EDEN BAYSAL DENTAL TRAUMA INDEX MANUAL

Including Modified Version With Figures

Prof.Dr. Ece EDEN
Ege University, School of Dentistry,
Department of Pedodontics
Izmir- Turkey

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CONTENT

PREFACE

Dental injuries are one of the most important issues that require urgent intervention in dentistry. There are many classifications related to dental trauma in the dental literature. However, these classifications do not ensure that the injury is categorized properly. On the other hand, an index that is defined and used as a sign or measure of an entity may be used to record many variables related to health and dentistry. Interestingly, although many incdicies were used for dental caries or periodontal health, there was no index about dental trauma.

In November 2018, after my lecture on the subject, 4th grade student Mehmet Baysal came to me with questions that he had about this topic. After a through evaluation of the literature, we discussed how we can improve the recordings and structured an index. Then we worked on the validity of this index which was aproved by many well-known dental traumatologysts.

Eden Baysal Dental Trauma Index has become the first index developed on dental trauma and we used our last names to name it. This manual aims to describe the index and guide the practitioners, researchers and policy makers on its use.

Ece Eden
İzmir 2020

EDEN BAYSAL DENTAL TRAUMA INDEX

Definition

'Eden Baysal Dental Trauma Index' is a five-digit index that defines the type of the injury of the hard-dental tissues (crown in relation with the pulp and root), periodontal ligament, alveolar process and also records the maturity of apex. FDI tooth code should be used in parenthesis to indicate the injured tooth.

Following FDI tooth code in paranthesis, the index contains five digits. It can be used in both dentitions.

The index intends to be used in recording the dental trauma cases as well as giving suggestions on treatment since the maturity of apex is one of the most important factor in treatment decision.

The index is suitable for electronic data collection and its simplicity provides easy handling. The computer registered index can easily be transferred to excel sheets and evaluated statistically. It gives us the possibility to record 1008 different scenarios.

A study that used e-Delphi consensus method was conducted for the face and content validity of the index and published (1). Well-known 15 experts from Australia, Brazil, Chile, Denmark, France, Sweden, Ireland, Japan, Turkey, UK and USA on dental traumatology has worked on the validation process. Then 10 researchers from Egypt, Indonesia, Kenya, Turkey and USA reported feedback on the validated index. It is important to note that the researchers that were included in the study were not only from different countries that almost represented the world but were from different specialities as well since the topic is of interest to all practitioners especilly to pediatric dentists, endodontists, dental surgeons and periodontologists.

The experts agreed on the definiton of the index after one round and reached an agreement for the statements and wording of the codes in the second round with providing feedback on its user firendly nature. This was the introduction of the index to dental community (1).

The index intents to record traumatic dental injuries of affected tooth and provides information for treatment planning and may report data of the multiple injuries. Soft tissue injuries can also be included as superscript numbers but this is named as 'Modified Eden Baysal Dental Trauma Index' since the soft tissue injuries should be recorded on patient base. Both injuries of the gingiva and skin can be recorded. It is possible to record 259 056 different scenairos with this modification and the article is under construction.

This manual will provide fundamental information about the index and its modified version and aims to help dental professionals to use it effectively.

How to use 'Eden Baysal Dental Trauma Index'?

The affected tooth with the injury is indicated by the two-digit FDI numbering system in parenthesis. Therefore, the index can easily be used for both primary and permanent dentitions.

FDI coding as seen below is used to represent the tooth involved:

Permanent dentition

| 18-17-16-15-14-13-12-11 | 21-22-23-24-25-26-27-28 |
| 48-47-46-45-44-43-42-41 | 31-32-33-34-35-36-37-38 |

Primary dentition

| 55-54-53-52-51 | 61-62-63-64-65 |
| 85-84-83-82-81 | 71-72-73-74-75 |

The index contains five digits following FDI tooth code. The first two digits contain numbers starting from 0, the third digit contains capital letters, the fourth digit contains lower case first letters and the fifth digit contains plus or minus sign. Intraoral and radiographic findings are used to record the cases with the index. The coding of the traumatic injury is divided into 3 groups as injuries of the crown (1st digit), injuries of the root (2nd dgit) and the luxation injuries (3rd digit).

The reader is referred to Andreasen Classification for definition of each traumatic injury that is used in the index with codes (2).

