



INTRAOPERATIVE PAIN DURING GLIDE PATH CREATION WITH THE USE OF A ROTARY OR RECIPROCATING SYSTEM

ABSTRACT




Objectives: The objective of this study was to compare the intraoperative pain levels of patients caused from using different glide path systems in creating the glide path before the root canal shaping the teeth with asymptomatic irreversible pulpitis.

Materials and Methods: The study included 88 patient with asymptomatic irreversible pulpitis in mandibular molar tooth. The teeth were randomly assigned to four groups according to use of glide path files: R-pilot (RP), WaveOne Gold Glider (WOG G), One G (OG), Proglider (PG). In all the groups, the patients were asked to specify the pain level by using Visual Analogue Scale (VAS). Kruskal-Wallis and Mann-Whitney U was used to determine significant differences at $p < 0.05$.

Results: In the present study, it was determined that the lowest intraoperative pain level was observed in PG, followed by OG, RP, and WOG G. Statistically significant differences were observed between PG and RP and between PG and WOG G groups ($p < .05$).

Conclusion: All of the file systems used in creating the glide path in root canal treatment caused intraoperative pain. The minimum intraoperative pain was found with PG glide path file, whereas RP and WOG G caused higher level of intraoperative pain.

Keywords: Endodontics, pain, root canal treatment

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INTRODUCTION

Root canal treatment is one of the most frequently performed procedures in dentistry, and it is also the most fearful operation for the patients.^{1,2} For this reason, the management of intraoperative or postoperative pain is very important for both clinicians and patients.² The factors affecting the pain during or after the endodontic treatment are the local anesthetics, premedication, irrigation solutions and systems, root canal preparation techniques, and designs of canal instruments that were used.³

There are many studies carried out on measuring the patients' pain level after the use of various preparation methods and different file systems in root canal treatment.⁴ In general, the studies in literature focus on the post-op subjects, and there are few studies carried out on measuring the intraoperative pain level. It was reported that the demographical factors, anatomical differences between teeth, preparation method, and file systems operating based on different kinematics might affect the level of pain during the root canal treatment.^{5,6}

The advancements in metallurgy in recent years enabled many new file systems working on different kinematics, besides the innovative designs. Despite the technological advancements, all of the preparation methods and file systems, which have been used to date, have been reported to cause dentine extrusion at various levels.⁷ In previous studies^{8,9}, the nickel-titanium (NiTi) single file systems, which operate with rotational movement and reciprocal movement, used in root canal preparation were reported to cause lower amount of debris extrusion during the preparation when compared to the preparation made by using manual files.

The term glide path, which is defined as the space from the root canal to the apex, is very important for safely shape the root canals.¹⁰ Creating the glide path is very useful in preventing the complications, which might be seen during the preparation, such as stepped structure, apical transportation, and instrument fracture.¹¹ In creating the glide path, it was

recommended to use the stainless steel K-type files or rotary nickel-titanium (NiTi) instruments.^{4,8,11,12} When compared to the stainless steel manual instruments, the NiTi rotary instruments were reported to offer better protection of canal morphology and to offer a better path for file systems to be used.¹³

In recent years, many single-file glide path systems such as One-G (OG, Micro-Mega, Besançon, France), ProGlider (PG, Dentsply Maillefer), R-pilot (RP, VDW, Munich, Germany), and WaveOne Gold Glider (WOG G, Dentsply Maillefer) were introduced to the market. PG is made of M-Wire alloy developed by using special thermal methods. PG has 0.16 mm of tip diameter, taper varying between 2% and 8% through the shaft, and four cutting edges with square cross-section. OG has 0.14 mm of tip diameter and 3% taper that is constant throughout the shaft. The file has three cutting edges with asymmetric cross-section.^{10,14} RP is a glide path file made of M-wire alloy and working with reciprocal movement. RP has single size (with tip diameter of 12.5), constant 4% taper and an S-shaped cross-section.¹² WOG G has 0.17 mm of tip diameter, taper varying between 2% and 6% through the shaft and a parallelogram shaped cross-section.¹²

Although the intraoperative pain does not affect the success of treatment, it is a very important factor for clinicians and patients. In the comprehensive literature review made here, no study on the effect of different glide path file systems on intraoperative pain could be found. For this reason, it was aimed in the present study to compare the intraoperative pain levels of patients caused from using different glide path systems in creating the glide path before the root canal shaping the teeth with asymptomatic irreversible pulpitis. The null hypothesis of present study is that there would be no statistically significant difference between the compared groups.

