



Evaluation of Mesiodens Prevalence, Characteristics, and Complications on Panoramic Radiographs

Meziodens Prevelansı, Özellikleri ve Komplikasyonlarının Panoramik Radyograflar ile Değerlendirilmesi

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ABSTRACT

Objective: Hyperdontia is when the number of teeth in the dental arch is higher than normal, and the plus teeth that form this excess are called supernumerary teeth. The supernumerary teeth located in the maxillary and mandibular anterior region are called mesiodens. The mesiodens is the most common supernumerary tooth in the jaws. The aim of this study is to investigate the incidence, characteristics and complications of mesiodens in panoramic radiographs taken for various diagnostic reasons. **Material and Methods:** In this study, panoramic radiographs of 10000 patients aged 16-64 years, taken under ideal conditions for various diagnostic purposes in our clinic, were examined by two observers and the presence/absence of mesiodens, the number, localization, position, shape, eruption status and the presence/absence of complications were recorded. SPSS V.21 software (IBM Corp., Armonk, NY, USA) was used for data analysis. **Results:** In the examined sample of 10,000 individuals, mesiodens was detected in 52 cases, with a prevalence of 0.52%. The majority of mesiodens were found in a horizontal position, followed by vertical and inverted positions, respectively. The most common type of mesiodens observed was the conical type, followed by canine-like and incisor-like types. Among the complications detected, the most frequent was axial rotation or inclination of the permanent incisors. **Conclusion:** Mesiodens is the most common type of supernumerary tooth in the permanent dentition. In order to prevent malocclusions and complications at an early stage, dentists should perform a detailed examination during clinical and radiological examination.

Keywords: *Hyperdontia, Mesiodens, Panoramic radiography, Supernumerary tooth*

ÖZ

Amaç: Hiperdonti, diş arkındaki diş sayısının normalden fazla olması durumudur ve bu fazlalığı oluşturan dişlere süpernumerer dişler adı verilmektedir. Maksiller ve mandibular anterior bölgede yer alan fazla sayıdaki dişlere ise meziodens denir. Meziodens çenelerde en sık görülen süpernumerer diştir. Bu çalışmanın amacı çeşitli tanısal nedenlerle çekilen panoramik radyograflarda meziodensin görülme sıklığını, özelliklerini ve komplikasyonlarını araştırmaktır. **Gereç ve Yöntemler:** Bu çalışmada kliniğimizde çeşitli tanı amaçlı ideal koşullarda çekilen 16-64 yaş arası 10.000 hastanın panoramik radyografları iki gözlemci tarafından incelenerek meziodens varlığı/yokluğu, sayısı, lokalizasyonu, pozisyonu, şekli, sürme durumu ve komplikasyon varlığı/yokluğu kaydedildi. Veri analizi için SPSS V.21 yazılımı (IBM Corp., Armonk, NY, ABD) kullanıldı. **Bulgular:** İncelenen 10,000 kişilik örnekleme, 52 bireyde meziodens tespit edilmiş olup, prevalans %0,52 olarak belirlenmiştir. Meziodenslerin büyük bir kısmı yatay konumda bulunurken, bunu sırasıyla dikey ve ters konumlar takip etmiştir. En sık rastlanan meziodens tipi konik tip olup, bunu kanin diş benzeri ve kesici diş benzeri tipler izlemiştir. Saptanan komplikasyonlar arasında en yaygın olanı, daimi kesici dişlerde aksel rotasyon veya eğim olarak kaydedilmiştir. **Sonuç:** Meziodens, daimi dişlenme döneminde en sık görülen süpernumerer diş türüdür. Maloklüzyon ve komplikasyonları erken dönemde önlemek için diş hekimlerinin klinik ve radyolojik muayene sırasında detaylı muayene yapmaları gerekmektedir.

Anahtar Kelimeler: *Hiperdonti, Meziodens, Panoramik radyografi, Sürnümere diş*

INTRODUCTION

Developmental dental anomalies, which occur as a result of disorders in different developmental stages of teeth, are an important group among dental morphological variations. Abnormalities in tooth shape, size and structure are caused by morphodifferentiation stage abnormalities, while tooth rotation, impaction and ectopic eruption are caused by developmental abnormalities in the eruption stage (1). Hyperdontia, one of the dental anomalies, is defined as the number of teeth being more than normal and these extra teeth are called supernumerary teeth (2). Supernumerary teeth can be found in both jaws, single or multiple, unilateral or bilateral. They may be observed in patients without any systemic disease or syndrome and may be associated with various developmental diseases and syndromes such as Gardner syndrome, Cleidocranial Dysostosis, Ehlers-Danlos syndrome, Fabry-Anderson syndrome (3-5).

