

# Effect of Prolonged Endodontic Treatment on Temporomandibular Joint and Masticatory Muscles

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## ABSTRACT

**Aims and objectives:** The objective of the study is to assess the outcome of lengthy root canal sessions (more than 2 hours) on temporomandibular joint (TMJ) and its associated structures.

**Materials and methods:** Totally, 250 patients who had undergone root canal treatment that lasted for more than 2 hours were examined for the status of TMJ and masticatory muscles. The second part of the examination was performed after 1 week to check for any pain and tenderness. Data were analyzed using Statistical Package for the Social Sciences (SPSS).

**Results:** Results showed that patients of older age suffered from more pain postoperatively. Similarly, women experienced more pain than males. Those patients who were treated for their posterior teeth complained of more pain than those treated for anterior teeth.

**Conclusion:** Prolonged root canal sessions result in longer and wider opening of mouth for longer period of time, thus causing harm to TMJ and associated masticatory structures and may give rise to sign and symptoms of temporomandibular disorder (TMD).

**Clinical significance:** It is prudent to break treatment sessions into shorter appointments and let patients relax during the treatment to prevent any extra stress on the TMJ and associated masticatory apparatus.

**Keywords:** Lengthy sessions, Long duration, Temporomandibular joint dysfunction.

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## INTRODUCTION

The masticatory structure comprises masticatory muscles, TMJ, and teeth.<sup>1,2</sup> Any functional disturbances that occur to the TMJ will have an effect on the muscles of mastication and *vice versa*; any disturbance that occurs to the muscles of mastication will have an effect on the TMJ.<sup>3</sup>

Temporomandibular disorder is the second most frequent cause of orofacial pain.<sup>4</sup> It is a musculoskeletal disorder within the masticatory system that defines a subgroup of painful orofacial disorders, involving complaint of pain in the TMJ region, dysfunction of the masticatory muscle, restricted mandibular movements, aching craniofacial pain, and the presence of articular clicking.<sup>5-8</sup> The TMD is a prevailing disorder that is most commonly observed in individuals between the ages of 20 and 40 years. Around 33% of the population suffered at least one TMD symptom and 3.6 to 7% of the population suffered from severe TMD symptoms that cause them to seek treatment.<sup>9-11</sup> The TMJ refers to a cluster of conditions characterized by dull aching pain in the jaw joint and surrounding tissue, limited movement or locking of the jaw, pain in jaw muscles, painful clicking, or grating sound in the jaw joint. It may also be associated with chronic headaches, dizziness, and ear pain, and vision problems.<sup>12</sup> The etiology of TMD is complex and multifactorial. Biomechanical, neuromuscular, biopsychosocial, and neurobiological factors may contribute to the disorder.<sup>13</sup> These factors are categorized as predisposing, initiating, and aggravating factors to emphasize on their role in the progression of TMD.<sup>14</sup> History of past dental treatment was found to be a very common finding in people suffering from TMJ disorder. Iatrogenic injuries act as both initiating as well as predisposing factors, and this could occur during any dental procedure in which there is prolonged mouth opening.<sup>15</sup> Endodontic treatment is a common procedure in dentistry. It is a sequence of treatments for the infected pulp of a tooth which results in the elimination of infection and protection of the decontaminated tooth from future microbial invasion.<sup>16</sup> Effective root canal treatment is characterized by an absence of clinical signs and symptoms in teeth without radiographic evidence of involvement of periodontal ligament. No difference exists in the effectiveness of root canal treatment in terms of radiological success. Mostly, short- and long-term complications are also similar in terms of frequency, although patients undergoing a single visit may experience a slightly higher frequency of pain and swelling and may develop signs and symptoms of TMJ disorder.<sup>17</sup> By pursuing this study, it is intended to evaluate the effect of lengthy root canal treatment (more than 1 and a ½ hour) on TMJ and associated masticatory muscles.

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## MATERIALS AND METHODS

The present cross-sectional study was conducted from June 1, 2015, to April 1, 2016, in the Department of Operative Dentistry, Baqai Dental College, Baqai Medical University to evaluate the effect of long-duration root canal treatment on TMJ and associated masticatory muscles. Ethical permission was granted by the Ethical Committee, Baqai Medical University. An informed written consent was also obtained from the participants. A simple random technique was employed and 250 patients, aged 18 to 85 years, were selected. The sample size was calculated by taking the prevalence rate and computed using the Epi Info Version 6 statistical package at 95% confidence interval and  $\alpha = 5\%$ .

Subject selection was based on the following inclusion criteria: Good periodontal health, the absence of active caries and any over hanged fillings, good occlusion, and no history of orthodontic treatment. Patients aged between 18 and 85 years with a history of systematic, musculoskeletal, neurological disorder, parafunctional habit (bruxism and clenching), and facial trauma were excluded from the study.