MATERIALS AND METHODS

This randomly controlled and single-blind clinical study was approved by the Clinical Studies

Registration Center of Mustafa Kemal University (2018/182). The present study was carried out on the patients, who applied to the Department of Endodontics, Faculty of Dentistry, in Mustafa Kemal University between January 2018 and March 2018. A power calculation was conducted using G*Power 3.1 software (Heinrich Heine University, Dusseldorf, Germany). For analysis with $\alpha=0.05$ and 80% power, the sample size was calculated to be minimum 22 patients in order to determine the difference level between the groups accurately.

Patient Selection

88 patients (50 female and 38 male patients) aged between 18 and 69 years and diagnosed for asymptomatic irreversible pulpitis in 1st or 2nd mandibular molar tooth were involved in the present study (Table 1).

Table 1. Demographic and clinical characteristics of patients

Gender	Female	50
	Male	38
Age		40±13
Lower First Molar		47
Lower Second Molar		41
Total		88

The diagnosis of asymptomatic irreversible pulpitis is made based on increased response to cold test performed using Green Endo-ice (1.1,1.2-tetrafluoroetan, Hygenic Corp, Acron, OH, USA) and the presence of deep caries reaching at the pulp determined in radiographic imaging. The patients found to have fistula or abscess in the mouth and to have lesion determined in periapical radiography were excluded from the study. The patients were required to have not taken any analgesic or non-steroidal anti-inflammatory medication, which can alter their pain perception, in last 12 days. Those having history of analgesic or anti-inflammatory medication, maternity, systemic disease, allergy to any medication, calcified canal in relevant tooth, internal or external resorption, and teeth with unclosed apex were excluded from the study. The patients meeting the criteria were informed about the study, and the informed consent forms were

obtained from them. The study flow diagram is shown in Fig 1.

Randomization

The names of glide path systems were written on the papers, the papers were folded, and these papers were placed into a dark box, which cannot be seen from the outside. Before each treatment, the clinical assistant chose a paper randomly from the dark box and the glide path system written in that paper was applied to the patient.

Treatment Protocol

A single operator performed all of the treatment procedures. For the purpose of anesthesia, the inferior alveolar nerve blockage was achieved using 1.8% Articaine with 1:100,000 epinephrine (Ultracaine D-S Forte; Aventis, Istanbul, Turkey), and then rubber-dam was placed on the tooth.

Before opening the entrance cavity, using cold or vitality test checked the effectiveness of anesthesia and, when necessary, the intraligamentary support anesthesia was applied. By observing the blood coming from pulp when the entrance cavity was opened, the vitality of tooth was confirmed. The working length was measurement using Root ZX II apex finder (J Morita Corp, Kyoto, Japan) by entering the mesiobuccal and mesiolingual canals with #10 K-type file. The measurement result was confirmed by using periapical radiography, and the working length was set to be 0.5mm shorter than the radiographic apex. Since reaching at the apical is more difficult when compared to distal canal, the mesiobuccal and mesiolingual canals were preferred in the present study.

RP group: R-pilot file (12.5, .04) was operated at the predetermined working length together with the instructions of manufacturer in ‘Reciproc All’ settings of the endodontic motor (Silver Reciproc; VDW, Munich, Germany).

WOG G group: WaveOne Gold Glider (17, variable taper) file was operated at the predetermined working length in “WaveOne All” setting of the endodontic motor.

