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Original Article

The Assessment of Impact of the COVID-19 Pandemic on Patients Receiving Orthodontic Treatment

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Main Points

- Ortodontic treatments were significantly affected by the COVID-19 pandemic.
- Solving the problems faced by patients when they cannot visit their clinical check-ups reduces anxiety.
- Teleortodontics can also be an effective resource for reducing the number of visits to the clinics.

ABSTRACT

Objective: The aim of this study was to determine the difficulties experienced by patients receiving orthodontic treatment during the COVID-19 pandemic and to evaluate the problems experienced by orthodontic patients, along with their attitudes toward these problems.

Methods: A cross-sectional survey study including a total of 502 patients (291 female; 211 male) receiving orthodontic treatment at a public or private clinic was conducted via a web-based questionnaire.

Results: Of all participants, 70.1% (352) were between the ages of 12 and 18 and 77.1% (387) were treated in a public clinic. According to the results, 97.3% (372) of the patients in the public clinic and 71.1% (79) of the patients in the private clinics had not been able to continue their treatment for 2 months or longer. Most of the participants were concerned about extended treatment duration (349, 69.5%) during this period. While the most common problems in patients with fixed appliances were soft tissue irritation (230, 52.5%), bracket failure (142, 32.4%), gingival swelling (88, 20.1%), and pain (88, 20.1%); there were issues of new spaces between teeth (41, 64.1%), pain (37, 57.8%), and gingival swelling (29, 45.3%) among patients with removable appliances.

Conclusion: Most patient appointments were delayed during the COVID-19 pandemic. Patients experienced various problems with their treatment, and as a result, concerns about extended treatment duration increased. Therefore, orthodontists should pay more attention to teleorthodontics during the pandemic process.

Keywords: Anxiety, COVID-19, emergencies, orthodontic treatment, teleorthodontics

INTRODUCTION

Throughout history, pandemics have caused a high mortality rate and severe socio-economic crises in the affected countries. The outbreak of SARS-CoV-2, which started in China in December 2019, spread globally in a short time, and the disease was named COVID-19.[1] A global emergency was declared by the World Health Organization on January 30, 2020, and the outbreak was declared as a pandemic on March 11, 2020.[2] In order to prevent the spread of the pandemic, various measures have been implemented, such as regular maintenance of hand hygiene, use of face masks and social isolation. Most countries were placed under a total lockdown to prevent cross infection as the number of people infected increased.[3]

The average incubation period of COVID-19 is 5-6 days. The symptoms may appear within 2-14 days after contact, and contagiousness may begin within 1-2 days before the onset of symptoms.[4] The disease is mainly

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transmitted by droplets, and it is believed that droplets spread from the infected individual due to coughing, sneezing, and speaking, and are transmitted to sensitive individuals via contact/inhalation through the eyes, mouth, and nasal mucosa.[5] All age groups are susceptible to COVID-19. Various symptoms may be present at the onset of the disease; however, the predominant symptoms are fever and cough, while the gastrointestinal symptoms are less common. In addition to the predominant symptoms, patients may also experience headache, conjunctival hyperemia, nasal congestion, sore throat, increased secretion, sputum, weakness, hemoptysis, nausea/vomiting, diarrhea, abdominal pain, myalgia, rash, and dysfunctions of taste and smell. Severe symptoms may be observed, such as shortness of breath, respiratory failure, and death from viral pneumonia. However, some individuals may recover from this disease with mild symptoms such as nasal congestion and smell dysfunction, or with no symptoms at all.[5-7]

Due to the contagious nature of this virus, healthcare workers are among the most vulnerable groups. Dentistry practices pose a higher risk for dentists and residents due to the intensive generation of aerosol, very high viral load in the saliva of the infected individuals, and close face-to-face contact with patients during treatment.[4] Studies have demonstrated that the coronaviruses remain viable and contagious for several days on surfaces.[8,9] In addition, aerosols, especially from infected individuals, pose a significant risk of cross-infection in closed areas, even when social distance is maintained.[10] Accordingly, the Republic of Turkey Ministry of Health COVID-19 Scientific Advisory Committee defined the dental emergency practices and recommended that other non-urgent treatments be postponed, as of April 2020.[11] In this context, some orthodontists only performed emergency treatments, while others completely closed their clinics.

