

# Patterns of Dental Care Utilization Among Patients with Temporomandibular Disorders

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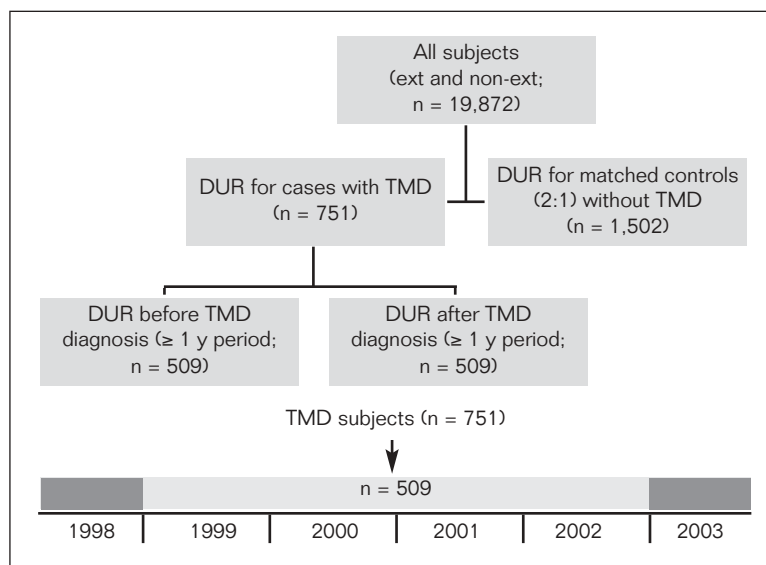
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***Aims:** To use data from a large health maintenance organization to specifically investigate dental utilization rates among patients with and without temporomandibular disorders (TMD). **Methods:** Subjects were enrolled in Kaiser Permanente Northwest between 1998 and 2003. Two age- and gender-matched controls were selected for each subject who had a TMD diagnosis during the study period. Dental treatment was categorized using Current Dental Terminology (CDT) codes. Overall dental utilization rates were calculated, as well as rates based on age, gender, categories of treatment, and periods before and after TMD diagnoses. These rates were analyzed with t tests. **Results:** TMD subjects utilized significantly more dental services than comparison subjects overall and for several dental categories. The difference was between 10% to 20%, or about 1 additional dental procedure per year. A positive linear relationship existed between dental utilization rates and age, with a significant increase in utilization for each ascending age cohort. Females had higher dental utilization rates than males in TMD and non-TMD groups and in all categories of dentistry. After a TMD diagnosis, major differences in utilization were not found when compared to patterns of treatment prior to the diagnosis. **Conclusion:** TMD subjects utilized 10% to 20% more dental services than non-TMD subjects. Gender and age were important factors with increased utilization in females and older patients. TMD diagnoses did not affect dental utilization patterns, indicating that most TMD patients continue to seek routine dental care. J OROFAC PAIN 2008;22:108-114*

**Key words:** age groups, dental care, dental insurance, dental utilization, temporomandibular disorders

**T**emporomandibular disorders (TMD) is a collective term that embraces a number of clinical conditions involving the masticatory musculature and/or the temporomandibular joint (TMJ) and associated structures.<sup>1,2</sup> Cross-sectional studies have shown 45% to 75% of adults have at least 1 sign of TMD, such as movement abnormalities or joint sounds, and 33% describe at least 1 symptom during their life span, usually manifested by pain.<sup>3-5</sup> However, less than 5% of the population with signs and symptoms of TMD seek or need treatment,<sup>3,6</sup> and the gender distribution of those seeking care is disproportionately female (5:1 or higher).<sup>7</sup> TMD is 1.5 to 2 times more common in women than in men, and the prevalence of TMD pain is highest in women of child-bearing years (ages 25 to 44). It decreases to about 4% for women age 65 and older, with an even lower prevalence for men.<sup>8,9</sup>

**Fig 1** Schematic diagram illustrating the selection of subjects for the calculation of dental utilization rates for TMD and non-TMD patients. Five hundred nine subjects were identified for the analysis of dental utilization rates before and after an initial TMD-related diagnosis. DUR = dental utilization rate; ext = extraction.