CONSORT 2010 Flow Diagram

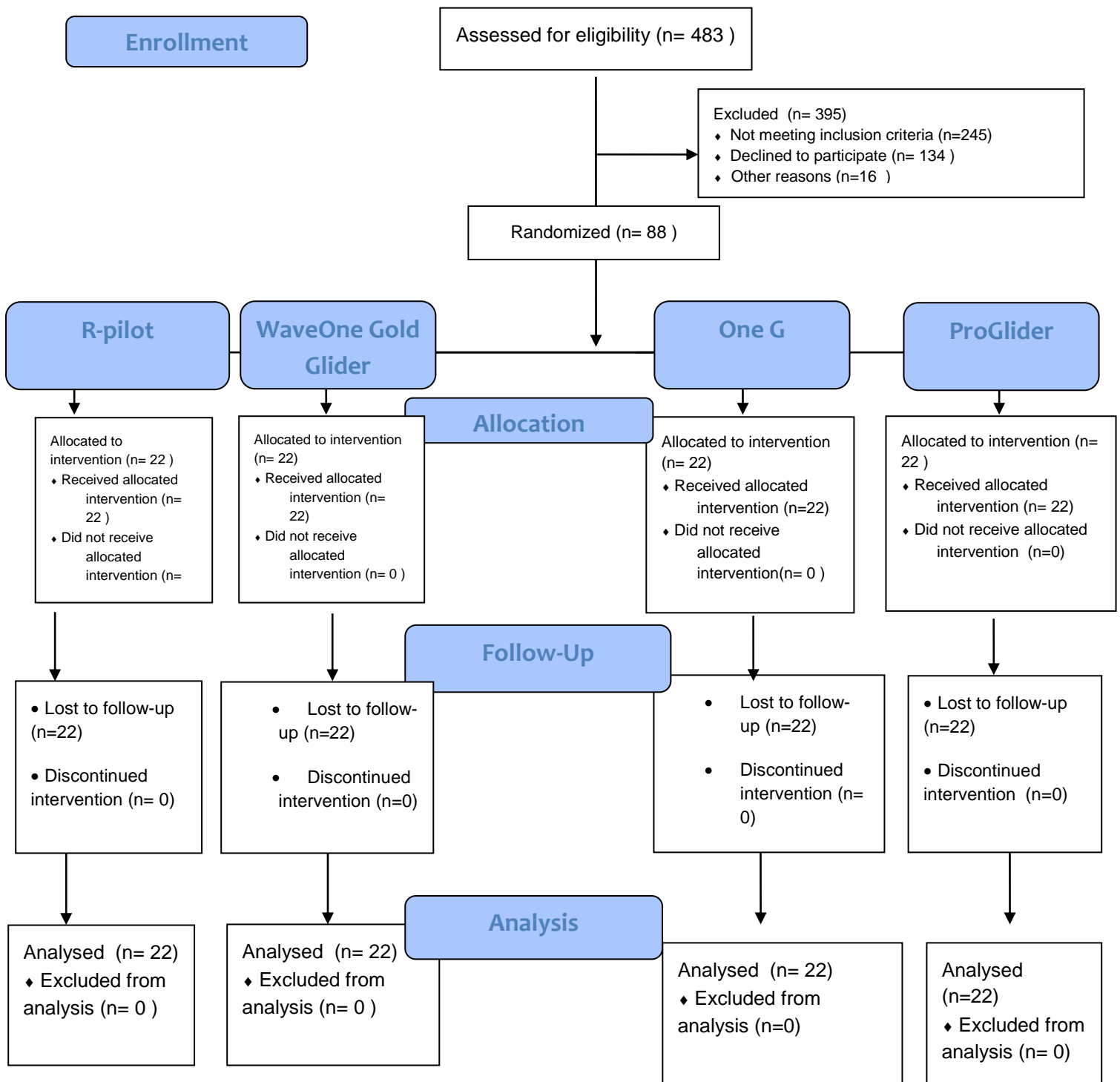


Figure 1. A flow diagram of the study design according to the CONSORT statement

OG group: OG (14, .03) instruments were operated according to the manufacturer's instructions. The OG instrument was used with same motor in continuous rotation at 300 rpm, 1.2 N cm torque.

PG group: ProGlider (16, variable taper) file was operated together with the same device with OG group at 300 rpm and 5 Ncm in continuous rotational movement.

In all the groups, the patients were asked to specify the pain level by using Visual Analogue Scale (VAS). In this scale, the level of pain is specified by using numbers between 0 and 10; no pain (0), mild pain (1-3), moderate pain (4-6) and severe pain (7-10). In each file group, the patients were asked to specify the level of pain for the mesiobuccal and mesiolingual canals separately. The average of two values reported by the patient was taken and then accepted as VAS value.

Statistical Analysis

The data, which were collected, were analyzed using SPSS 20.0 version (SPSS Inc., Chicago, IL). The normality of variables' distribution was tested using Shapiro-Wilk test, and it was determined that the distribution of data was not normal. In order to compare the pain between the groups, non-parametrical Kruskal-Wallis and Mann-Whitney U analysis tests were utilized (p< 0.05).