Dental emergencies have been identified in most countries. However, there is a deficiency regarding the orthodontic treatments addressed in these regulations. Emergencies are less common in most patients undergoing orthodontic treatment; however, orthodontists need a guideline on emergency care.[12] Orthodontic treatments last a minimum of 1.5-2 years, and patients are required to visit their orthodontists for monthly routine checks during this period. During the pandemic, follow-up sessions of orthodontic patients could not be performed due to the closure of some clinics.[13] During this period, orthodontic patients experienced various problems such as bracket failure, soft tissue irritation, and incompatibility of appliances. However, the problems could not be addressed for a long time due to the inability to undergo the necessary treatments.[14] This caused anxiety and stress in orthodontic patients.[15] Understanding the impact of the pandemic on orthodontic treatments may affect the future implementations of orthodontic practice. The aim of this study is to determine the difficulties experienced by patients receiving orthodontic treatment during the COVID-19 pandemic and to evaluate the problems experienced by orthodontic patients, along with their attitudes toward these problems.

METHODS

The study was approved by the Clinical Research Ethics Committee of Aydın Adnan Menderes University, Faculty of Dentistry (2021/05). The size of the sample was calculated using an online calculator, www.raosoft.com/samplesize.html. The survey study aimed to reach 1403 individuals. The required sample size was calculated to be a minimum of 302 with a 5% margin of error and a 95% confidence interval. Before sending out the questionnaire to the participants, a pilot study was conducted by sending it to a small group of approximately 20 orthodontic patients, in order to evaluate the clarity of the questions, the required time, and validity. An open-ended option was added to the end of each question, where the participants could add additional responses where necessary. Next, the questionnaire was modified accordingly and finalized. These questionnaires were not included in the total number of samples in the study.

This questionnaire was administered to patients whose orthodontic treatment had started and had been ongoing before the pandemic in 1 public clinic and 2 private clinics. The survey was uploaded to a website, and the link was sent to 1403 patients via SMS. All participants were informed that participation in the survey was voluntary and that they could stop responding to the questionnaire at any time. The survey was conducted anonymously to preserve the privacy of the participants. All data obtained were recorded on a researcher's computer and their confidentiality was ensured. Responses were received over a period of 3 weeks. The survey was answered by 502 orthodontic patients.

The questionnaire was developed in accordance with CHERRIES (Checklist for Reporting Results of Internet E-Surveys).[16] There were 23 questions in 4 sections of the survey. In the first section (questions 1-4), information was collected about the demographic characteristics of the participants, such as age, gender, and education level. The second section (questions 5-7) contained questions about symptoms of COVID-19, modes of transmission, and prevention methods. The third section (questions 8-19) consisted of questions regarding the extent to which the orthodontic treatments of the participants were affected during the pandemic, whether follow-up sessions were realized, and the conditions under which they consulted with the orthodontist. In addition, this section contained questions about whether orthodontic treatments were urgent, or what orthodontic emergencies were, according to the participants, whether they were worried about orthodontic treatment processes during the pandemic, and their concerns about the treatment processes. The fourth section (questions 20-23) involved questions about whether there were differences in the participants' oral hygiene and eating habits during the pandemic.

Statistical Analysis

The data of the study were compiled using Microsoft Office Excel 2007 (Microsoft, Reymond, WA, United States). The data were analyzed using the Statistical Package for Social Sciences (SPSS) software for Windows (version 21.0; IBM Corp., Armonk, NY, USA).

Table 1. Demographic characteristics of samples

	Public Clinic Patients, n (%)	Private Clinic Patients, n (%)	Total, n (%)
Age			
12-18	279 (72.1)	73 (63.4)	352 (70.1)
19-24	77 (19.9)	29 (25.2)	106 (21.1)
25-34	20 (5.2)	6 (5.2)	26 (5.1)
<34	11 (2.8)	7 (6.1)	18 (3.6)
Gender			
Female	230 (59.4)	61 (53.1)	291 (58)
Male	157 (40.6)	54 (46.9)	211 (42)
Education status			
Primary School	3 (0.8)	-	3 (0.6)
Secondary School	49 (12.7)	16 (13.9)	65 (12.9)
High School	254 (65.6)	74 (64.3)	328 (65.3)
University	72 (18.6)	22 (19.1)	94 (18.7)
Postgraduate	7 (1.8)	3 (2.6)	10 (0.2)
Appliance			
Fixed appliance	334 (86.3)	104 (90.4)	438 (87.2)
Removable appliance	53 (13.7)	11 (9.6)	64 (12.7)
Total	387 (77.1)	115 (22.9)	502 (100)