Studies investigating the frequency and cost of medical and dental services received by TMD patients are scarce. Results suggest that TMD patients utilize significantly more health-care services and have higher associated costs than non-TMD subjects.<sup>10–12</sup> These studies estimate that TMD subjects utilize 1.5 to 3 times as much overall health care and dental services as non-TMD subjects.

To add to our understanding of dental care services utilized by TMD subjects, the purpose of the present study was to use data from a large health maintenance organization to investigate dental utilization rates among patients with and without TMD. Dental utilization rates over a 6-year period (1998 to 2003) were examined by age group, gender, and different categories of dental procedures. In addition, dental utilization rates for TMD patients were compared before and after an initial TMD-related diagnosis to see whether TMD symptoms affected subsequent patterns of dental utilization.

## Materials and Methods

### Subjects

The sample was selected from 19,872 Kaiser Permanente Northwest enrollees who had continuous dental enrollment from January 1, 1998 to December 31, 2003 (Fig 1). These subjects were originally selected for a project investigating third molar removal and consisted of 4,968 subjects who had at least 1 third molar removed during the study period, along with 14,904 age- and gender-matched subjects who did not have a history of third molar removal during the same period (1:3

match). From this entire sample of 19,872 individuals, 751 TMD cases were identified using International Classification of Disease 9th edition codes (ICD-9-CM diagnoses 524.60 to 524.69, Table 1).<sup>13</sup> Two control subjects who did not have TMD diagnoses were selected for each of the cases, matched with respect to age, gender, and third molar extraction status. Dental utilization rates were then compared among the TMD cases and controls. Dental utilization rates, defined as the average number of dental procedures per patient, per year, were obtained from Kaiser Permanente Northwest's electronic database. Utilization rates were calculated for different categories of dental care and overall care for each decade of life and by gender.

Dental utilization rates were also investigated for TMD patients before and after their initial TMD diagnosis. For this investigation, a minimum of 1 year of insurance coverage both before and after the TMD-related diagnosis was required for inclusion. As shown in Fig 1, 509 TMD subjects were identified for the analysis of dental utilization rates before and after an initial TMD-related diagnosis.

### Dental Utilization Categories

Utilization rates for different dental procedures were analyzed using the American Dental Association's Current Dental Terminology procedural codes (CDT-3/2000).<sup>14</sup> The following categories of dental care were examined: diagnostic, preventive, restorative, endodontics, periodontics, removable prosthodontics, fixed prosthodontics, oral and maxillofacial surgery, orthodontics, and adjunctive general services. All procedures related

**Table 1** Diagnosis Codes Used to Identify TMD Subjects

Description	ICD-9-CM Code	No. of subjects
TMJ disorders, unspecified and TMJ pain dysfunction syndrome	524.60	345
Adhesions and ankylosis (bony or fibrous)	524.61	1
Arthralgia of TMJ	524.62	274
Articular disc disorder (reducing or nonreducing)	524.63	79
Other specified TMJ disorders	524.69	52

ICD-9-CM = International Classification of Diseases, 9th revision, Clinical Modification.

**Table 2** Age and Gender Distribution of TMD Subjects

Age range (y)	Male		Female		All subjects	
	n	%	n	%	n	%
10–19	52	21	107	21	159	21
20–29	58	24	158	31	216	29
30–39	50	21	108	21	158	21
40–49	39	16	84	17	123	16
50–59	29	12	40	8	69	9
60+	14	6	12	2	26	3
Total	242		509		751	

The total percentages do not add to 100% due to rounding in this and other tables.

to TMD treatment (categorized under oral and maxillofacial) were excluded so that overall dental utilization rates for TMD subjects would not be artificially inflated.

### Statistical Analysis

The dental utilization rates between case and control groups for the various parameters (age, gender, and dental category) were compared with *t* tests using SAS Version 9.1 (SAS Institute).<sup>15</sup> The Wald statistic was used to test for a difference in dental utilization before and after an initial TMD diagnosis to account for the correlated data. Values of  $P < .05$  were considered significant.

## Results

### Age and Gender Distribution

TMD subjects had a mean age of 31.5 years, and 68% were female. TMD subjects were age- and gender-matched with non-TMD subjects; the controls had identical distributions with twice as many subjects. As shown in Table 2, the percent distribution of all subjects remained relatively consistent in the first 4 age cohorts (16% to 29%), and then declined to 3% for subjects over the age of 60. The percent distribution of males and females was also consistent among age cohorts.

