



# THE IMPACT OF ENDODONTIC STATUS ON QUALITY OF LIFE

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**SUMMARY** – The influence of endodontic status on quality of life has not been fully clarified. The aim of this study was to quantify the effect of endodontic status on everyday functioning using the psychometric instrument Oral Impacts on Daily Performances (OIDP) and to correlate endodontic status with quality of life using the OIDP questionnaire. A total of 600 participants were referred to dental radiography for digital orthopantomograms and asked to fill out the OIDP questionnaire. Digital orthopantomograms were analyzed and compared with OIDP results. The correlation between endodontic status and quality of life was tested. The statistical analysis consisted of descriptive statistics, non-parametric statistics, hierarchical multiple regression analysis by enter method, and correlation analysis. The results showed that quality of life was significantly affected by tooth loss ( $p < 0.05$ ). Endodontic treatment on canines and incisors positively correlated with higher OIDP scores, indicating an effect on quality of life ( $p < 0.05$ ). In conclusion, the correlations between variables describing the endodontic status and the quantitative results of the OIDP questionnaire indicate a measurable effect of endodontic disease/health on everyday functioning.

**Keywords:** *Endodontics; Oral impacts on daily performance; Quality of life*

## Introduction

Apical periodontitis has a prevalence in different populations of 2%–12% (1–6). The consequences of acute forms of apical abscess can be serious, but the

effects that various forms and stages of apical periodontitis may have on everyday functioning are generally not clearly determined (1, 2). However, prolonged exacerbations of chronic periapical diseases may significantly negatively impact quality of life (1–6).

The analytical method developed by Eckerbom et al. (7) uses root canal filling length and homogeneity as criteria for estimating the quality of endodontic treatment. A long-term favorable prognosis was found to be significantly related to root canal filling length within 2 mm from the apex and the homogeneous radiographic appearance of the root canal filling (6, 8, 9).

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The periapical index (PAI) developed by Orstavik *et al.* (10) radiographically differentiates five levels of radiopacity of the periapical region. The PAI scoring system is based on the finding of Brynolf (11), who showed that the level of apical bone destruction correlates with the radiographical appearance and size of the lesion.

The quality of endodontic filling was found to be positively correlated with PAI (2-5).

Aside from the objective assessment, the subjective assessment of the disease and its effect on everyday functioning is also important in planning the treatment for each individual patient and it has implications for public oral health planning (12, 13). FDI World Dental Federation recently proposed a new definition of oral health, recognizing that person's perceptions and expectations should be taken into account (14). Oral health includes the ability to speak, smile, smell, taste, touch, chew, swallow, and convey emotions through facial expressions with confidence, without pain, discomfort, and disease of the craniofacial complex (14).

Accordingly, several instruments for measuring the effects of various oral health-related factors on certain segments of quality of life have been developed in the past 40 years.

In this study, we used the Oral Impacts on Daily Performances (OIDP) instrument. It is based on the World Health Organization's international classification of impairments, disabilities, and handicaps and the conceptual model of oral health (15). Also, the determinants of oral health defined by the FDI match the subscales of the OIDP instrument (14, 15). The OIDP instrument estimates eight physical, psychological, and social performances: (i) eating and enjoying food, (ii) cleaning teeth, (iii) speaking and pronouncing clearly, (iv) sleeping and relaxing, (v) smiling without embarrassment, (vi) emotional stability, (vii) carrying out major work, and (viii) enjoying social contact. The total score is the numerical value used for statistical analysis. The OIDP instrument was chosen because it is suitable for evaluating the outcomes of endodontic treatment and the effects of root canal treatment on quality of life. It can also be used as a predictive tool for the treatment.

This study aimed to correlate the endodontic status in an adult population with quality of life using the OIDP instrument. The null hypothesis was that endodontic status would not affect quality of life.

## Patients and methods

The study was approved by the Ethics Committee of the School of Dental Medicine, University of Zagreb (Ethical approval No. 15042011).

### Patients

The participants were patients referred for digital orthopantomograms at the School of Dental Medicine, University of Zagreb, and seven dental radiography studios in five Croatian regions (two in Zagreb, two in Split, and one in Osijek, Varaždin, and Rijeka each). A pilot study was performed to test the protocol and minimize the amount of missing data. A total of 600 participants were included in the study. All participants signed the informed consent form and could withdraw from the study at any point. Eligibility criteria included the signed informed consent and dental/orofacial indication for orthopantomogram. All patients signed informed consents and filled out the OIDP questionnaire either before or after X-ray.

