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## Original Article

## The Influence of Excessive Chewing Gum Use on Headache Frequency and Severity Among Adolescents

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## ABSTRACT

**BACKGROUND:** Excessive gum-chewing is underreported as a headache precipitant in children and adolescents. We evaluated the influence of daily excessive gum-chewing in older children and teenagers with chronic headache, emphasizing the impact of habit discontinuation and its reintroduction. **METHODS:** Patients with chronic headache and excessive gum-chewing were consecutively recruited and asked to fill questionnaire pertaining headache characteristics, potential triggers, family history of headaches, and gum-chewing habits. These individuals were classified into four groups depending on the number of daily hours of gum-chewing. All children discontinued chewing for 1 month, reintroduced the habit, and were reinterviewed after 2 to 4 weeks. **RESULTS:** Thirty patients (25 girls) were recruited. Median age was 16 years. Most had migraine-like headaches. Following gum-chewing discontinuation, 26 reported significant improvement, including headache resolution in 19. All 20 patients reintroducing the habit reported symptom relapse within days. Duration of headache before discontinuation and the number of daily hours of chewing had no influence on the response to habit discontinuation. **CONCLUSION:** Excessive daily gum-chewing may be associated with chronic headache and should get more attention in the medical literature. Physician and patient awareness of this association could have a meaningful impact on the quality of life of children and adolescents with chronic headache who chew gum excessively.

**Keywords:** chewing gum, headache, trigger, children, adolescents, temporomandibular joint

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### Introduction

Chronic or recurrent headache is common in children. Its prevalence before the age of 12 years is about 2.5% for both sexes, rising thereafter to up to 10%, with female preponderance.<sup>1</sup> However, up to 40% of school-age children complain of sporadic headaches, and about 75% will have experienced a significant headache by 15 years of age.<sup>2</sup> Recently, a survey among 60 high-school students revealed that 84% had recurrent headache and that females were most affected.<sup>3</sup>

Migraine and tension type headache are the most common type of headache in childhood and adolescence.<sup>3,4</sup> Many triggers that precipitate headache attacks have been recognized, affecting individual patients differently. Most reports refer to migraine headaches rather than to tension type headaches.<sup>5</sup> The most common precipitating factors in children and teenagers with migraine are: stress, tiredness, lack of sleep, high environmental temperature, video games, noise, sunlight, smoking, missing meals, and menstruation.<sup>3,6,7</sup>

Clinical experience of the corresponding author (N.W.) suggested that daily, excessive chewing gum use, particularly among adolescents, may represent an important yet underrecognized trigger for headache. Very little has been reported in the literature on gum-chewing as a potential trigger: one report pertains a single case attributed to excessive gum-chewing,<sup>8</sup> whereas another study described three adults whose headaches were considered to be

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associated with the sweetener aspartame present in the gum.<sup>9</sup>

The aim of this study was to assess the impact of excessive gum-chewing on headache occurrence among children and adolescents, especially the effect of discontinuing the habit on the prevalence of the symptom.

## Methods

This study was approved by Meir Medical Center's Internal Review Board. Patients referred for neurological evaluation between September 2010 and July 2011 complaining of recurrent/chronic headache were consecutively recruited from Meir Medical Center's headache clinic and from community clinics where the authors served as consultants (N.W., M.H., M.M.). On routine interview, all referred children were asked about chewing gum habits and patients with a positive history were given a questionnaire on the habit. Patients/caregivers reporting excessive daily gum-chewing were asked to fill a questionnaire on their habit and the characteristics of their headache.

Besides demographic data, the questionnaire included information on previous medical and neurological history, baseline headache characteristics, family history of headaches, previous diagnostic workup, and potential (known) triggers. Regarding gum-chewing, the children were divided into four groups, based on the Gavish et al. study on the influence of oral habits on temporomandibular disorders in teenagers.<sup>10</sup> This study suggested that regarding daily gum chewing the daily duration of the habit was significant, with more temporomandibular symptoms and findings detected in teenagers with more than 3 hours of gum-chewing a day. By classifying our patients into four subgroups according to gum-chewing duration, we attempted to determine whether a minimum habit duration was necessary to provoke the headaches.