### Dental Utilization for CDT Categories

Mean dental utilization rates for different categories of dentistry are shown in Table 3. Overall, TMD subjects had about 6.7 dental visits per year versus 5.9 in the comparison group, a difference of approximately 0.75 procedures per year ( $P < .001$ ). Dental utilization rates for TMD subjects were significantly higher for diagnostic, preventive, restorative, and adjunctive general services, and oral and maxillofacial surgery were higher for non-TMD subjects. For both the case and control groups, the highest dental utilization rates were associated with diagnostic procedures followed by preventive and restorative services.

### Dental Utilization by Age

Mean dental utilization rates for all dental services combined by age cohort are shown in Table 4. Differences between the 2 groups, with higher dental utilization rates for TMD subjects, were significant in age cohorts 20 to 29, 40 to 49, 50 to 59, and overall. For all subjects combined, dental utilization rates were greatest past the age of 50, with 7.6 to 7.8 procedures per year. For both TMD and non-TMD subjects, a significant positive linear relationship existed between dental utilization rate and age in all but the youngest age cohort (10 to 19 years).

**Table 3 Dental Utilization Rates (Mean Number of Procedures Per Year) by CDT Category for TMD and non-TMD Subjects, 1998 to 2003**

	DUR for TMD (n = 751)	% total procedures	DUR for non-TMD (n = 1,502)	% total procedures	P	Ratio TMD to non-TMD
Diagnostic	2.42	36.3	2.03	34.4	***	1.2
Preventive	1.95	29.2	1.77	30.0	*	1.1
Restorative	0.91	13.7	0.81	13.7	*	1.1
Endodontics	0.09	1.4	0.08	1.4	NS	1.1
Periodontics	0.29	4.3	0.25	4.3	NS	1.1
Prosthodontics— removable	0.12	1.9	0.13	2.2	NS	0.9
Prosthodontics— fixed	0.03	0.4	0.02	0.4	NS	1.3
Oral and maxillo- facial surgery	0.20	3.0	0.25	4.2	*	0.8
Orthodontics	0.23	3.5	0.23	3.9	NS	1.0
Adjunctive general services	0.42	6.3	0.32	5.5	***	1.3
Total sample	6.66		5.90		***	1.1

DUR = dental utilization rate. NS = not significant; \* $P < .05$ ; \*\*\*  $P < .001$  (t test).

**Table 4 Dental Utilization Rates (Mean Number of Procedures Per Year) by Age for TMD and non-TMD Subjects, 1998 to 2003**

Age range	DUR for TMD (n = 751)	DUR for non-TMD (n = 1,502)	DUR for all subjects (n = 2,253)	P	Ratio TMD to non-TMD
10–19	6.57	6.72	6.67	NS	1.0
20–29	5.43	4.78	5.00	*	1.1
30–39	6.35	5.56	5.82	NS	1.1
40–49	7.54	6.29	6.71	*	1.2
50–59	9.11	7.18	7.83	**	1.3
60+	8.56	7.05	7.56	NS	1.2
Total sample	6.66	5.90	6.15	***	1.1

DUR = dental utilization rate; NS = not significant; \* $P < .05$ ; \*\* $P < .01$ ; \*\*\* $P < .001$  (t test).

### Dental Utilization by Gender

Dental utilization rates for all dental procedures combined by gender are shown in Table 5. Females had higher dental utilization rates than their male counterparts in both groups. Significantly greater utilization in the TMD group was observed with female subjects, male subjects, and overall.

Table 6 shows dental utilization rates by gender (case and comparison groups combined) for each CDT category. Overall, female subjects had a significantly higher dental utilization rate, with approximately 6.4 procedures per year versus 5.7 procedures for male subjects. Significant differences were found in several categories. Female subjects had a higher dental utilization rate than male subjects in all categories where a significant difference existed, with the exception of periodontics.