How to use 'Eden Baysal Dental Trauma Index'?

The 1st digit after the FDI tooth code stands for hard dental tissue injuries affecting the crown with information on its relation with the pulp and root. Intraoral clinical evaluation is used to gather information for proper coding. Numbers are used to categorize the injury in hierarchical order in relation to severity. The codes are as follows:

0= none

1= enamel fracture

2= enamel and dentin fracture= Uncomplicated crown fracture

3= enamel and dentin fracture including the pulp= Complicated crown fracture

4= enamel- dentin- cement fracture= Uncomplicated crown-root fracture

5= enamel- dentin- cement fracture including the pulp= Complicated crown-root fracture

2nd digit stands for hard dental tissue injury of the root indicating the location of the fracture line. Numbers are used to categorize the injury in hierarchical nature in relation to its position. The position of the fracture line in relation to the gingival margin defines the severity of the injury and impaired prognosis. In case of an oblique root fracture affecting more then one location on the root, the position of the fracture line close to the cervical region is recorded. The codes used in the second digit are as follows:

0= none

1= apical 1/3 root fracture

2= middle 1/3 root fracture

3= cervical 1/3 root fracture

3rd digit stands for periodontal ligament injuries (Luxation injuries). The type of the periodontal ligament injury that is present is indicated by its first letter written in capitals. First letters of the luxation injuries are used as follows:

N= None

C= Concussion

S= Subluxation

E= Extrusive Luxation- Extrusion

L= Lateral Luxation

I= Intrusive Luxation- Intrusion

A= Avulsion

4th digit stands for maturity of the apex.   Radiographic evaluation reveals the characteristics of the apex in both dentitions. In an immature apex, the root has thinner dentin walls, it may be short and the apical foramen is large. In a mature apex, the apical end of the root is completely formed and the periodontal membrane has a uniform width around the root and the apex. In primary dentition, physiological root resorption may be present. Therefore, 3 codes are used in this digit. Lower case first letters of the words defining the characteristics of the apex are used as below:

i = immature apex

m= mature apex

r= resorbed apex (physiological)

5th digit indicates presence or absence of a fracture of the alveolar process and expressed by plus (+) or minus (-) sign, respectively. It is important to note that the fracture should be related with the alveolar process only. The definition of the codes for this digit are as follows:

Plus sign (+) =   Presence of a fracture of the alveolar process

Minus sign (-) =   None-detectable alveolar process fracture

Proper treatment plan for a trauma patient is dependent on several factors that can be obtained with convenient diagnosis. The information gathered from the examination of affected dental tissues after a traumatic injury determine the treatment plan and long term prognosis.

Examination of a trauma patient includes firstly a through patient history that is followed by extraoral and intraoral evaluations. Intraoral examination of the patient will provide information on the injury of the crown in relation with the pulp and cement which can be coded as the first digit. Radiographical evaluation including orthopantomograph,

periapical and/or occlusal radiographs will further the assessment of the affected tissues. Periapical radiograph will give information on the injury of the root, the maturity of the apex. The accompanying bone injury may be detected by orthopantomograph. Cone beam tomography may be used in complicated cases.   The findings of the radiographical evaluation will be used in the following digits (digits 2, 3, 4 and 5) of the index respectively.

Table 1 shows the summary of the codes used in 'Eden Baysal Dental Trauma Index.' This simple table can be included in the patient record form to remind the clinician about the index codes and may enable the recording.

The coding used in the index is suitable for computer registration as well. This can be implemented as a drop down menu for each digit for eas of use.

Table 1: Summary of codes used in 'Eden Baysal Dental Trauma Index' (Illustrated by Alara Ayraç)