RESULTS

With the participation of 502 people in the survey, a response rate of 35.7% was obtained. The demographic characteristics of the participants are presented in Table 1. There were 291 females (58%) and 211 males (42%) among the 502 participants. Most of the participants were between 12 and 18 years of age (352, 70.1%), and 77.1% (387) had been undergoing treatment in a public clinic. The descriptive statistics regarding the second part of the questionnaire are presented in Table 2.

Table 2. Descriptive statistics of responses to section 2

Question	Item	Total, n (%)
Which one/ones do you think are among the symptoms of COVID-19?	Cough	395 (78.7)
	Joint pain	299 (59.6)
	Fever	427 (85)
	Eye redness	94 (18.7)
	Throat ache	298 (59.4)
	Numbness in hands and feet	78 (15.5)
	Nausea	113 (22.5)
Which one/ones do you think are the ways of COVID-19 transmission?	Surface pollution	335 (66.7)
	Via droplet	378 (75.3)
	By air	418 (83.3)
	None	7 (1.4)
	All	277 (55.2)
Which one/ones do you think are the ways of protection from COVID-19 infection?	Social isolation	451 (89.8)
	Wearing mask	478 (95.2)
	Using gloves	359 (71.5)
	None	5 (0.9)
	All	344 (68.5)

According to the results, 97.3% (372) of the patients in the public clinic, and 71.1% (79) of the patients in the private clinics had not been able to continue their treatment for 2 months or longer. Of the participants, 81.4% (367) were not able to attend the follow-up sessions due to the closure of the clinic where they had been treated. Of the patients who experienced problems or required information during the pandemic, 84% (95) of them in the private clinics and 77.8% (291) of them in the public clinic contacted the orthodontist at least once. The descriptive statistics of the third section, which were related to orthodontic treatment processes during the pandemic, are presented in Table 3. The participants were divided into 2 groups according to whether they were treated in the public or the private clinic. Most of the participants were concerned about extended treatment duration (349, 69.5%) during this period.

The problems faced by the participants receiving fixed orthodontic treatment and removable appliances are displayed in Figures 1 and 2, respectively. While the most common problems in patients with fixed appliances were soft tissue irritation (230, 52.5%), bracket failure (142, 32.4%), gingival swelling (88, 20.1%), and pain (88, 20.1%); patients with removable appliances indicated problems with new spaces between teeth (41, 64.1%), pain (37, 57.8%), and gingival swelling (29, 45.3%).

The descriptive statistics regarding the fourth section of the survey are presented in Table 4. While 60.7% (300) of the participants stated that there was no change in their brushing habits, 25.1% (124) stated that their brushing habits increased as they paid more attention to hygiene during this period, and 14.1% (70) stated that there was a decrease in their brushing habits.

DISCUSSION

The coronavirus outbreak has significantly impacted access to healthcare worldwide. Despite the fact that orthodontic practice generates less aerosol compared to other dental treatments, aerosols are generated in procedures such as bonding brackets and bands, while removing residual adhesives during the removal of the appliances, and during attachments in treatment with clear aligners. In addition, saliva droplets may splash during the insertion or removal of orthodontic ligatures and wires. Similar to other dental treatments, orthodontic practice has been affected by the pandemic due to the high exposure of orthodontists and the risk of cross-infection from patients. Significant problems have been experienced regarding the patients' orthodontic treatment.[13,17,18] Therefore, evaluating the effect of the pandemic on orthodontic practice is important in terms of mitigating these effects. This study is one of the first studies to evaluate the knowledge of patients undergoing orthodontic treatment during the COVID-19 pandemic, the problems they experienced regarding the treatment processes during this period, and their attitudes toward them.