Two trained examiners were designated by the head of Operative Department to carry out the examination procedure. The examination consisted of two parts preoperative and postoperative. In the preexamination part, a demographic form was filled containing the patient's name, age, gender, and tooth number to be treated. Preoperative examination of the TMJ and masticatory muscles was carried out for each patient. These examinations consisted of palpating the masticatory and cervical muscles and search for areas of tenderness. Masticatory muscles (temporalis, masseter, medial pterygoid, and lateral pterygoid) were palpated bimanually. The TMJ was auscultated during mandibular motion. Any crepitus, grinding, clicking, or popping sound was noted. The degree of mandibular opening was also measured using the distance between the incisal edges of the upper and lower anterior teeth. The minimal normal mouth opening is 40 mm, 7 mm for lateral movements and 6 mm for protrusive movements. Reframed<sup>9</sup> opening of <30 mm is considered abnormal in adults. Endodontic treatment was performed by the house surgeons who were posted in the Department of Operative Dentistry. Root canal treatment was completed in 2 to 3 visits for anterior and posterior teeth with 1 to 2 hours of mouth opening. Reframed, the postoperative examination was carried out after 1 week of the root canal treatment so that the pain can be masked by any other type of pain. The same steps of preoperative examinations were repeated, and any pain, tenderness, spasm of masticatory muscles was noted along with any clicking sound. Maximum jaw opening was recorded

again to detect limitation of mouth opening after root canal therapy.

After collection of all the forms, the data were evaluated and analyzed for frequency and percentages. Chi-squared test was performed to assess the association of TMD with gender using SPSS software version 22; p-value was set at 0.05.

## RESULTS

The present study analysis showed that women suffered from more pain postoperatively as compared with men (Table 1). The TMJ examination showed that 6 (17.6%) of the male patients complained of painful clicking sound (Table 2). Totally, 13 (43.3%) of the female patients complained of pain and tenderness in masticatory muscles (Table 3). Limited mouth opening was reported by 11 (38%) female patients (Table 4). The results showed that pain was reported more frequently in patients who were treated for their posterior teeth than those who were treated for their anterior teeth. Patients above the age of 50 experienced more pain as compared with those who were young (<50) (Table 5).

## DISCUSSION

Root canal treatment, especially for multirouted teeth performed by an untrained house surgeon, is usually a lengthy and prolonged treatment.<sup>18</sup> The present study results showed that when root canal was done by an untrained house surgeon, resulting in prolonged treatment and mouth opening, it causes more trauma to the TMJ and associated masticatory structures and gives rise to signs and symptoms associated with TMD. Sahebi et al<sup>18</sup> in a study reported that 1 week postoperatively, pain in and around ear increased significantly ( $p = 0.007$ ). Ryalat et al<sup>19</sup> reported that pain in or about the ears was the most common symptom. Habib et al<sup>20</sup> also reported pain in or about the ear and joint locking. The assessment of TMD is also based on the clinical sign of the mouth opening pattern. Nguyen et al<sup>21</sup> in a study reported a mouth-opening deviation occurred in 37.6% of the elderly and 9.7% had a limited mouth opening. A similar study finding showed that 7.9% of elderly Japanese exhibited restricted mouth opening,<sup>22</sup> and another study has reported that the elderly have impaired maximal jaw-opening capacities compared with other age groups.<sup>23</sup> It is likely that disorders of mouth-opening patterns result

**Table 1:** Gender distribution with age

Gender	Age (%)		Total (%)
	<50	>50	
Male	74 (68.5)	34 (31.5)	108 (100)
Female	62 (67.4)	30 (32.6)	92 (100)

**Table 2:** Relationship between age, gender, and TMJ examination

	TMJ examination					Total (%)	p-value
	Normal (%)	Painful clicking or grafting sound (%)	Locking jaw (%)	Aching facial pain (%)	Aching pain in and around ear (%)		
<i>Gender &lt;50</i>							
Male	72 (97.3)	1 (1.4)	0 (0)	0 (0)	1 (1.4)	74 (100)	0.46
Female	59 (95.2)	2 (3.2)	0 (0)	1 (1.6)	0 (0)	62 (100)	
<i>Gender &gt;50</i>							
Male	26 (76.5)	6 (17.6)	0 (0)	0 (0)	2 (5.9)	34 (100)	0.466
Female	21 (72.4)	4 (13.8)	2 (6.9)	0 (0)	2 (6.9)	29 (100)	

TMJ: Temporomandibular joint

**Table 3:** Association between age, gender, and masticatory muscle examination

	Masticatory muscle examination			Total (%)	p-value
	Normal (%)	Pain/tenderness (%)	Referred pain to head and neck region (%)		
<i>Gender &lt;50</i>					
Male	71 (96)	2 (2.7)	1 (1.4)	74 (100)	0.533
Female	59 (95.2)	3 (4.8)	0 (0)	62 (100)	
<i>Gender &gt;50</i>					
Male	25 (73.5)	8 (23.5)	2 (6.9)	34 (100)	0.119
Female	14 (48.3)	13 (44.8)	2 (6.9)	29 (100)	