RESULTS

88 of 110 patients meeting the inclusion criteria of the present study were involved. All the data were collected from the patients in written and signed for right after the treatment, and the statistical analysis was performed. No data loss occurred during collecting the data from patients. Given the demographical data of patients, no statistically significant difference was observed (p>.05).

In the present study, in which the effect of different glide path files on the intraoperative pain, it was determined that the lowest intraoperative pain level was observed in PG (Table 2).

Table 2. Median and standard deviations of groups. Different superscript letter in the same column indicate statistically significant difference (p<0.05)

Glide Path Files	n	Median	Minimum	Maximum	Standart Deviation
Grup RP	22	2.0000 ^a	1.00	5.00	.95346
Grup WG	22	3.0000 ^a	.00	4.00	1.01183
Grup OG	22	2.0000 ^{ab}	1.00	3.00	.63960
Grup PG	22	1.5000 ^b	.00	3.00	.80178

Statistically significant differences were observed between PG and RP, and between PG and WOG G groups (p<0.05). There were no statistically significant differences between RP and WOG G groups, and between OG-PG groups (p<0.05).

DISCUSSION

The main objective of root canal preparation is to protect the original canal configuration, to remove the debris in the root canal, and to shape the canal. Preparation of the glide path, which is the first step of root canal preparation, allows for an understanding the original canal anatomy, renders the canal patent to receive rotary files, and enables a more effective and safer action during root canal shaping.¹⁵

It is known that preparing the glide path increases the efficiency of files to be used in preparation and decreases the occurrence of transportation and ledge formation, frequency of strip perforation, incidence of the fractured NiTi instrument.¹⁶ Moreover, when compared to the manual files, the NiTi glide path files were reported to decrease the preparation duration and better protect the root canal anatomy.¹⁷

It was reported that different file systems used in preparation caused the extrusion of infected debris form apex this might cause acute inflammatory response.¹⁸ The selection of file systems (type, number, and working principle of files) is an important factor since the transportation of debris from debris to periapical tissues might cause postoperative pain.^{19,20}

One of the fundamental concerns in studies carried out on pain is the subjective nature of this

evaluation. Every individual has his/her own pain threshold that is different from that of others. In evaluating the postoperative and intraoperative pain, it is important for the questions to be completely understood by the patients and easily interpreted by the researchers.²¹ For this reason, the intraoperative pain level was determined by VAS method, which is a reliable and valid method used widely in endodontic literature.⁶ In order to standardize the measurement values to be obtained, the mesial canals of mandibular molar teeth, which have morphologically similar root canals, were preferred.²¹

RP, WOG G, OG, and PG are the single-file systems working with endodontic motor by using different kinematics. When compared to manual files, these systems were developed in order to simplify and accelerate the procedures of preparing the glide path.³ Many studies^{8,11,22} in the literature of endodontics examine the postoperative pain feeling of patients. Besides that, it is known that the patients, who will receive endodontic treatment, will relate the fear of pain not to the period after the treatment but the pain, which they will feel during the root canal treatment.⁴

According to the present study carried out on assessing the effects of different glide path files on intraoperative pain, it was observed that all of the glide path files caused intraoperative pain. For this reason, the null hypothesis of present study was rejected. In the comprehensive literature review, it was determined that, after shaping the root canals by using the different file systems, the rotational movement caused more postoperative pain shaping when compared to the reciprocal movement, and that this pain is related to the apical extrusion.^{19,23, 24} Since there is no similar study in the literature, which was carried out on the effect of using glide path on intraoperative pain, the results of present study cannot be compared to the results of other studies.

In their study on evaluating the demographical characteristics of patients on intraoperative pain, Kayaoğlu *et al.*⁵ reported that the demographical factors and the presence of preoperative pain are the determinant factors in

intraoperative pain. Given the results of patients' demographical characteristics in the present study, no significant difference was observed between the groups.

During the reciprocal movement, the tip of file passes through the dentine by cutting it with its rotation in counterclockwise direction, and then it runs in clockwise direction in order to set the instrument free.⁷ The rotary instruments operate based on the asymmetrical rotary movement. The center of asymmetrical rotary instruments is positioned off-center relative to the instrument's central axis of rotation. During the rotational movement, the mechanical movement wave runs through the length of working part of instrument, and the objective here is to minimize the contact between file and dentin. Thus, when compared to the reciprocal systems, the rotary systems have the advantage of the decrease in postoperative complications by enabling the removal of lower amount of debris from the apical.²⁵ In previous studies^{18,26} reported that the ProGlider had the least extrusion of debris among the other rotary NiTi instrument groups. They analysed the geometric differences resulted in the difference of debris extrusion. In the present study, it was determined that RP and WOG G glide path files used with reciprocal movement caused more intraoperative pain, and that the minimum intraoperative pain was found with PG files. This could be explained by geometric differences of glide path instrument and kinematics.