Table 3. Descriptive statistics of responses to section 3

Question	Item	Public Clinic Patients, n (%)	Private Clinic Patients, n (%)	Total, n (%)
How often were your orthodontic checks performed during the pandemic period?	My appointments continued monthly	10 (2.6)	32 (28.8)	42 (8.5)
	1-2 months	104 (27.2)	44 (39.6)	148 (30)
	More than 2 months	131 (34.2)	29 (26.1)	160 (32.4)
	I had no control during this period	137 (35.8)	6 (5.4)	143 (29)
What was the reason for discontinuation of your orthodontic treatment?	The clinic was closed	198 (53.2)	50 (63.2)	248 (55)
	I was afraid of going to the clinic due to the epidemic	76 (20.4)	8 (10.1)	84 (18.6)
	For both reasons	98 (26.3)	21 (26.6)	119 (26.4)
How many times have you communicated with your orthodontist during this period?	I have never communicated	83 (22.2)	18 (15.9)	101 (20.7)
	1 or 2 times	175 (46.7)	59 (52.2)	234 (48.2)
	3 or 4 times	75 (20.3)	24 (21.3)	99 (20.3)
	More than 4	41 (10.9)	12 (10.6)	53 (10.8)
How did you communicate with your orthodontist?	Voice call	291 (75.3)	19 (16.5)	310 (61.7)
	Mobile phone application	10 (2.5)	61 (53.1)	71 (14.1)
	Calling and application	31 (8.0)	29 (25.2)	60 (12)
	SMS	55 (14.2)	6 (5.2)	61 (12)
What was your main concern about your orthodontic treatment process during this period?	My teeth conditions will relapse	128 (33)	38 (33.1)	166 (33.1)
	Treatment duration will be extended	268 (69.2)	80 (69.5)	349 (69.5)
	My orthodontist will be very busy during this period and will not be able to spare the necessary time for my treatment	59 (15.2)	16 (13.9)	75 (14.9)
	All	42 (10.8)	13 (11.3)	55 (10.9)
	I have no worries about my treatment process	59 (15.2)	21 (18.2)	80 (15.9)
To what extent do you agree / disagree with the closure of dental clinics to minimize the spread of the Covid-19 outbreak?	I absolutely agree	51 (13.5)	22 (19.4)	73 (14.8)
	I agree	64 (16.6)	17 (15)	81 (16.3)
	I partially agree	91 (23.9)	19 (16.8)	110 (22.2)
	I am indecisive	83 (21.4)	24 (21.5)	107 (21.5)
	I do not agree	64 (16.5)	17 (15)	81 (16.2)
	I strongly disagree	31 (8.1)	14 (12.3)	45 (9)
Have you followed all the instructions given by your orthodontist, such as using elastics or maintaining oral hygiene?	Yes, I did regularly	266 (71.5)	79 (70.5)	345 (71.2)
	Sometimes it is not very regular	102 (27.4)	31 (27.6)	133 (27.4)
	No, I could not pay attention	4 (1.1)	2 (1.9)	6 (1.4)
Have you experienced any emergency situation such as pain, swelling?	No, I have not had any problems	290 (77.1)	89 (78.7)	379 (77.5)
	Yes, I had a problem. I contacted my orthodontist	55 (14.6)	17 (15.2)	72 (14.8)
	Yes, I have, but I self-medicated	31 (8.3)	7 (6.1)	38 (7.7)
Do you think orthodontic treatment should be seen as an emergency?	Yes, because it can impair the final result	180 (47.2)	46 (40.3)	226 (45.6)
	Yes, some conditions such as pain, swelling, bracket failure, and soft tissue irritation should be considered urgent	140 (36.7)	48 (42.1)	188 (38)
	No, orthodontic treatments are not an emergency as they are not vital	62 (16.1)	20 (17.6)	82 (16.4)
What do you think about going to your orthodontic treatment appointments during the pandemic period?	I will go to my appointments regularly	317 (83.2)	101 (87.8)	418 (84.2)
	I prefer to go to my appointments less often	61 (16)	14 (12.2)	75 (15.1)
	I will not go until the pandemic is all over	3 (0.8)	-	3 (0.7)
Are you afraid of going to the clinic for your orthodontic treatment during this period?	Yes, I am afraid	161 (42.8)	45 (39.1)	206 (41.9)
	No, I am not scared	191 (50.7)	63 (54.7)	254 (51.7)
	Partly, I am worried	24 (6.5)	7 (6.2)	31 (6.4)