Supernumerary teeth have different names according to their localization. Those located in the region of the molars are called paramolars, those located distal to the third molar are called distomolars, and those located in the maxillary and mandibular anterior region are called mesiodens (6). The most common type is mesiodens, almost always in the maxilla but rarely in the mandible (7). Supernumerary teeth usually occur during permanent dentition and rarely affect deciduous dentition (8). The prevalence of mesiodens has been reported as 0.3-0.8% in deciduous teeth and 0.1-3.8% in permanent teeth (6, 9) (Table 1). Males are affected about twice as often as females (10). Morphologically, the mesiodens are usually conical, but can also be tubercular or normal tooth-shaped (supplemental) (11-13). Although the exact etiology is unknown, the theory that it is caused by hyperactivity of the dental lamina residues is now widely accepted (14).

Usually, asymptomatic impacted mesiodens are detected incidentally during routine clinical and radiographic examination. They can lead to complications such as tooth eruption disorders, midline diastema, axial rotation or inclination of permanent incisors, resorption of adjacent teeth and development of dentigerous cysts (11, 15). Radiographic examinations are of great importance in the diagnosis and treatment of these complications and in the differential diagnosis of supernumerary teeth. Panoramic radiographs, which are frequently used in routine dental examinations in the diagnosis of mesiodens, can be used in the initial stage of the diagnosis, but are insufficient in some cases (8). Considering the fact that supernumerary teeth usually remain impacted and cause various pathologies, it is suggested to use cone beam computed tomography (CBCT), which is one of the advanced imaging methods that enables three-dimensional evaluation of anatomical structures and pathologies (16).

The aim of this study was to investigate the incidence, characteristics and complications of mesiodens in panoramic radiographs taken for various diagnostic reasons in the Turkish population.

Table 1: Mesiodens Prevalence Studies Conducted in Different Populations

Population	Authors	Year	Individuals	Prevalence (%)
Finnish	Jarvinen and Lehtinen(17)	1981	1141	0.4
Hispanic	Kaler(18)	1988	Not available	2.2
Norwegians	Hurlen and Humerfelt(19)	1985	63.029	1.43
Chinese	Huang et al(20)	1992	543	7.8
Japanese	Miyoshi et al(21)	2000	8122	0.05
Saudi	Osuji and Hardie(22)	2002	1878	0.85
Mexican	Salcido-Garcia et al(23)	2004	2241	2.1
Turkish	Gunduz et al(24)	2008	23.000	0.3
Indian	Nagaveni et al(25)	2010	2500	1
Thai	Kositbowornchai et al(26)	2010	570	1.05
Iranian	Ghabanchi et al(27)	2010	414	0.97
Turkish	Kazancı et al(28)	2011	3351	0.3
Indian	Khandelwal et al(29)	2011	3896	3.18
Indian	Nayak and Nayak(30)	2011	500	0.6
Turkish	Colak et al(31)	2013	11.256	0.13
Indian	Patil et al(32)	2013	4133	1.4
Turkish	Göksel et al(33)	2018	5000	5,04
Turkish	Aren et al(34)	2018	58142	0.01
Indian	Pal et al(35)	2019	6332	0.69
Iraqi	Abd Al-Aaloosi(36)	2020	814	0.49
Nepali	Karmacharya and Kafle(37)	2021	1194	2.84
Indian	Zafar et al(38)	2021	340	8.5
Turkish	Tankuş and Bingül(39)	2022	8002	0.37
Turkish	Kızılcı and Cihangir(40)	2022	54.895	0.58
Indian	Panda et al(41)	2023	2312	1.81