In the literature, Gomes *et al.*²¹ carried out a study on analyzing the effects of files on intraoperative discomfort. In their study, in which they compared the effects of multi-file rotary system (Mtwo) and single-file reciprocal (Reciproc) system on the intraoperative discomfort, Gomes *et al.*²¹ found no statistically significant difference between the file systems. As the reason of this, the authors emphasized that the disadvantage of multi-file system was the length of preparation duration and the disadvantage of reciprocal movement was the dependence of file system on the movement kinematics. In the present study, the effects of different glide path

files consisting of single file and working on rotational and reciprocal movement on the intraoperative pain were examined. In a different study, the effects of root canal shaping methods on the intraoperative pain were compared, and it was reported that step-back method was applied with stainless-steel manual files, whereas crown-down method was implemented in shaping the root canals by using NiTi rotary files. According to the results of present study, the intraoperative pain level of patients, who were undergone root canal shaping by using rotary instruments, were higher than the other group.⁶

All glide path files used in the present study were observed to cause intraoperative pain at various levels. Since there is no study, with which the results of present study can be compared, it is though that the reason for difference between the groups in present study might be the cross-section, design, taper, and operation kinematics of the files used here.

CONCLUSIONS

Within the limitation of present study, it was observed that all of the file systems used in creating the glide path in root canal treatment caused intraoperative pain. The minimum intraoperative pain was found with PG glide path file, whereas RP and WOG G caused higher level of intraoperative pain.

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The authors deny any conflicts of interest related to this study.

CONFLICTS OF INTEREST

None

Kök Kanal Şekillendirilmesi Sırasında Kullanılan Farklı Glide Path Eğelerinin İşlem Sırasındaki Ağrı Üzerine Etkisinin Değerlendirilmesi: Bir Randomize Klinik Çalışma

ÖZ

Amaç: Bu çalışmanın amacı, asemptomatik irreversible pulpitisli mandibular molar dişlerde kök kanal şekillendirilmesi öncesinde farklı glide path eğeleri ile oluşturulan kayma yolunun hastalarda oluşturduğu işlem sırasındaki ağrı düzeylerini karşılaştırmaktır. **Gereç ve Yöntemler:** Çalışmaya

asemptomatik irreversible pulpitis teşhisi koyulmuş mandibular molar diş sahipleri 88 hasta (50 kadın, 38 erkek) dahil edilmiştir. Dişler kullanılacak glide path eğesine göre; R-pilot (RP), WaveOne Gold Glider (WOG G), One G (OG), Proglider (PG) olmak üzere rastgele 4 gruba ayrılmıştır. Tüm gruplarda hastaların işlem sırasında hissettiği ağrı seviyelerini sormak amacıyla Görsel Analog Skala (VAS) kullanılmıştır. Gruplar arasında tedavi sırasında hissedilen ağrıyı karşılaştırmak için non-parametrik Mann-Whitney U ve Kruskal-Wallis analizi testleri $p < 0,05$ anlamlılık düzeyinde kullanılmıştır. **Bulgular:** Yapılan değerlendirmeler sonucunda en düşük işlem sırasındaki ağrı seviyesi PG grubunda ölçülürken, onu sırasıyla OG, RP, WOG G takip etmektedir. PG-RP ile PG-WOG G grupları arasında istatistiksel olarak anlamlı farklılık gözlenmiştir ($p < 0,05$). **Sonuçlar:** Kök kanal tedavisinde glide path oluşturulması sırasında çalışmamızda kullandığımız eğe sistemlerinin tümünün işlem sırasında ağrıya neden olduğu gözlenmiştir. İşlem sırasında oluşan ağrı en az ProGlider glide path eğesinde gözlenirken, resiprokal hareket ile çalışan RP ve WG glide path eğelerinin daha fazla işlem sırasında ağrı gösterdiği belirlenmiştir. **Anahtar Kelimeler:** Ağrı, endodonti, kök kanal tedavisi.

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