- Group 1: Up to 1 hour of gum-chewing a day.
- Group 2: 1-3 hours of gum-chewing/day.
- Group 3: 3-6 hours of gum-chewing/day.
- Group 4: More than 6 hours/day.

After filling the questionnaire, patients were asked to stop gum-chewing for 1 month. No other therapeutic intervention for their headaches was offered at this time. At the end of the month, children and their parents were interviewed personally or by phone by the second author (M.M.). At this stage, patients were asked to renew their gum-chewing habit exactly as it was before discontinuation. A second interview was carried 2-4 weeks later.

Headaches were classified according to the 2004 classification established by the International Headache Society.<sup>11</sup>

Patients were asked to evaluate the impact of discontinuing gum-chewing on their headache as: no change in headache frequency/intensity, partial improvement, and total disappearance of symptoms. Following reintroduction of gum-chewing, they were asked whether symptoms recurred, and, if so, the time interval in days between reintroduction of the trigger and reappearance of headache. The intensity of the recurrent headache was also compared by patients to the pre-discontinuation headache.

Fisher's exact test was used to analyze the data.

## Results

During the 12 months of the study, 183 children and adolescents were seen in our clinic for headache complaints. Of these, 30 children and adolescents (25 girls) who described recurrent episodes or chronic headache and reported daily gum chewing were consecutively recruited. All 30 patients agreed to participate in the study. Their ages ranged from 6 to 19 years (mean 12.8 years, median 16 years). Headache characteristics were migrainous in 60% and tension-type in 40%. Patients had been symptomatic for

4 months to 4 years. The main characteristics of the 30 children are depicted in Table.

All patients reported gum-chewing for a minimum of 1 hour per day. They were included in the four groups as follows.

- Group 1: six children; all (100%) reported partial or total improvement
- Group 2: 11 children; 10 (91%) reported partial or total improvement
- Group 3: eight children; six (75%) reported partial or total improvement
- Group 4: five children; four (80%) reported partial or total improvement

There was no significant difference among the four groups. Family history of migraine was present in 16 patients (53%). Six patients underwent either head computed tomography or brain magnetic resonance imaging. All studies were normal. All patients underwent funduscopic examination. None of the patients exhibited optic disc edema.

Following the discontinuation of gum-chewing, 19 of the 30 patients reported complete resolution of headaches and seven described some improvement in headache frequency and intensity. No improvement occurred in four patients. The duration of symptoms (headache) before stopping gum-chewing did not play a role in the clinical response because some children who reported full or significant improvement had suffered from chronic headache for up to 6 years. An analysis of the four patients that did not improve and of the five male patients revealed no common features that would make these patients stand out from the other patients.

Twenty of the 26 patients who reported either complete or partial headache relief reintroduced gum-chewing in the same manner as before the discontinuation (ie, each patient according to the group he/she belonged). All 20 children

**TABLE.**  
Characteristics of the 30 patients

Gender	25 girls 5 boys
Age	6-19 yr Mean 12.8 Median 16
Headache type	Migraine 18 (60%) Tension-type 12 (40%)
Family history of migraine	Present in 16 (53%)
Gum-chewing habits (n)	Up to 1 hr/day: 6 1-3 hr/day: 11 3-6 hr/day: 8 >6 hr/day: 5
Response to gum-chewing discontinuation	Complete resolution: 19 Partial improvement: 7 No effect: 4
Symptoms upon reintroduction of habit (n = 20)	Reappearance of headache: 20
Associated symptoms	Temporomandibular joint-related: 10

were interviewed within 2 weeks of having reintroduced gum-chewing and all reported relapse of the headache within days to a week of similar intensity to that before discontinuing gum-chewing. A chart review 2 years later showed that none of the 26 patients had returned for headache complaints since the study was conducted.