### Methods

The orthopantomograms used for the analysis were recorded using the Ortoceph® OC200D (Instrumentarium, Finland) and Veraview IC5 HD (J. Morita Inc., USA) equipment. The X-rays were analyzed using ImageJ version 1.46r for Windows (Wayne Rasband, National Institutes of Health, USA, and public domain software), ACD See 6.0 (ACD Systems Ltd., USA) and Adobe Photoshop Elements 6.0 (Adobe Systems Inc., USA) on a Panasonic TX-P37X20E plasma monitor with a resolution of 1,280 × 720 pixels, and automatically set brightness, contrast and gamma display.

The endodontic status was analyzed using Eckerbom and Magnusson's criteria (9). The homogeneity and length of root canal fillings estimation were based on the radiographic appearance (Fig. 1-3). In multi-rooted teeth, the lowest recorded values of the filling length and homogeneity were recorded. The parameters of the root canal filling length variable were as follows: (i) filling length up to 2 mm from the radiographic apex; (ii) filling length of 2-5 mm from the radiographic apex; (iii) filling length of 5 mm or more from the radiographic apex; (iv) filling over the radiographic apex (overfilling); (v) pulpectomy without root canal filling.

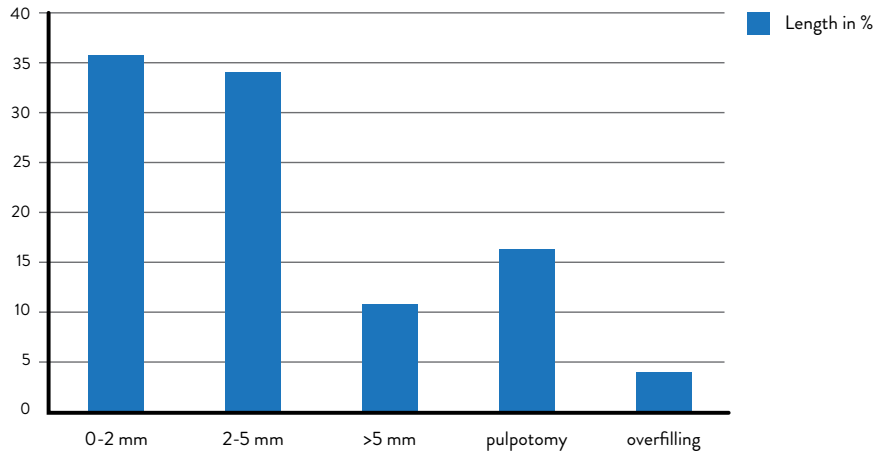


Fig. 1. Root canal filling length in the whole sample in percentages.

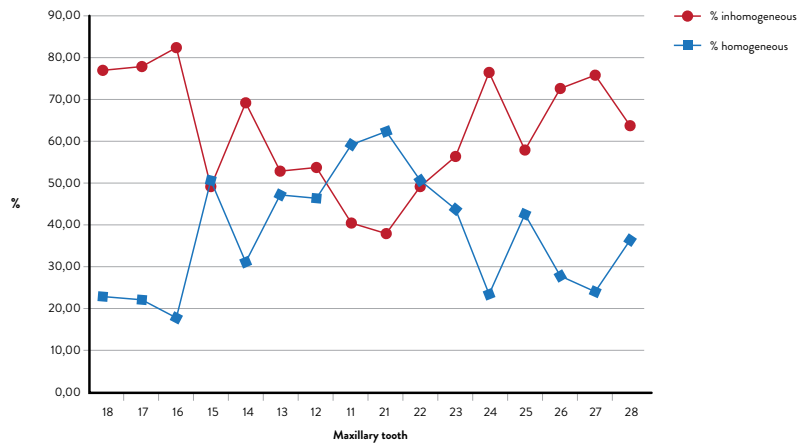


Fig. 2. Quality of obturation in maxillary teeth.

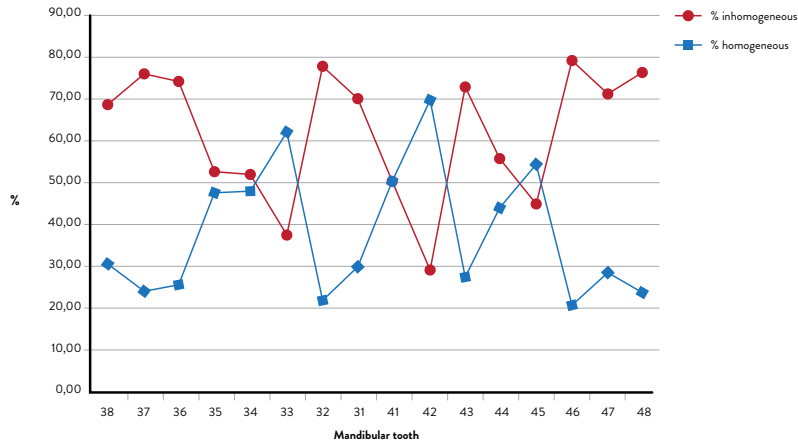


Fig. 3. Quality of obturation in mandibular teeth.