### TMD Subjects Before and After Initial Diagnosis

Table 7 shows dental utilization rates for TMD subjects before and after their initial TMD-related diagnosis. During the 6-year study period, a mean of 2.9 years had elapsed before and 3.1 years after the initial TMD-related diagnosis. A small but statistically significant increase in dental utilization rate after the initial diagnosis was found for all procedures combined, but increases in dental utilization rates were significant only for preventive and endodontic services.

### Discussion

Overall, results show a modestly elevated increase in dental utilization among TMD subjects, a finding

**Table 5 Overall Dental Utilization Rates by Gender for TMD and non-TMD Subjects**

	TMD group (n = 751)				Non-TMD group (n = 1,502)				P
	No. of subjects	No. of procedures	% Total	DUR	No. of subjects	No. of procedures	% Total	DUR	
Male	242	8,998	30	6.20	484	15,802	30	5.44	***
Female	509	21,012	70	6.88	1,018	37,388	70	6.12	*
Total	751	30,010	100	6.66	1,502	53,190	100	5.90	***

DUR = dental utilization rate; NS = not significant; \* $P < .05$ ; \*\*\* $P < .001$  ( $t$  test).

**Table 6 Dental Utilization Rates (Mean Number of Procedures per Year) by Gender and CDT Category for All Subjects, 1998 to 2003**

CDT category	Dental utilization rate		P	Male-female ratio
	Males (n = 726)	Females (n = 1,527)		
Diagnostic	2.00	2.24	***	0.9
Preventive	1.66	1.91	***	0.9
Restorative	0.81	0.86	NS	0.9
Endodontics	0.07	0.09	*	0.7
Periodontics	0.33	0.23	**	1.4
Prosthodontics, removable	0.13	0.13	NS	1.0
Prosthodontics, fixed	0.02	0.03	NS	0.9
Oral and maxillofacial surgery	0.24	0.23	NS	1.1
Orthodontics	0.14	0.27	**	0.5
Adjunctive general services	0.30	0.38	***	0.8
Total	5.69	6.37	***	0.9

NS = not significant; \* $P < .05$ ; \*\* $P < .01$ ; \*\*\* $P < .001$  ( $t$  test).

**Table 7 Dental Utilization Rates (Mean Number of Procedures) for TMD Subjects Before and After Initial TMD Diagnosis, 1999 to 2002<sup>†</sup>**

CDT category	Dental utilization rate		P	Before-after ratio
	Before TMD diagnosis	After TMD diagnosis		
Diagnostic	2.43	2.37	NS	1.0
Preventive	1.78	2.06	**	0.9
Restorative	0.87	0.94	NS	0.9
Endodontics	0.08	0.11	*	0.7
Periodontics	0.24	0.33	NS	0.7
Prosthodontics, removable	0.11	0.14	NS	0.8
Prosthodontics, fixed	0.02	0.03	NS	0.9
Oral and maxillofacial surgery	0.21	0.18	NS	1.1
Orthodontics	0.28	0.14	*	2.0
Adjunctive general services	0.41	0.40	NS	1.0
Total	6.43	6.68	**	1.0

NS = not significant; \* $P < .05$ ; \*\* $P < .01$  (Wald test).

<sup>†</sup>Subjects who received a TMD diagnosis during the first year of the study period (1998) or the last year (2003) were excluded.

consistent with several investigations.<sup>10-12</sup> Relative to previous reports, this study investigated a broader scope of dental treatment and age ranges and analyzed utilization patterns by age, gender, and categories of dental treatment during a 6-year period as well as before and after a TMD diagnosis.

### Age and Gender Demographics

Subjects in this study had a mean age of 31.5 years, and 68% were female, findings that differ slightly from those of White et al, who also used Kaiser Permanente Northwest records over an ear-

lier 6-year interval and reported a mean age of 40.5 years in a cohort that was 80% female.<sup>12</sup> This difference may in part reflect a limitation of the present study, ie, the TMD subjects were selected from a sample that was initially based on exposure status to third molar extractions rather than being randomly drawn from all possible Kaiser Permanente Northwest enrollees. Despite this limitation, the present findings are consistent with other TMD studies, ie, the prevalence of TMD was greatest in young females and diminished appreciably when the subjects reached the age of 65.<sup>8,9,16,17</sup>

A general limitation for research that uses an insurance database relates to inherent limitations on the reliability of claims data versus direct observation of treatment or chart verification. A prior Kaiser Permanente Northwest study demonstrated excellent agreement between the electronic data in their databases and the actual procedures documented in patient charts (0.5% disagreement).<sup>18</sup> In addition, any misclassification of TMD patients as controls would likely narrow the differences in mean utilization rates between the 2 groups. Thus, the difference in utilization rates found in the present study may be a conservative estimate. In the present study, TMD procedural codes were excluded to prevent inflated utilization rates for the TMD subjects.

