven motives for smoking (psychological image, hand-mouth activity, indulgent, sedative, stimulation, addictive, and automatic)<sup>16</sup> and an overall dependence score.<sup>17</sup> At an initial

assessment interview, subjects were weighed, blood samples were taken for measurement of nicotine concentration,<sup>18</sup> and expired-air carbon monoxide levels were measured.

The group treatment that followed lasted for four weeks, consisted of one or two introductory sessions and four further weekly meetings, and was free of charge. Subjects were asked to stop smoking after the first meeting. The group treatment procedures are described elsewhere.<sup>19</sup> At each session, nicotine chewing gum (2-mg) was dispensed and its consumption in the previous week recorded. (A few subjects tried the stronger 4-mg preparation during the group course, but at one year all long-term gum users were taking 2-mg gum.) Subjects were encouraged to use up to 15 pieces a day for up to three months, but the gum continued to be supplied after that period. The gum was provided at one third of the usual cost for the first ten boxes (1050 pieces), after which the full price was charged.

One-year success was defined as sustained abstinence from any form of tobacco use following the treatment and was ascertained initially by telephone calls. A stricter follow-up routine was gradually established whereby subjects claiming abstinence were invited for a follow-up interview that included validation of smoking status by measurement of expired-air carbon monoxide level.<sup>20,21</sup> This was done in 71% of the subjects classified as one-year successes. Long-term gum use was defined as any use of gum at one year. No case of a treatment failure continuing to use the gum for a protracted period was encountered.

Apart from pretreatment data, other variables examined included compliance with treatment, ie, consumption of nicotine chewing gum during treatment (self-reports of gum use were usually based on counting the pieces remaining in the box), attendance, and week of stopping smoking, as well as gum consumption and weight gain at one year.

### Statistical Methods Used

In analyzing the differences between long-term gum users, "gum-free" one-year successes, and treatment failures, one-way analysis of variance with Scheffe's test for multiple comparisons was used, except where homogeneity of variance was violated, in which case a Kruskal-Wallis test was used. Where appropriate,  $\chi^2$  statistics were computed. Stepwise multiple logistic regression was used to examine predictors of membership of the three groups. For the analysis of the correlates of gum use at one year among long-term users

and for prediction of gum use during treatment in all subjects, linear stepwise multiple regressions were used. Univariate analyses were used in evaluating the differences in weight gain and elsewhere as appropriate.

## RESULTS

### Occurrence of Long-term Gum Use and Gum Consumption at One Year

At one year of follow-up, 34 subjects were still using the gum. This represents 6.3% of all smokers offered the gum and 25% of one-year successes (N = 136).

Long-term gum users were using an average of 6.8 pieces of gum a day at one year of follow-up. Nineteen subjects (56%) were using one to five pieces a day; six (18%) were using six to ten pieces a day; and nine (26%) were using 11 to 15 pieces a day. Nobody exceeded the maximum recommended dose of 15 pieces a day, although one subject later increased his consumption to over 25 pieces a day.

The amount of gum chewed by long-term gum users (N = 34) at one year correlated significantly with pretreatment carbon monoxide level ( $r = .46$ ;  $P < .01$ ) and cigarette consumption ( $r = .40$ ;  $P < .05$ ; N = 33), but not with gum use during treatment ( $r = .24$ ; difference not significant). It was also positively related to having the first cigarette before the first morning cup of tea or coffee ( $r = .39$ ;  $P < .05$ ; N = 29), shorter duration of previous abstinence ( $r = .40$ ;  $P < .05$ ; N = 29), and attending fewer treatment groups ( $r = .40$ ;  $P < .05$ ). In a multiple regression analysis, only two significant predictors remained, ie, groups attended (beta =  $-.53$ ;  $P < .01$ ) and cigarette consumption (beta =  $.51$ ;  $P < .01$ ; overall,  $R = .70$ ,  $P < .001$ , and N = 28).

### Comparison of Long-term Gum Users, Other Long-term Treatment Successes, and Treatment Failures

As all long-term gum users were long-term successes, a global comparison between them and the rest of the sample would be biased by differences between successes and failures. Instead, we have examined differences between long-term gum users and other long-term treatment successes ("gum-free successes") and between both long-term gum users and gum-free successes and one-year treatment failures (Table 1).

There were 34 long-term gum users, 102 gum-free successes, and 402 treatment failures. Table 1 shows that the long-term gum users were heavier smokers than the gum-free successes and felt more addicted to tobacco.

Treatment failures also had higher smoke intake than the gum-free successes and scored higher on several indicators of cigarette dependence in which they were not different from the long-term gum users. There was an overall difference between the three groups in occupation, but no significant overall difference in any other demographic or questionnaire variable. The frequency of long-term gum use among men and women was very similar (6.3% and 6.4% among all smokers offered the gum and 26.7% and 24.2% among long-term treatment successes, respectively). Treatment failures differed from both other groups in attendance and from the gum-free successes in week of quitting.

Long-term gum users used more gum during treatment than both treatment failures and gum-free successes, while treatment failures used more than gum-free successes. These differences in overall gum use during treatment, as given in Table 1, apply to each week of treatment taken separately as well, with the exception of week 2, when only the difference between long-term gum users and gum-free successes was significant ( $P < .01$ ).