The obturation variable parameters depended on the homogeneity of the filling and included complete obturation (i.e. homogeneous filling) and incomplete obturation (i.e. inhomogeneous filling). Third molars were included in the analysis.

**Statistical analysis**

The questionnaire results were entered into a previously created MS Access (2003, Microsoft, Redmond, USA) database with the associated invoice forms and forms created using Google Docs (Google, www.google.com). The results of the analysis of the corresponding endodontic status and root canal filling quality were compared with those of the individual questionnaire components and the total questionnaire result. Hierarchical multiple regression was performed by the enter method for the individual parameters of the endodontic status variable,

quality of endodontic treatment variables, and their effects on the outcome of the OIDP questionnaire and each component (variable) of the questionnaire were analyzed.

The SPSS for Windows package version 17.0 (IBM, Chicago, USA) was used in the analysis and presentation of the results. The statistical analysis included descriptive statistics, nonparametric statistics, scalability reliability analysis, hierarchical multiple regression analysis by enter method, and correlation analysis.

**Results**

Among the 600 participants, 448 (74.6%) filled out the questionnaires correctly and had suitable radiographs for analysis. Of 448 participants, 61.4% were female, and 37.5% male (1.1% not answered). Age

*Table 1. Endodontic status according to Eckerbom's criteria for particular tooth in the upper and lower jaw expressed in percentages*

Healthy	58.7	73.2	52.2	63.2	64.7	86.8	81.9	81.3	82.1	78.6	85.3	66.3	59.2	50.7	72.3	59.4
Missing	37.5	16.7	31	19.2	23.4	4.2	5.6	4	4.2	7.4	4.7	19	21.9	30.1	20.5	37.5
Apico	0	0	0	0.4	0	0.2	1.3	0.2	0.9	0.4	0	0.2	0	0	0	0
Endo	2.7	8.3	13.8	10.3	7.6	4.7	4.2	8.3	5.4	6	5.4	8	11.4	14.7	5.1	2.2
Endo-sep	0	0	0	0.2	0	0	0	0	0	0	0	0.2	0.9	0.7	0	0
Implant	0.7	0.2	1.1	0.9	1.1	0.9	0.2	0.4	0.2	0.7	0.7	1.8	1.6	1.3	0.7	0
post+ fill	0.2	0.9	1.3	5.6	1.3	3.1	6	5.4	6.5	6.3	3.8	3.8	3.3	2	0.9	0.4
post – fill	0.2	0.7	0.2	0.2	1.8	0	0.4	0.4	0.7	0.7	0.2	0.7	1.8	0.2	0.2	0.2
R relicta	0	0	0.2	0	0	0	0.2	0	0	0	0	0	0	0.2	0.2	0.2
<b>UPPER JAW</b>	<b>18</b>	<b>17</b>	<b>16</b>	<b>15</b>	<b>14</b>	<b>13</b>	<b>12</b>	<b>11</b>	<b>21</b>	<b>22</b>	<b>23</b>	<b>24</b>	<b>25</b>	<b>26</b>	<b>27</b>	<b>28</b>
<b>LOWER JAW</b>	<b>48</b>	<b>47</b>	<b>46</b>	<b>45</b>	<b>44</b>	<b>43</b>	<b>42</b>	<b>41</b>	<b>31</b>	<b>32</b>	<b>33</b>	<b>34</b>	<b>35</b>	<b>36</b>	<b>37</b>	<b>38</b>
Healthy	64.7	63.2	40	69.6	85	94.9	95.3	95.8	96.4	96	96	85.3	74.8	35.7	63.2	66.1
Missing	31.3	25.2	45.8	18.5	7.6	2	2.5	2	1.6	1.8	2	8.7	15	48.4	24.6	30.4
Apico	0	0	0	0	0	0.2	0.4	0.2	0	0	0.2	0	0.2	0	0	0
Endo	3.6	9.2	11.2	8	5.1	2.2	1.6	1.8	1.6	2.2	1.1	4	7.4	12.3	9.4	2.7
Endo-sep	0	0	0.2	0	0	0	0	0	0	0	0	0	0	0.4	0	0
Implant	0	0.9	1.6	0.2	0.7	0.4	0	0	0	0	0.2	0.4	0.4	1.1	0.9	0.4
Post+ fill	0.4	1.1	1.1	3.1	1.6	0	0.2	0.2	0.2	0	0.2	1.6	2	1.8	1.6	0.4
Post – fill	0	0	0	0.4	0	0.2	0	0	0.2	0	0.2	0	0.2	0.2	0.2	0
R relicta	0	0.4	0.2	0	0	0	0	0	0	0	0	0	0	0	0.2	0