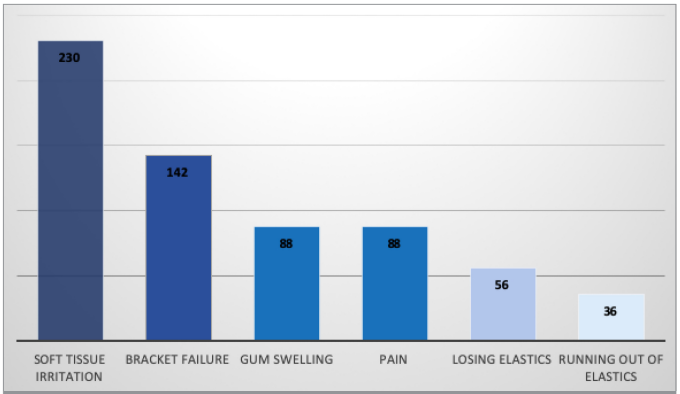

Figure 1. The problems faced by the participants receiving fixed orthodontic treatment.

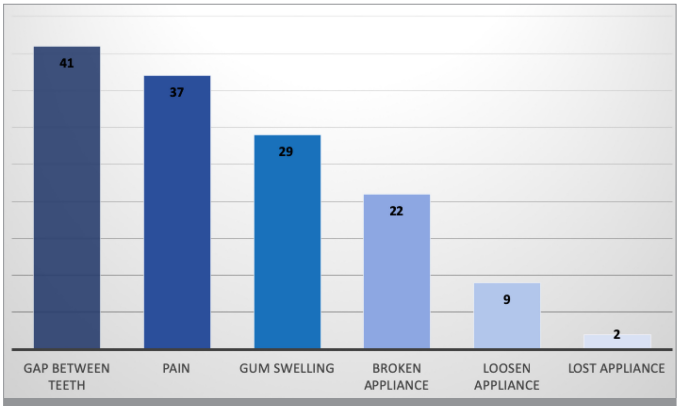

Figure 2. The problems faced by the participants receiving orthodontic treatment with removable appliances.

Patients undergoing fixed orthodontic treatment during the pandemic experienced more problems than patients undergoing removable orthodontic treatment. In fixed treatment, soft tissue irritation due to bracket failure was the most common problem. On the other hand, the most common problem with removable appliances was the incompatibility. This result of the study was found to be consistent with the results of similar previous studies.[19-21] In the present study, the problem of bracket failure that was encountered frequently in patients undergoing fixed orthodontic treatment may have occurred due to disregard of the nutritional warnings given by their orthodontist. In addition, the presence of gingival swelling was a common response in patients undergoing fixed and removable orthodontic treatment. Gingival swelling accompanies a lack of oral hygiene, and patients' motivation to ensure oral hygiene may have decreased during the pandemic.[22]

The orthodontic treatment was interrupted during the pandemic for the vast majority of patients in the present study. Most of these patients had been undergoing treatment in the public clinic, and the main reason for the inability to access treatment was the closure of the clinic. This could be justified by the mandatory decision of the government to close the universities. In guidelines and scientific articles, it was recommended that patient appointments be rescheduled and only emergency cases be treated during the COVID-19 pandemic.[14,18,23] In the current study, the majority of the patients treated in private clinics presented only for emergency treatment, as recommended. On the other hand, most of the patients were willing to continue their routine orthodontic treatment despite the recommendations. The participants stated that they had sufficient information about the symptoms of COVID-19 and transmission routes. This may have been due to the inability of the patients to understand the severity of the pandemic, or due to their concern about the treatment processes. Most of these patients believed that their orthodontic treatment would be extended due to the COVID-19 outbreak. This may have been caused by the concern that the quality of treatment would deteriorate due to insufficient information about the progress of their treatment. A greater proportion of patients were concerned about extended treatment durations rather than the recurrence of orthodontic treatments. This result was consistent with the results of the previous studies.[19,21]

Face-to-face interaction is at the core of healthcare services; however, it is recommended that the emergencies should be