Number of tooth (FDI)	1st digit Crown Fracture	2nd digit Root Fracture	3rd digit Luxation Injury	4th digit Maturity of Apex	5th digit Alveolar process injury
	0 =none	0 =none	CAPITAL FIRST LETTERS	small first letters	+ or -
			N= None C= Concussion S= Subluxation E= Extrusive Luxation L= Lateral Luxation I= Intrusive Luxation A= Avulsion	i = immature apex m = mature apex r= resorbed apex	(+ sign) alveolar process injury (- sign) No alveolar process injury
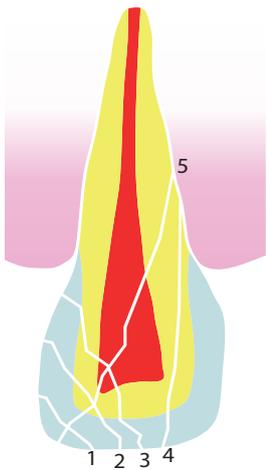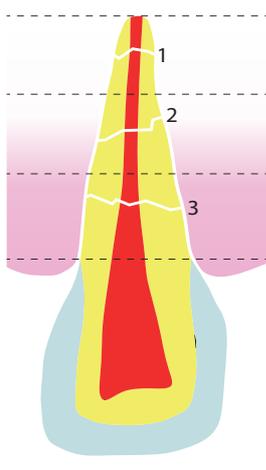
How to use 'Modified Eden Baysal Dental Trauma Index'?

Dental trauma not only affects the teeth and the neighboring dental hard tissues but may also damage the soft tissues extra- and/or intra- orally. The skin on the face and the lips may suffer from the impact. Gingiva, lingual or labial frenulum and the tongue may be injured with or without an accompanying hard dental tissue injury. Soft tissue injuries usually do not affect the prognosis of the injured tooth/teeth. Appropriate emergency treatment of the soft tissues on the first arrival to the health center is mostly adequate.

'Modified Eden Baysal Dental Trauma Index ' aims to record the soft tissue injuries on a patient base together with the information of injured tooth or teeth and alveolar process. Extraoral, intraoral and radiographic findings of the patient are used to record the cases with the modified version of the index. The characteristics of the injuries of the face or the gingiva are coded without indicating the location or the severity.

Soft tissue injuries affecting skin, lip and/or gingiva are recorded for each patient by adding superscript numbers outside the brackets containing the records of injured teeth and alveolar process recorded by 'Eden Baysal Dental Trauma Index'. Multiple soft tissue injuries should be written in ascending order separated by commas as superscript numbers.

Superscript numbers from 0 to 8 are used to record soft tissue injuries affecting skin, lip and/or gingiva following 5 digits of Eden Baysal Dental Trauma Index in brackets.
When multiple teeth are affected in a patient, all traumatized teeth will be recorded by 'Eden Baysal Dental Trauma Index' in brackets separated by commas and soft tissue codes will be added as superscript numbers after the bracket. When there is more than one type of soft tissue injury, the superscript numbers should be written in ascending order separated by commas.

Four different types of soft tissue injuries are coded for both skin/lip and gingiva/tongue. The total of nine codes starts with '0' indicated no injury and followed by

extroral soft tissue injuries (1 to 4). The codes from 5 to 8 are used to record the intra-oral soft tissue injuries affecting gingiva, frenulum or the tongue.

The codes used to record soft tissue injuries as superscript numbers for Modified Eden Baysal Dental Trauma Index are as follows:

0= none

1= Skin / Lip abrasion

2= Skin / Lip laceration

3= Skin / Lip contusion

4= Skin / Lip avulsion

5= Gingival abrasion

6= Gingival laceration

7= Gingival contusion

8= Gingival avulsion

Table 2 shows the soft tissue codes for 'Modified Eden Baysal Dental Trauma Index.' with illustrations.

Table 2: Summary of codes for soft tissue injuries used in 'Modified Eden Baysal Dental Trauma Index' (Illustrated by Cem Eden)

Modified Eden Baysal Dental Trauma Index Codes	Illustrations
Code 0 [(..) . . . . .] ^{0} None	
Code 1 [(..) . . . . .] ^{1} Skin / Lip abrasion	
Code 2 [(..) . . . . .] ^{2} Skin / Lip laceration	
Code 3 [(..) . . . . .] ^{3} Skin / Lip contusion	
Code 4 [(..) . . . . .] ^{4} Skin / Lip avulsion	
Code 5 [(..) . . . . .] ^{5} Gingival abrasion	
Code 6 [(..) . . . . .] ^{6} Gingival laceration	
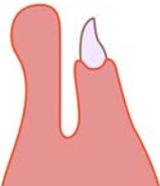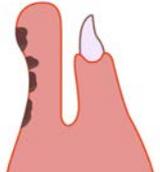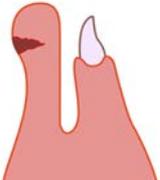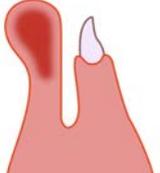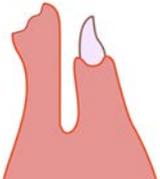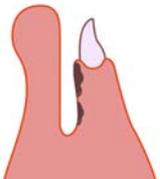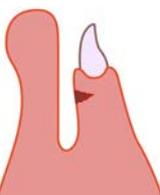
Modified Eden Baysal Dental Trauma Index Codes (continued)	Illustrations
Code 7 [(..) . . . . .] [7] Gingival contusion	
Code 8 [(..) . . . . .] [8] Gingival avulsion	
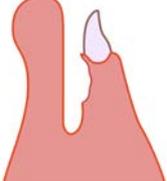
Clinical Cases