In 243 subjects, gum consumption was recorded 24 hours after the first session. The treatment failures and gum-free successes did not differ significantly (using an average of 6.5 and 5.7 pieces of gum, respectively), but a significant difference between long-term gum users (using nine pieces) and the two other groups had already emerged ( $P < .05$  and  $P < .01$ , respectively).

Three stepwise multiple logistic regressions were carried out to examine which variables predicted membership in the long-term gum use, gum-free success, and treatment failure groups, taking the groups in pairs. This should be viewed as an exploratory analysis and interpreted with caution, as only cases with complete data could be included (N = 23, N = 89, and N = 294 for long-term gum users, gum-free successes, and treatment failures, respectively). Looking at the long-term gum use and gum-free success groups, gum use during treatment (beta =  $.19$ ;  $P < .001$ ) and desire to quit smoking (beta =  $1.39$ ;  $P < .05$ ) were significant in predicting the probability of being a long-term gum user (overall,  $\chi^2 = 17.5$  and  $P < .001$ ). Gum-free successes differed from treatment failures in attending more group meetings (beta =  $.77$ ;  $P < .001$ ), using less gum during treatment (beta =  $-.10$ ;  $P < .01$ ), craving less when unable to smoke (beta =  $-.43$ ;  $P < .05$ ), and worrying less about weight gain when stopping smoking (beta =  $-.24$ ;  $P < .05$ ; overall,  $\chi^2 = 46.6$

Table 1.—Differences Between Long-term Gum Users, Other Long-term Treatment Successes, and Long-term Treatment Failures

Variables	A Long-term Gum Users (N=34),* X	B Other Long-term Treatment Successes (N=102),* X	C Long-term Treatment Failures (N=402),* X	Overall Tests	Significant Comparisons (.05 Level)
Nonmanual occupation, %	83.9	73.3	63.9	<i>P</i> <.05	None
Cigarettes/d	27.3	21.9	25.1	<i>P</i> <.005	A vs B B vs C
Carbon monoxide, ppm†	39.1	30.3	34.7	<i>P</i> <.01	A vs B B vs C
Perceived addiction‡	14.9	13.9	14.7	<i>P</i> <.001	A vs B B vs C
First cigarette before tea/ coffee, %	34.5	34.0	48.8	<i>P</i> <.05	B vs C
SMQ§ overall dependence score (range, 0-27)	15.6	13.8	15.3	<i>P</i> <.05	B vs C
Average gum use during treatment, pieces/d	9.8	5.9	7.4	<i>P</i> <.001	All pairs
Group meetings attended	4.5	4.5	3.5	<i>P</i> <.001	A vs C B vs C
Week of quitting (range, 1-4)	1.3	1.2	1.7¶	<i>P</i> <.001	B vs C

\*Sample sizes N vary owing to missing data. For long-term gum users, N equals 27 to 34; for other long-term treatment successes, N equals 97 to 102; and for treatment failures, N equals 376 to 402.

†Similar results apply to blood nicotine concentration: for long-term gum users (N=20), mean blood nicotine concentration was 28.9 ng/mL; for other long-term treatment successes (N=79), 19.3 ng/mL; and for treatment failures (N=283), 24.9 ng/mL; significant comparisons at the .05 level were A vs B and B vs C (overall *P*<.001).

‡Composite score from four interrelated Addiction Research Unit Questionnaire items concerning discomfort and craving when unable to smoke, feeling addicted, and expecting difficulting in quitting.

§SMQ indicates Smoking Motivation Questionnaire.

||Calculated from weekly reports at group meetings. Nonattenders were coded as missing data for the given week.

¶Only data for 200 treatment failures abstinent by the end of treatment are included.

and *P*<.001). Long-term gum users and treatment failures differed only in the long-term gum users using more gum during treatment (beta = .13;  $\chi^2 = 7.2$ ; *P*<.05).

As gum use during treatment was the main predictor of long-term gum use, a multiple linear regression was carried out to explore its relationship to pretreatment variables. With N=419, two independent predictors of gum use during treatment emerged, ie, carbon monoxide level (beta = .22; *P*<.001) and overall Smoking Motivation Questionnaire dependence score (beta = .18; *P*<.001; overall, *R* = .31 and *P*<.001).

### Long-term Gum Use and Weight Gain

There was no significant difference in pretreatment weight between long-term gum users and other long-term treatment successes (67.5 kg [N=34] and 65.8 kg [N=102], respectively). Follow-up weight gain data were obtained from 96 subjects. Eighty-eight were weighed at follow-up and their weight compared with the values from the assessment interview; eight subjects provided self-reports only. The long-term gum users had gained significantly less weight than the other long-term treatment successes in terms of both net gain and gain as a percentage of baseline (Table 2). The relationship between weight gain and the amount of gum used per day at one year was not significant (*r* = -.18; N = 24).