Legend for the categories of endodontic status: Healthy, Missing – extracted, Apico- root canal treatment and apicoectomy, Endo-root canal treatment, Endo-sep- separated instrument in the root canal, Implant, Post+fill- radiologically visible root canal filling and post, Post-fill- post in canal without radiologically visible filling, R relicta- radix relicta.

Table 2. Correlation between certain subscales of the questionnaire and total number of missing teeth and teeth with root canal fillings

		Total missing	Total with root canal treatment
1	Pearson's correlation	0.318**	0.045
	P	0.000	0.347
2	Pearson's correlation	0.217**	0.017
	P	0.000	0.722
3	Pearson's correlation	0.206**	-0.013
	P	0.000	0.792
4	Pearson's correlation	0.178**	0.010
	P	0.000	0.836
5	Pearson's correlation	0.320**	0.008
	P	0.000	0.865
6	Pearson's correlation	0.316**	0.004
	P	0.000	0.940
7	Pearson's correlation	0.227**	0.065
	P	0.000	0.169
8	Pearson's correlation	0.274**	-0.030
	P	0.000	0.532
OIDP score	Pearson's correlation	0.412**	0.021
	P	0.000	0.664

Legend: 1 – Eating and enjoying food, 2 – Speaking and clear pronunciation, 3 – Teeth cleaning, 4 – Sleeping and resting, 5 – Smiling, laughing, and showing teeth without shame, 6 – Maintaining a common emotional condition without irritability, 7 – Performing important business or social roles, 8 – Enjoying human contact

range was between 18 and 65 years, and the mean age was 35.2 years.

The endodontic status was analyzed in 14 336 teeth (Table 1). The filling lengths and homogeneity of fillings are presented in Supplementary material.

The number of extracted teeth was found to be a strong predictor of the OIDP questionnaire results (Table 2). Unlike the number of teeth with root canal treatments, the number of extracted teeth showed a statistically significant correlation with the OIDP questionnaire results and the questionnaire subscales ( $p=0.001$ ).

With respect to a type of tooth, a significant correlation was found between treated canines and incisors and the results of the questionnaire ( $p_{inc}=0.018$ ;  $p_{can}=0.024$ ).

No statistically significant correlation was observed between the root canal filling homogeneity and length and the results of a particular questionnaire subscale ( $p>0.05$ ).

## Discussion

The present study confirmed the effect of endodontic disease/health and quality of root canal filling on everyday functioning using the psychometric instrument OIDP. It was found that the number of extracted/missing teeth and endodontically treated canines and incisors statistically correlated with the results of the questionnaire. The null-hypothesis was thus rejected.

Favorable outcomes of non-surgical endodontic treatment, with a high incidence of tooth retention after a period of up to 10 years, have been reported (10, 16, 17). However, the clinical outcomes of the studies that estimated the success rates after endodontic treatment put aside the paradigm shift in oral health care and considered the patient-centered outcomes of treatments and services as relevant indicators of oral health outcomes (16). By considering patient's

perception of the effect of endodontic diseases and endodontic treatment on oral health and quality of life in general, professionals performing endodontic treatment are encouraged to appreciate the patient's subjective view and oral health implications of their treatment.

Oral health-related quality of life (OHRQoL) is the unique term that replaces multiple physical and psychosocial factors caused by a disease or a treatment from an individual's perspective. Studies have analyzed the effect of the number of teeth requiring endodontic treatment and the endodontic treatment-related factors on quality of life using the Oral Health Impact Profile (OHIP) 14, OHIP 17, and other OHRQoL instruments (11, 18, 19). According to the literature, only one study has used the OIDP instrument to estimate the quality of life in a cohort of 127 patients with persistent lesions four years after the treatment and found painful exacerbations to be correlated with patient and treatment factors (20). The current study aimed to correlate endodontic status, with the overall quality of life using the OIDP instrument on many patients and to identify the daily performances mostly affected by endodontic status.

Limitations of the study are determined by the concept of semiquantitative rationale of the quality of life measurement and inherent to the measurement instruments. Other possible sources of bias in this study originate from the fact that the participants were taking orthopantomograms due to a dental/orofacial indication. However, a more representative sample would rise some ethical issues regarding negative effects of ionizing radiation.