Table 3a and 3b presents clinical cases and the use of 'Moidfied Eden Baysal Dental Trauma Index' that also includes 'Eden Baysal Dental Trauma Index.'

Case 1:

Fourteen months old male patient with injured primary right lateral incisor had applied to the clinic with otherwise healthy medical history. Parents reported that the child had fallen down two days ago and one of the front teeth on the right side had moved below the gingiva. Extraoral evaluation revealed no soft tissue injuries related to the skin or the lip. Intraoral soft tissues were intact as well. Periapical rdiograph showed an erupting primary canine and an intruded primary right lateral incisor with an open apex.

Here is the reording of the injured tooth with 'Eden Baysal Dental Trauma Index.' Primary right lateral incisor is coded as 52 according to FDI numbering system. The crown and the root of the affected tooth is intact, therefore the first and the second digits should be coded with '0.' The tooth has an intrusive luxation so the third digit will contain the capital first letter of the word 'Intrusive luxation' which is 'I'. The apex of the tooth was immature so the fourth digit will be the first digit of the word 'immature' in small letters as 'i'. The radiographic evaluation showed no concomitant bone injury and this is indicated by a minus sign as the 5th digit. Therefore, the coding of the injured teeth with Eden Baysal Dental Trauma Index is: (52) 0 0 I i –

Since there is no soft tissue injury, 'Modified Eden Baysal Dental Trauma Index' is as follows:

[52) 0 0 I i –]^{0}

Case 2:

Twelve year old male patient had applied to the clinic after a traffic accident. He had been treated in the emergency clinic of a hospital for soft tissue injuries before attending the dental clinic. He had unremarkable medical history.

Extraoral evaluation revealed sutured laceration of the lower lip. Gingival contusion and abrasion was detected at the neighboring soft tissues of the injured permanent right incisors. Intraorally, right lateral incisor was showing extrusive luxation and the permanent right central incisor was mobile with uncomplicated crown fracture whereas enamel fracture was present on permanent left central incisor. Periapical radiograph showed root fracture of the permanent right central incisor and an erupting permanent right canine.

Here is the recording of the injured teeth with 'Eden Baysal Dental Trauma Index.' The injured teeth were 12, 11, and 21 according to FDI numbering system.

The crown and the root of 12 was intact, therefore the first and the second digits should be coded with '0.' On the otherthand, the tooth has an extrusive luxation so the third digit will contain the capital first letter of the word 'Extrusive luxation' which is 'E'. The apex of the tooth was mature so the fourth digit will be the first digit of the word 'mature' in small letters as 'm'. The radiographic evaluation showed no concomitant bone injury and this is indicated by a minus sign as the 5th digit. Therefore, the coding of the injured teeth with Eden Baysal Dental Trauma Index is: (12) 0 0 E m –

Uncomplicated crown fracture was observed in 11 and coded with '2' as the first digit. The periapical radiograph showed root fracture located at the apical third of the root and coded with '1' as the second digit. There was no bodily movement of the tooth so the third digit will contain the capital first letter of the word 'None' which is 'N'. The apex of the tooth was mature so the fourth digit will be the first digit of the word 'mature' in small letters as 'm'. The radiographic evaluation showed no concomminent bone injury and this is indicated

by a minus sign as the 5th digit. Therefore, the coding of the injured teeth with Eden Baysal Dental Trauma Index is: (11) 2 1 N m −