### Duration of Gum Use Among Treatment Successes

For all of the treatment successes, including long-term gum users, the av-

Table 2.—Long-term Gum Use and Weight Gain at One-Year Follow-up

	Long-term Gum Users (N=24), X	Other Long-term Treatment Successes (N=72), X	Comparisons
Pretreatment weight, kg	66.4	65.9	<i>t</i> = 0.2, NS*
Weight gain at 1 year, kg	3.1	5.2	<i>t</i> = 2.4, <i>P</i> <.05
Weight gain as % of baseline	4.7	7.9	<i>t</i> = 2.5, <i>P</i> <.05

\*NS indicates not significant.

erage duration of gum use was 5.6 months (SD = 4.5), which is significantly longer than the three months recommended by the manufacturer (*t* = 6.7; *P*<.01). The average duration of gum use among treatment successes not using the gum at one year (N = 102) was 3.5 months (SD = 2.9). Forty-nine (48%) used the gum for up to two months, 30 (29%) for three to five months, 16 (16%) for six to eight months, and seven (7%) for nine to 11 months.

### COMMENT

The frequency of long-term gum use in our study (25% of the long-term successes) is very similar to that in previous reports<sup>2,7,9</sup> (21% to 23%), with the exception of one study<sup>10</sup> in which only 5% of one-year successes were long-term gum users. However, that study looked at abstinence at one year rather than for the duration of one year, which could have diluted the proportion of long-term gum users in a mixture of both short-term and true long-term successes.

To see what type of smokers become long-term gum users, long-term gum users were compared with other long-term treatment successes and treatment failures. Such division is somewhat artificial, as both the length of gum

use and the duration of abstinence were continuous variables. However, a one-year follow-up is often used as a cutoff point in smoking cessation research and it is convenient for our purpose.

Univariate comparisons of the long-term gum users and the other long-term treatment successes showed that long-term gum users were heavier and more dependent smokers who consumed significantly more gum during treatment. In fact, long-term gum users used more gum from the very first day of treatment. This might reflect need for nicotine, but it could also be caused by initial readiness to take maximum advantage of the aid offered. Like long-term gum users, treatment failures were also heavier and more dependent smokers than gum-free successes. They differed from long-term gum users only in using less gum during treatment and, predictably, in dropping out of treatment and therefore having worse treatment attendance. The multivariate analysis of a reduced sample confirms the significance of gum use during treatment in separating all three groups.

This pattern of results, showing that both treatment failures and long-term gum users were heavier and more dependent smokers than gum-free successes, while long-term gum users dif-

ferred from treatment failures in using more gum, seems to suggest that what stood between treatment failures and gum-free success was cigarette dependence, while use of nicotine chewing gum was instrumental in separating treatment failures from long-term gum users. However, given the descriptive correlational nature of the data, this explanation should be regarded as speculative.

Finding that gum use is related to pretreatment smoke intake and dependence is in accord with the results of our previous study,<sup>4</sup> which showed that smokers with higher carbon monoxide levels and a higher Smoking Motivation Questionnaire dependence score report most benefit from the gum, and with other studies.<sup>2,3,5</sup>

The pretreatment rate of smoking seemed to play an important role in determining not only gum use during treatment but also its consumption by long-term gum users one year later. The amount of gum used at one year was also inversely related to group attendance. It is possible that subjects relying more on psychological elements of group treatment needed less gum and vice versa.

Long-term gum users gained significantly less weight (over 2 kg less) than gum-free successes, though being heavier smokers they could have been expected to gain more.<sup>12,22</sup> It is likely that this was due to the continuing nicotine intake,<sup>23</sup> but it could also be because the activity of chewing suppressed appetite and/or prevented them from having more frequent snacks. The amount used at one year did not correlate with weight gain.

At one year, most long-term gum users were using only a few pieces of gum a day. This could provide only a fraction of the nicotine these smokers had been used to getting from their cigarettes.<sup>24,25</sup> It may have been enough to avert withdrawal and thus be sufficiently reinforcing to maintain the gum-using behavior for the whole year, but it is also possible that other nonnicotine effects of gum use could keep the habit alive. It is intriguing that quantity of gum use at one year was only weakly related to gum use during treatment. The phenomenon of long-term use of small amounts of nicotine chewing gum de-

serves further study.

Gum-free successes who did not become long-term gum users used the gum for an average of 3.5 months. Although the time of gum use for the whole sample of treatment successes was significantly longer, recommending three months of gum use seems to be a reasonable strategy.

What should a physician who is considering prescribing the gum but is worried about the risks of its long-term use make of the results of our study? Although there is a chance that a heavy smoker who manages to quit with the help of the gum will go on using it beyond one year, in our opinion recommending the gum remains well justified. Given to dependent smokers it cannot create dependence on nicotine, only transfer it to a different source. At least some of the disadvantages of not being able to stop using nicotine completely are balanced by the lessening of weight gain. More importantly, the similarities between long-term gum users and treatment failures in variables related to gum-free abstinence could be seen as suggesting that without the gum many long-term gum users would be likely to continue to smoke; as the gum does not contain tar, carbon monoxide, or other harmful components of tobacco smoke and does not pollute the air, chewing it is preferable to smoking. There is no doubt, though, that ways of helping long-term gum users quit without relapsing to smoking should be explored.

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