MATERIAL and METHOD

The present study was approved by the Research Ethics Committee at Necmettin Erbakan University, Faculty of Dentistry (Approval Date: 23.02.2023, Approval Number: 2023/263) and adhered strictly to ethical guidelines and relevant protocols. The study exclusively utilized panoramic radiographic images, renowned for their diagnostic efficacy, acquired under optimal conditions. The imaging dataset comprised 10000 subjects of both genders, ranging from 16 to 60 years, who sought dental care at Necmettin Erbakan University, Faculty of Dentistry, Department of Oral and Maxillofacial Radiology between June 2022 and February 2023 for diverse dental concerns. All panoramic radiographs were captured by a consistent team of technicians under ideal circumstances. The imaging equipment employed included the Morita Veraviewepocs 2D device (J Morita MFG Corp., Kyoto, Japan) and the NewTom GiANO HR 2D device (NewTom GiANO HR, Italy). The radiographs were acquired at 70 kVp, 10 mA, and 10 s for the Morita device, while the NewTom device utilized parameters of 77 kVp, 6 mA, and 12.7 s, aligning with the recommended protocols specified by the respective manufacturers.

Some criteria were considered when selecting panoramic images. The inclusion criteria were as follows; panoramic radiographs of patients between 16-64 years of age, taken under ideal conditions for various diagnostic purposes, with optimal diagnostic competence. The exclusion criteria are as follows; history of trauma and/or surgery in the maxillofacial region, patients with developmental anomalies/pathologies in the maxillofacial region, patients with any syndrome or disease affecting odontogenesis and eruption, records with artifacts that would prevent the examination of the image.

Within the scope of the study; the images were classified and recorded after the consensus of two radiologists (BÖ and AA). Age and gender information of the examined patients, presence/absence of mesiodens, number and localization of the mesiodens (midline/right of midline/left of midline), position of the mesiodens (vertical/inverted/horizontal), shape of mesiodens (conical/incisor-like/canine-like), eruption status (erupted/non-erupted), presence/absence of complications (midline

diastema/axial rotation or inclination of permanent teeth/resorption/cystic lesion of permanent teeth) were recorded.

Statistical Analysis

The project was carried out in two parts: the first part was the collection and organization of the data set; the second part was the statistical evaluation of the collected data. SPSS V.21 software (IBM Corp., Armonk, NY, USA) was used for data analysis. Descriptive statistics (mean, standard deviation) were calculated for all parameters in the study. The examination of potential disparities in the distribution of dental anomalies, stratified by gender, was undertaken through the application of the Pearson Chi-squared test. Statistical significance was established at a threshold of $p < 0.05$.

RESULTS

This study evaluated 10000 patients (5623 females, 4377 males). The females and male patients had a mean age of 32.12 ± 11.91 years, ranging from 16-60, and 33.01 ± 12.08 years, ranging from 16-64, respectively. Males had more mesiodens ($n=33$) than females ($n=19$). The prevalence of mesiodens for males and females was 0.75%, and 0.33%, respectively (Table 2). 53 mesiodens were found in 52 patients out of 10000 subjects examined, thus the prevalence was 0.52%. Just in one case had two mesiodens (Figure 1). The difference between gender was statistically significant using Chi square test ($p=0.001$) (Table 2).

Table 2: The Frequency of Mesiodens According to Gender

Gender	n	Mesiodens	Prevalence(%)	χ^2	p value
Female	5623	19	0.33	11.640	0.001*
Male	4377	33	0.75		
Total	10000	52	0.52		