The homogeneity of obturation was relatively better in the frontal teeth of both jaws, whereas inhomogeneous filling prevailed in the treated molars. This finding calls for certain measures at the organization and planning level of the endodontic treatment of premolars and molars at the national level.

Using the OHRQoL instrument, the number of teeth requiring endodontic treatment was found to be associated with poor OHRQoL (11). However, in the present study, the number of endodontically treated teeth was not correlated with quality of life, and the number of extracted teeth was strongly correlated with quality of life. These results could be explained by the fact that endodontically treated teeth are not

necessarily diseased/disease-related, including the ones that radiologically seemed inadequately treated. These findings are in accordance with the report of improvement after root canal treatment in more than 90% of patients using the OHIP instrument (21). Furthermore, longitudinal studies showed worse prognosis for endodontically treated teeth with a low quality of root canal filling (length and homogeneity), thus implying that the technical quality of the filling alone can be a predictor of treatment outcome (16, 17). Extracted teeth, unlike endodontically treated ones, present esthetic and functional loss, and it is only logical that they strongly affect the quality of life. In the present study, all categories of the questionnaire were correlated with the number of extracted teeth.

Furthermore, the analysis showed that endodontically treated incisors and canines were significantly correlated with the OIDP score. This could be explained by the effect the endodontically treated teeth in the frontal sextant could have on esthetics. This could be because of possible color changes due to certain root filling materials and large amount of tooth structure loss, thus contributing to the impact on quality of life despite the generally better quality of endodontic treatment in the frontal region. The fact that the quality of endodontic treatment is better in the frontal regions and that the first molars are the first teeth at risk of caries and endodontic pathology implies that patients are more concerned with esthetics than function.

Aside from measuring the association between a particular clinical entity and quality of life, the OIDP questionnaire can be used to study the effects of different treatment methods and outcomes. The OIDP questionnaire covers the period of six months, and to avoid the negative effect of the disease on the results, data should be gathered six months after the therapy or six months after the beginning of the treatment protocol (22). Endodontic patients should be clinically and radiographically followed up at 6 and 12 months after the treatment. A prospective study on the effect of endodontic treatment on quality of life should be conducted to provide insights into the correlation between the different methods of endodontic treatment and quality of life.

Taking into account the fact that OIDP questionnaire is based on the World Health Organization's framework of diseases and disabilities and their impact

on everyday functioning and is translated into many different languages, similar studies could be performed worldwide with comparable results, which could also be generalizable.

Within the limitations of this study, due to the fact that the participants required orthopantomograms, it can be concluded that the quality of root canal treatment did not affect quality of life. There was a positive correlation between endodontically treated incisors and canines and the quantitative results of the OIDP questionnaire and between the number of extracted teeth and the quantitative results of the OIDP questionnaire.

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### Sažetak

## UTJECAJ ENDODONTSKOG STATUSA NA KVALITETU ŽIVOTA

*P. Dijanić, A. Ivanišević, S. Jukić Krmek, J. Perica Pavešić, Z. Karlović i J. Matijević*

Utjecaj endodontskog statusa na kvalitetu života još nije do kraja razjašnjen. Cilj ovog ispitivanja bio je kvantificirati učinak endodontskog statusa na svakodnevno funkcioniranje pomoću psihometrijskog instrumenta o utjecaju oralnog zdravlja na svakodnevni život, pod nazivom *Oral Impacts on Daily Performances (OIDP)*, i povezati endodontski status određen OIDP upitnikom s kvalitetom života. Ukupno je 600 sudionika upućeno u stomatološke radiografske studije na digitalne ortopantomograme i ispunilo OIDP upitnik. Ispitana je povezanost endodontskog statusa i kvalitete života. Statistička analiza uključivala je opisnu statistiku, neparametrijsku statistiku, hijerarhijsku višestruku regresijsku analizu metodom unosa i korelacijsku analizu. Rezultati su pokazali da je na kvalitetu života značajno utjecao gubitak zuba ( $p < 0.05$ ). Endodontsko liječenje na očnjacima i sjekutićima pozitivno je povezano s višim rezultatima OIDP-a, što ukazuje na učinak navedenih zahvata na kvalitetu života ( $p < 0.05$ ). Zaključno, povezanost između varijabli koje prikazuju endodontski status i kvantitativnih rezultata upitnika OIDP ukazuju na mjerljiv učinak endodontske bolesti/zdravlja na svakodnevno funkcioniranje.

**Ključne riječi:** *Endodoncija; Oralni utjecaji na svakodnevno funkcioniranje; Kvaliteta života*