**Table 4:** Relation between age, gender, and maximum jaw opening

	Maximum jaw opening			Total	p-value
	Normal (%)	Limited mouth opening (%)	Restricted side to side movement (%)		
<i>Gender &lt;50</i>					
Male	73 (98.6)	1 (1.4)	0 (0)	74 (100)	0.198
Female	60 (96.8)	0 (0)	2 (3.5)	62 (100)	
<i>Gender &gt;50</i>					
Male	25 (73.5)	4 (11.8)	5 (14.7)	34 (100)	0.047
Female	14 (48.3)	11 (38)	4 (13.8)	29 (100)	

**Table 5:** Relation between age and tooth number to be treated

Age	Quadrant	Gender		Total	p-value
		Male (%)	Female (%)		
<50	Anterior	51 (58.6)	36 (41.4)	87 (100)	0.189
	Posterior	23 (46.9)	26 (53.1)	49 (100)	
>50	Anterior	6 (42.9)	8 (57.1)	14 (100)	0.344
	Posterior	28 (57.1)	21 (43)	49 (100)	

from muscle incorporation or joint immobility due to intracapsular joint disorder.<sup>24</sup>

The present study reported that 5 (2.5%) had experienced pain in and around the ear (p = 0.46). No specific study was found, which suggested that prolonged root canal treatment resulted in TMD. However, it was noted that there is a 60% increased risk of experiencing TMD in patients who went for third molar extractions.<sup>25</sup> Tracheal tube intubation has been proposed to be a risk factor for TMD, and it is usually associated with the duration that TMJ structure is stressed.<sup>26</sup> Habib et al<sup>20</sup> in a study reported moderate dysfunction of TMJ after root canal treatment. Muscles of mastication and articular ligaments during such procedures are stressed out for a longer

period of time and this causes muscle contractions, pain, and discomfort with limited mouth opening.<sup>18</sup> A study conducted by Nguyen et al<sup>21</sup> found that muscle tenderness occurred more often in the temporalis, masseter, and lateral pterygoid muscles than in the posterior mandibular and submandibular regions. This finding was expected because the hyperactivity of the main masticatory muscles often causes tenderness and has been associated with TMD. Similar findings were reported by Sipilä et al<sup>27</sup> in Finland and Camacho et al<sup>28</sup> in Brazil and higher than levels were reported by Schmitter et al<sup>23</sup> and from Turkey by Nekora-Azak et al.<sup>29</sup>

The present study reported that 13 (43.3%) females and 8 (23.5%) males reported pain and tenderness during masticatory muscle examination. The higher prevalence rate among women can be due to hormonal variation, biological, cultural, and environmental factors.<sup>30</sup>

Concerning genders, a significant difference was observed by Ahmed and Abuaffan<sup>31</sup> in a study where females showed a higher prevalence of TMD than male subjects. Similar results had been reported by Anamari among Brazilians,<sup>32</sup> and Tecco et al<sup>33</sup> and Sahebi et al<sup>18</sup>

also reported similar results with regard to gender. Pedroni et al<sup>34</sup> reported that 68% of the subjects exhibited some degree of TMD and the women were the most affected. Nomura et al<sup>35</sup> reported that 63.11% of females and 40.62% of males showed some level of TMD. The present study reported that female patients complained of more pain postoperatively than males.

The present study showed that patients who had their posterior teeth treated complained of more pain postoperatively than those patients who had their anterior teeth treated. Sahebi et al<sup>18</sup> in a study also reported that pain was more commonly observed in patients who had undergone root canal treatment for their posterior teeth than those who were treated for their anterior teeth. Patients have to open the mouth wider and for a longer duration for the root canal treatment of posterior teeth, when compared with the anterior teeth. It is usually reported in studies that people affected by TMD are between 18 and 80 years of age.<sup>36-39</sup> However, in the present study, it was found that patients who were over 50 years of age were affected more than patients <50 years. Nguyen et al<sup>21</sup> also reported high prevalence of TMDs among an elderly Vietnamese population and TMD symptoms occurred among 62.5% of the sample. This result was much higher compared with elderly populations in Sweden (18%),<sup>40</sup> Brazil (35.8%),<sup>41</sup> and Nigeria (17.4%).<sup>42</sup>

The reason is that in case of posterior teeth, the procedure is usually lengthy as tooth has multiple canals and needs greater time for cleaning and shaping than the anterior teeth, and, hence, the patient has to open their mouth for a longer period of time, resulting in more stress on TMJ. Furthermore, in older age, along with physiological and emotional factors, loss of natural dentition resulting in a change of the rest position due to the reduction of the vertical dimension of occlusion is also a predisposing factor resulting in increased TMD issues in old age.

## CONCLUSION AND RECOMMENDATION

The aim of the present study was to evaluate the effect of lengthy sessions of root canal treatment and its effects on TMJ and associated masticatory muscles. Long-duration root canal sessions result in longer and wider mouth opening, causing the muscles of mastication and articular ligaments to stretch for a longer period of time, which causes muscle contractions, pain, and discomfort during mouth opening and chewing with limited mouth opening and gives rise to symptoms associated with TMD. Hence, it is recommended to have multiple and short root canal sessions where the patient does not have to keep the mouth open for a long time and is allowed to take short breaks, thus preventing extra stress on TMJ and associated masticatory structures.

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