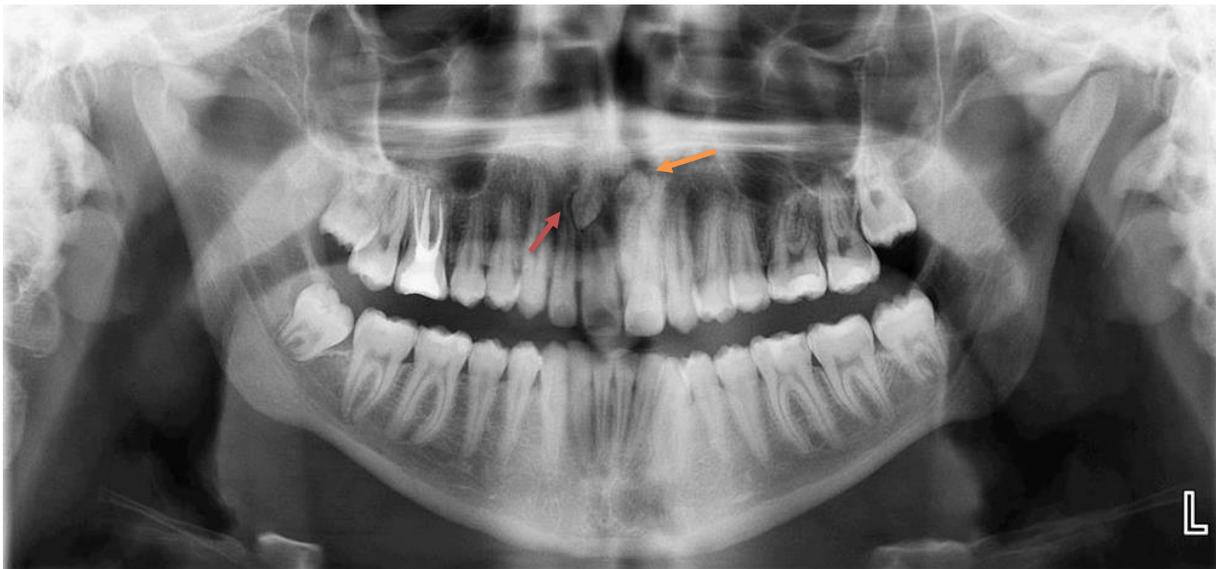


Figure 1: A Panoramic Radiograph Depicting A Case Involving The Presence of Two Mesiodentes. Red Arrow Shows the Right Mesiodens and Orange Arrow Shows the Left Mesiodens

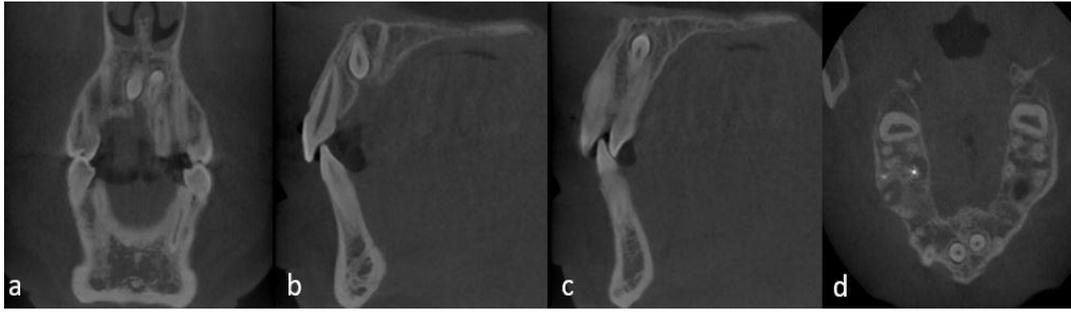


Figure 2: CBCT Images of Mesiodentes **A.** Coronal Vision of the Mesiodentes **B.** Sagittal Vision of the Right Mesiodens **C.** Sagittal Vision of the Left Mesiodens **D.** Axial Vision of the Mesiodentes

Position of Mesiodens

Of the 53 mesiodens, 52 (98.1%) were fully impacted, 1 (1.9%) was fully erupted (Table 3). Most of them were found in a horizontal position (37.7%) (Figure 3), followed by a vertical position (32.1%), and inverted position (30.2%) (Figure 1) (Table 3).