Among the 30 patients in this study, 10 also reported chronic symptoms related to the temporomandibular joint, namely temple and oral pain. These symptoms were not related to the headaches and also improved upon gum-chewing discontinuation.

## Discussion

This prospective study evaluated the role of excessive gum-chewing as a trigger of headaches in older children and adolescents. Of 30 patients, 19 reported complete symptom resolution upon habit discontinuation and seven reported partial improvement. Reintroduction of the habit in 20 of the 26 children who improved was followed within days by relapse of headaches, with intensity similar to that experienced before gum-chewing discontinuation.

Headache precipitants (triggers), although present both in migraine and tension-type headache, have mostly been reported in association with the former<sup>5</sup> and appear to be more frequent in migraneurs.<sup>12</sup> Among 120 adult patients, including both migraine and tension-type headache patients from a headache referral center and community clinics, the most common trigger factors experienced by the patients were weather, stress, menstruation, and relaxation after stress. Of note, triggers occurred occasionally and not consistently.<sup>13</sup> A larger population survey of 720 patients with both headache types detected similar precipitating factors, although frequent travelling was an important trigger. Moreover, physical activity was frequently recognized among tension-type headache patients.<sup>12</sup> The largest study on migraine triggers was published by Kelman on 1200 patients, of whom 75.9% reported triggers (rather infrequently). Stress was most common, followed by hormones in women, not eating, weather, sleep disturbance, perfume or odor, neck pain, light(s), alcohol, smoke, sleeping late, heat, food, exercise, and sexual activity. Of interest, triggers were more likely to be associated with a more florid acute migraine attack.<sup>14</sup>

In children, migraine precipitants are essentially similar to those observed in adults, although some differences exist. Video games are often reported<sup>6</sup> as well as environmental noise, exposure to smoke, and school book reading.<sup>7</sup> Specific foods and drinks, particularly chocolate, alcoholic drinks, and cheese are often associated not only with migraine but with tension-type headache as well.<sup>15</sup> Nevertheless, some controlled studies such as the one by Marcus et al. on chocolate as a trigger of migraine showed no correlation between purported triggers and headache attacks.<sup>16</sup>

Gum-chewing as a trigger of headaches has rarely been reported. As mentioned previously, a literature search uncovered only two reports: one case was attributed to excessive gum-chewing<sup>8</sup> exerting mechanical burden on the temporomandibular joints, whereas another study described three adults whose headaches were considered to be associated aspartame present in the gum.<sup>9</sup> Aspartame, an artificial sweetener, has been the subject of conflicting results

regarding its role as a precipitant headache factor. Some studies<sup>17,18</sup> support its role as a trigger of headaches, whereas other reports found no association between the sweetener and headaches.<sup>19</sup> We feel that temporomandibular joint overuse was the mechanism behind headaches in our patients. Because aspartame is present in many popular dietary products such as soft drinks, and low-calorie soft beverage consumption is quite prevalent, an association between headaches and soft drinks would probably be well recognized by the general population, but this does not appear to be the case. If present at all, this association would probably be related to caffeine present in the soft drink rather than to the drink's sweetener.<sup>20</sup> It seems that the amount of aspartame released while chewing gum is probably low because the gum becomes tasteless within minutes. Therefore, at least for patients who chew gum for longer periods, the exposure to aspartame is relatively brief compared with the duration of temporomandibular joint activity while chewing. Hence, the burden posed on the temporomandibular joint during hours of continued chewing is high.<sup>10</sup>

Interestingly, popular reports and articles do associate gum-chewing with headaches: in internet search engines such as Google, many citations, letters, questions, and comments can be found on this association.<sup>21</sup>