Table 4. Descriptive statistics of responses to section 4

Question	Item	Total, n (%)
Did your brushing habits change during the pandemic period?	There was no change	300 (60.7)
	My brushing habits increased	124 (25.1)
	My brushing habits decreased	70 (14.1)
How often did you brush your teeth during the pandemic period?	I brushed 3-4 times a day	195 (39.5)
	I brushed 1-2 times a day	269 (54.6)
	Sometimes I forgot and never brushed	29 (5.8)
Did you pay attention to the recommendations of your orthodontist about nutrition such as acidic drinks and solid foods during the pandemic period?	Yes, I have always taken care	218 (44.3)
	Sometimes I could take care	248 (50.4)
	No, I could not take any care	26 (5.3)
During this period, did you experience any problem such as bracket failure or soft tissue irritation due to not complying with the nutritional recommendations of your orthodontist?	No, there was no problem	309 (63.9)
	Yes, 1-2 instances of bracket failure	165 (34.2)
	Yes, there was frequent bracket failure, and the elastics came off	9 (1.9)

primarily managed remotely during the pandemic. In some cases, patients or parents can solve problems at home with guidance. For this purpose, orthodontists can send out the informative photos and videos they prepare or that are available on their websites. In addition, they can provide their patients with access to materials such as aligners, orthodontic wax, and elastics in order to ensure that their treatment is not interrupted.[13]

In fact, continuous evaluation by the orthodontist is necessary to evaluate the effectiveness and undesirable effects of orthodontic treatment. Nonetheless, some periodic visits are not absolutely necessary, and instructions can be provided on how to modify the appliances. Recently, an innovative approach has been proposed in the field of medicine. Telemedicine was initially developed to provide healthcare services in remote areas; however, healthcare services are beginning to be provided via video calls over the internet to patients who are not able to access healthcare institutions, or who avoid visiting them during the pandemic.[24] Telemedicine, which is used to reduce the spread of contagious disease and ensure more effective employment of healthcare personnel, facilitates access to healthcare services during the pandemic. The limitations of remote healthcare services and the problems they may cause should not be overlooked. According to the declaration of the World Medical Association about telemedicine practices, attention should be paid to the confidentiality of patient data, and informed consent should be obtained for the distinctive features of telemedicine practices.[25] Accordingly, scientific standards of e-health applications should be determined, and implementation guides should be created in order to protect patient and physician rights as well as the patient–physician relationship.

Orthodontists and dental assistants should take care to communicate effectively with patients in order to increase mutual trust and provide information.[26] In this context, teleorthodontics and other technologies can be utilized in emergency situations as an alternative to face-to-face communication. Phone calls, live video/teleconferencing, text messages on WhatsApp or social media, and e-mails can improve communication between the orthodontist and the patient.[27] Thus, this care and contact with patients can increase the confidence in the orthodontist, and reduce the anxiety and stress related to the orthodontic treatment process in patients. Moreover, it is known that of the factors contributing to patient satisfaction, the most important is the patient–physician relationship.[28] In the current study, most of the participants tried to communicate with the orthodontists in different ways. While the patients undergoing treatment in the public clinics mostly communicated by phone, the majority of patients undergoing treatment in private clinics accessed their orthodontist via mobile applications. Patients undergoing treatment in private clinics may have preferred the mobile application since they were able to display the problems they encountered more easily through pictures instead of describing them.

A web-based questionnaire was used in this study due to the restrictions during COVID-19. The questionnaire was sent out to all patients undergoing treatment in the clinics where this study was conducted; however, the possibility of selection bias should also be considered. Moreover, the number of participants was relatively small; therefore, surveys with larger sample sizes can produce more generalized results.

CONCLUSION

Orthodontic treatments were impacted significantly and disrupted by the COVID-19 pandemic, and most patient appointments were delayed. Patients experienced various problems with their treatment, and as a result, concerns about delay of treatment increased. Therefore, orthodontists should pay more attention to teleorthodontics during the pandemic process.

Ethics Committee Approval: Ethical committee approval was received from the Clinical Research Ethics Committee of Aydın Adnan Menderes University, Faculty of Dentistry (2021/05).

Informed Consent: Informed consent was obtained from the patients who agreed to take part in the study.

Peer Review: Externally peer-reviewed.

Author Contributions: Design - Y.A.Ü.; Concept - Y.A.Ü., E.K.; Data Collection - P.D.; Analysis - P.D.; Writing Manuscript - Y.A.Ü; Critical Review - E.K.

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