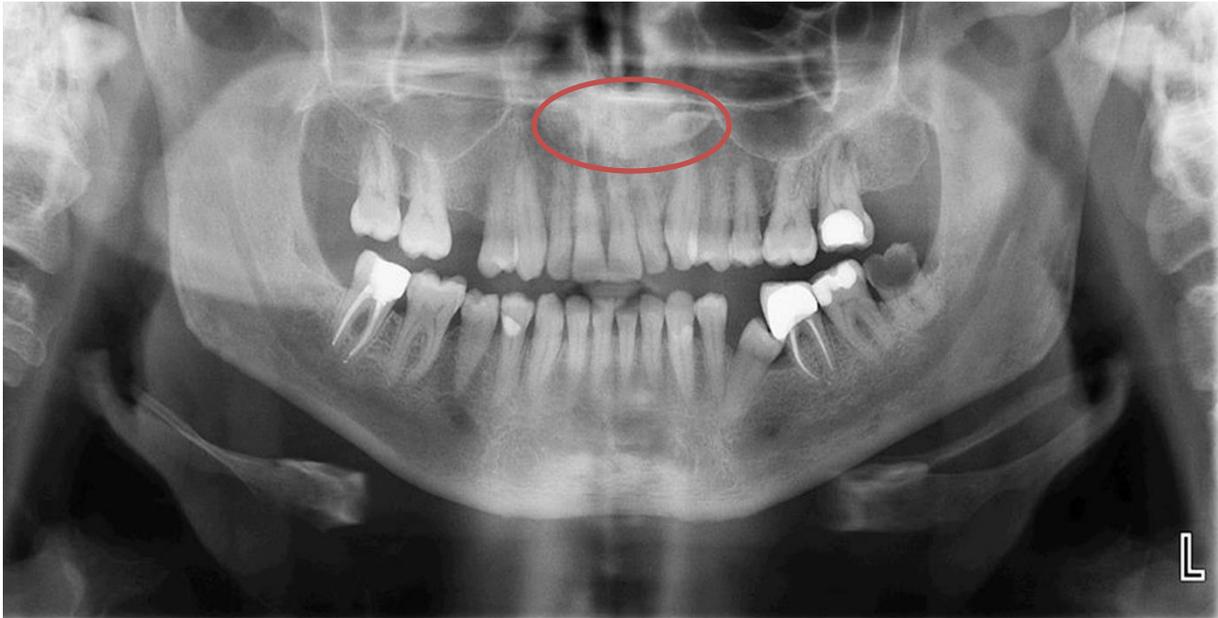


Figure 2: A Panoramic Radiographic Depiction Illustrating The Horizontal Position of The Mesiodens (Red Circle)

Shape of Mesiodens

The most commonly seen type of mesiodens was conical (64.2%) followed by canine-like (28.3%), and incisor-like (7.5%) (Table 3).

Complications Caused by Mesiodens

Axial rotation or inclination of permanent incisors (9.6%) was observed as most common complication caused by mesiodens followed by cystic change (%7.7), resorption of adjacent teeth (%5.7), and midline diastema (%3.9). No complications were detected in the other 38 patients (%73.1) (Table 3).

Table 3: Eruption Status, Position, Shape, and Complications of Mesiodens

Category	n	%
Eruption Status		
Non-erupted	52	98.1
Fully erupted	1	1.9
Position of Mesiodens		
Vertical	17	32.1
Inverted	16	30.2
Horizontal	20	37.7
Shape of Mesiodens		
Conical	34	64.2
Canine-like	15	28.3
Incisor-like	4	7.5
Complications Caused by Mesiodens		
Axial rotation/inclination of permanent incisors	5	9.6
Cystic change	4	7.7
Resorption of adjacent teeth	3	5.7
Midline diastema	2	3.9
None	38	73.1

DISCUSSION and CONCLUSION

Mesiodens is the most common dental anomaly that affects permanent dentition, but is rarely seen in deciduous dentition (42). To date, many studies on its prevalence in different populations have been published (Table 1). In studies on Turkish generation; the prevalence of mesiodens was found as 0.3% by Gunduz et al. (24), 0.3% by Kazancı et al. (28), 0.13% by Colak et al. (31) and 5.04% by Goksel et al (33). In our study, we found the prevalence in the Turkish population to be 0.52%. Mesiodens is two times more frequently seen in men than in women (43, 44). In our study, more mesiodens were observed in males (33) than females (19), supporting this rate. The prevalence of mesiodens for females and males was 0.33%, and 0.75%, respectively. Studies in the literature have found that most mesiodens are impacted (24, 45). In this study, 52 (98.1%) of 53 mesiodens were fully impacted and 1 (1.95%) was fully erupted.

Although the etiology of mesiodens is not clearly known, there are some theories put forward (46). These theories include environmental (47) and genetic (48) factors, dichotomy of the tooth bud, and hyperactivity of the dental lamina (49). It can also be seen together with syndromic conditions such as Cleidocranial Dysplasia, cleft lip and palate and Gardner syndrome (50). The most accepted view among these is the theory of hyperactivity of the dental lamina (51). In the literature, mesiodens are mostly found in vertical position, but they can also be seen horizontal or inverted (24, 42). In our study, unlike the literature, horizontal position was the most common with a rate of 37.7%, followed by vertical and inverted position. When supernumerary teeth are classified, they are often categorized according to their morphology (52). The eumorphic type of mesiodens is one that resembles a tooth of normal size and shape, whereas the dysmorphic type exists in a variety of shapes and sizes (53, 54). Many studies have reported that the most common type of mesiodens was conical (24, 44, 55). In our study, we found that the most common type was conical, followed by canine-like and incisor-like.