### Dental Utilization for CDT Categories

In both the TMD and non-TMD groups, dental utilization rates were dominated by diagnostic and preventive services (approximately 65% combined) and restorative services (approximately 14%), findings very similar to those of the TMD study by White et al<sup>12</sup> in which about 60% of the services were diagnostic or preventive and about 15% were restorative procedures. Similarly, Del Aguila and associates,<sup>19</sup> reporting from a random patient population unrelated to TMD status, found that diagnostic and preventive procedures accounted for 66% of all dental services and that approximately 17% of services were related to restorative treatment.

The present study showed the overall dental utilization rate to be 12% higher for TMD subjects than for non-TMD subjects. Case subjects had an overall dental utilization rate of approximately 6.7 procedures per year, versus 5.9 procedures for comparison subjects, or approximately 1 additional dental procedure per year. The increased utilization in the present study for TMD subjects (1.1 to 1.3 times higher across all dental cate-

gories) is markedly less than that reported from studies of overall health-care utilization rates, where utilization rates were found to be 2 to 3 times higher.<sup>10,11</sup> White et al<sup>12</sup> found that patients with TMD had significantly more dental visits (7.5 versus 5.3) and dental procedures (23.1 versus 17.2) during the 6-year study period than patients without TMD, which also equated to approximately 1 additional dental procedure per year (3.8 versus 2.9).

### Dental Utilization by Age

A significant positive linear relationship was found between overall dental utilization and increasing age following adolescence, with the highest utilization rates occurring over the age of 50. When TMD and non-TMD subjects were compared, dental utilization rates were greater in TMD subjects across all age cohorts, except the youngest age cohort, in which utilization rates were about the same. These results resemble those of Del Aguila et al,<sup>19</sup> who found a distinct bimodal pattern in Washington Dental Service patients, with patient distribution peaking for all dental services at ages 6 to 12 and then from ages 45 to 54.

### Dental Utilization by Gender

The present finding that females utilize health-care services more than their male counterparts is consistent with findings in other reports.<sup>12,17</sup> There are many theories as to why women are more likely to report or seek treatment for pain. Studies on gender and pain perception suggest this may be due to male-female differences in the endocrine and neuroimmune systems.<sup>2,16</sup> LeResche et al<sup>20</sup> examined the possible relationship between postmenopausal hormone replacements and temporomandibular pain and found that the odds of seeking treatment for TMD were approximately 30% higher among those receiving estrogen compared with unexposed individuals. A clear dose-response relationship was evident and suggested that decreasing hormonal levels in postmenopausal women may be a factor contributing to a lower prevalence of TMD in women over the age of 65. The influence of hormonal states on pain modulation was also demonstrated by Dao et al,<sup>21</sup> who found that myofascial pain was reduced in women of child-bearing ages who used oral contraceptives, which minimize hormonal fluctuations. Differing social rules for the expression of pain have also been proposed to explain an increased prevalence of TMD and greater health-care utilization in women relative to men.<sup>17</sup>



## Timing of TMD Diagnosis

Although overall dental utilization rates were statistically higher after a TMD diagnosis, this increase (0.25 in overall dental utilization rate) is not likely to be of clinical significance. Similar results were reported by Humphrey et al,<sup>22</sup> who concluded that even though a majority of TMD patients reported a change in seeking routine professional care (63%) and stated that dental office appointments were unpleasant because of jaw pain or limited opening (73% versus 5.1% of the control), most TMD patients continued to seek routine dental treatment in spite of their disorder.

In summary, the linked medical and dental records of Kaiser Permanente Northwest provided a unique opportunity to assess the dental utilization profiles of subjects with TMD and yielded insights into their dental care experiences across a wide range of dental services. Results of this study have shown that TMD subjects seek slightly more dental treatment than non-TMD subjects.

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