The mechanisms through which headache precipitants act are yet to be elucidated. Nevertheless, several hypotheses have been proposed. As in most cases, the latency between trigger exposure and headache onset is quite short; a neural mechanism is probably responsible. Triggers may produce excitation of the cerebral cortex that in turn causes withdrawal of descending sensory inhibition originating in the brainstem (trigeminovascular sensation) thus precipitating the headache. Neurotransmitters such as 5-hydroxytryptamine appear to be involved.<sup>22</sup> Indeed, the existence of a hypothetical "gate" at the trigeminal nuclear complex level where incoming trigeminal migraine pain impulses would "compete" with descending inhibitory signals from brain stem pain modulatory neurons has also been postulated. This hypothetical gate at the trigeminal nuclear complex level is controlled by activity of 5-hydroxytryptamine receptors, hinting at an additional site of action of triptans in aborting acute migraine pain.<sup>23</sup> These hypotheses do not address the mechanism of action of headache precipitants in tension-type headache.

For our study, we hypothesized that excessive gum chewing may act as a trigger for temporomandibular joint-related headache. Headache has been shown to be associated with and be provoked by temporomandibular joint dysfunction.<sup>24–26</sup> Oral habits are common among teenagers. In Israel, these habits include excessive gum-chewing, nail biting, object biting, leaning the chin on one's hand, ice crushing, and teeth grinding, and impose a mechanical burden on the temporomandibular joint. In particular, chin leaning, chewing gum for more than 3 hours daily, and teeth grinding show a statistically significant association with temporomandibular joint symptomatology.<sup>27</sup> As mentioned in the Methods section, previous reports suggested that temporomandibular joint-related symptoms and findings may be more frequent among patients who chew gum for more than 3 hours a day. Although it seems that mechanical burden on the temporomandibular joint was the headache trigger in our patients, the duration of daily gum-chewing did not appear to be as important as the

habit itself because all four groups included a fair amount of cases. This raises the question of whether other factors (such as aspartame, emotional stress, or individual facial anatomic features) may have played a role in our patients' headaches. However, the impressive response to gum-chewing discontinuation strongly suggests, in our opinion, that the habit (and the burden on the temporomandibular joint) played a major role in our patients.

A potential bias caused by the fact that patients were made fully aware by the investigators on the possible association between gum-chewing and their headache cannot be ruled out. Nevertheless, the majority of patients reported total or marked improvement upon elimination of the trigger, which may not be the result of self-suggestion. One of the authors (N.W.) has been implementing this technique for several years with very good results (unpublished data). Former patients have also reported improvement upon gum-chewing discontinuation and relapse of symptoms following habit reintroduction. Because those children were not subjects of a study, the likelihood of their being influenced by the physician seems low.

Despite the simplicity of this study and the relatively small number of participants, we feel that our findings emphasize the importance of daily life habits in the pathogenesis of headache in some patients. Moreover, this study suggests that habit-changing without pharmacological intervention may lead to major symptomatic improvement in a significant number of youngsters with excessive gum-chewing.

In summary, in our population of 30 older children and adolescents with chronic headaches and excessive gum-chewing, discontinuation of the habit led to headache resolution in 19 patients and to partial improvement in seven patients. Moreover, restitution of the gum-chewing habit in 20 of the 30 patients was followed by reappearance of the usual headaches in all. The association between excessive daily gum-chewing and headaches in older children and adolescents is underreported in the medical literature, although conventional wisdom may have recognized this association for quite a while. In our opinion, this habit provokes headaches by imposing mechanical burden on the temporomandibular joint rather than through the sweetener aspartame, whose association with recurrent headaches has not been definitely established. Further, longer-term, large-scale studies are necessary to corroborate the apparent association between excessive daily gum-chewing and chronic headache among older children and adolescents. These studies would also determine whether mechanical burden on the temporomandibular joint is the pathophysiological mechanism of headache in these cases or whether a different mechanism such as the sweetener aspartame (present in many commercial gums) may be responsible for the association between gum-chewing and headache.

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