Various complications can occur in the presence of mesiodens; including impaction of permanent incisors, delayed eruption pattern, crowding, spacing, alteration in the path of eruption of permanent incisors, median diastema, resorption or rotation of adjacent teeth, cystic transformations and other pathological problems (56, 57). In this study, no complications were seen in 38 patients (73.1%); the most common complication was axial rotation or inclination of the permanent incisors (9.62%), followed by cystic change (7.7%), resorption of adjacent teeth (5.7%), and midline diastema (3.9%). The mesiodens may occur singly or in multiple forms, with a single mesiodens formation being more common. Multiple mesiodens formation is rare except in syndromic individuals. In no study has

more than three mesiodens been observed (28, 32). In our study, two mesiodens formations were observed in 3 different patients and three or more than three formations were not observed. Patients with two mesiodens have no known systemic disease or syndrome.

Since supernumerary teeth are usually asymptomatic, they may be detected incidentally during radiographic examination. For the necessary diagnosis and treatment, detailed anamnesis, clinical and radiographic examination should be performed (58). Early diagnosis of mesiodens can prevent the occurrence of malocclusion and aesthetic problems or help reduce the problems that will arise (59). In cases of delayed eruption of adjacent teeth or dental asymmetry, the presence of mesiodens should be investigated (60). Panoramic radiography technique, which is used as a routine imaging tool, often provides information about supernumerary teeth and their complications, but provides limited evidence due to two-dimensional imaging (8). One of the most important limitations of our study is that mesiodens examination was performed on panoramic radiographs. In addition to this technique, occlusal radiography and periapical radiography techniques can also be used. The position of the mesiodens can be evaluated with the parallax technique known as the horizontal tube shifting method (61). CBCT is a method used to provide a three-dimensional and detailed examination of the presence of mesiodens, its position, shape, number and complications, if any (62).

There are two options in the treatment of mesiodens: surgical extraction or follow-up. A comprehensive clinical and radiological examination is required when making this decision (63). If asymptomatic and unerupted mesiodens do not cause any complications, they can be kept under observation with periodic follow-up. However, if the patient's aesthetics are negatively affected, if they cause complications by damaging anatomical structures in their area or if they interfere with the orthodontic treatment plan, they should be removed surgically (64). Although our study provides valuable literature information in terms of examining the prevalence of mesiodens and its complications in the Turkish population, there is a need for comprehensive multicenter studies involving more patients and including three-dimensional examination.

LIMITATIONS

One limitation of this study is the use of panoramic radiographs as the primary imaging modality for evaluating mesiodens. Although panoramic radiography is commonly employed in clinical settings due to its accessibility and cost-effectiveness, its diagnostic accuracy in detecting external root resorption in impacted teeth is inferior to that of cone-beam computed tomography (CBCT). Consequently, the prevalence of external root resorption may have been underestimated in this analysis. Future research employing CBCT imaging would provide a more precise evaluation of external root resorption and other related complications, thereby enhancing the validity of the findings.

Mesiodens is the most common type of supernumerary tooth in permanent dentition. Usually, asymptomatic mesiodens are detected during routine examination. Therefore, in order to prevent malocclusions and complications at an early stage, dentists should perform a detailed examination in clinical and radiological examination and, if necessary, resort to advanced imaging methods.

Declaration of Ethical Code: In this study, we undertake that all the rules required to be followed within the scope of the "Higher Education Institutions Scientific Research and Publication Ethics Directive" are complied with, and that none of the actions stated under the heading "Actions Against Scientific Research and Publication Ethics" are not carried out.

The study was conducted in accordance with the Declaration of Helsinki and ethical approval was received from the Necmettin Erbakan University Faculty of Dentistry Non-Drug and Non-Medical Device Research Ethics Committee (Date: 23.02.2023, Decision number: 2023/263).

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