Enamel fracture was seen on 21 and coded as '1' for the first digit. The root of 21 was intact, therefore the second digit should be coded with '0.' There was no luxation injury so the third digit will contain the capital first letter of the word 'None' which is 'N'. The apex of the tooth was mature so the fourth digit will be the first digit of the word 'mature' in small letters as 'm'. The radiographic evaluation showed no comminent bone injury and this is indicated by a minus sign as the 5th digit. Therefore, the coding of the injured teeth with Eden Baysal Dental Trauma Index is: (21) 1 0 N m −

For soft tissue injuries, the laceration of the lip will be coded with '2' and the gingival abrasion and contusion is coded '5' and '7' respectively. Therefore, 'Modified Eden Baysal Dental Trauma Index' for this case is as follows:

[(12) 0 0 E m -, (11) 2 1 N m -, (21) 1 0 N m -] [2,5,7]

Case 3:

Eight year old female patient attended to the dental clinic two hours after a bycycle accident with avulsed central incisors. She had skin abrasion on her face and contusion on her upper lip. Intraoral evaluation revealed no soft tissue injury. Both of the avulsed teeth were brought to the clinic and their crowns and roots were intact with immature apicies. Radiographic evaluation affirm that there was no fracture affecting the bone.

Here is the recording of the injured teeth with 'Eden Baysal Dental Trauma Index.' The injured teeth were 11 and 21 according to FDI numbering system.

The crown and the root of both teeth were intact, therefore the first and the second digits should be coded with '0.' Both of the teeth had avulsed so the third digit will contain the capital first letter of the word 'Avulsion' which is 'A' for both. The apex of the teeth were immature so the fourth digit will be the first digit of the word 'immature' in small letters as 'i'. The radiographic evaluation showed no concomitant bone injury and this is indicated by a minus sign as the 5th digit. Therefore, the coding of the injured teeth with Eden Baysal Dental Trauma Index is: (11) 0 0 A i – and (21) 0 0 A i –

The abrasion on her face will be coded as '1' and the contusion of the lip will be coded with '3'. Therefore, 'Modified Eden Baysal Dental Trauma Index' for this case is as follows:

[(11) 0 0 A i -, (21) 0 0 A i -] [1,3]

Table 3 a: Clinical examples on how to use the 'Eden Baysal Dental Trauma Index' and 'Modified Eden Baysal Dental Trauma Index'

Extraoral = view / information Intraoral View	Radiograph	Andreasen Classification	Eden Baysal Dental Trauma Index
CASE 1 **No soft tissue Injuries**		52 Intrusive luxation	(52) 0 0 I i -
Case 1: Modified Eden Baysal Dental Trauma Index= $[(52)\ 0\ 0\ I\ i\ -]^{0}$			
CASE 2 **Lip Laceration** **Gingival Abrasion and Contusion**		12 Extrusive luxation	(12) 0 0 E m –
		11 Enamel-dentin crown fracture and Apical root fracture	(11) 2 1 N m –
		21 Enamel fracture	(21) 1 0 N m -
Case 2: **Modified Eden Baysal Dental Trauma Index=** $[(12)\ 0\ 0\ E\ m\ -,\ (11)\ 2\ 1\ N\ m\ -,\ (21)\ 1\ 0\ N\ m\ -]^{2,5,7}$			

Table 3 b: Clinical examples on how to use the 'Eden Baysal Dental Trauma Index' and 'Modified Eden Baysal Dental Trauma Index'

Extraoral view / information Intraoral View	Radiograph	Andreasen Classification	Eden Baysal Dental Trauma Index
CASE 3 **Skin- Lip Abrasion** **Lip contusion** 	 	11 Avulsion 21 Avulsion	(11) 0 0 A i – (21) 0 0 A i -
Case 3: Modified Eden Baysal Dental Trauma Index= **[(11) 0 0 A i -, (21) 0 0 A i -] [1,3]**			

Who should use the index?

The index is suitable for computer registration and provides online recordings. This gives the opportunity to collect data from different centers, cities and countries easily. International Assciation of Dental Traumatology has recently included Eden Baysal Dental Trauma Index for recording dental injuries in 'Dental Trauma Guide' which is a evidence based treatment guide (Figure 1).

Figure 1: Dental Trauma Guide (https://dentaltraumaguide.org/patient-examination/)

The index can be used in routine clinical patient recordings as well as epidemiological studies. The information obtained may be used in treatment planning by dental professionals and for future health care planning by stakeholders and governments for the community.

Important Considerations

* The index can be included on computer or as a form that can be filled manually. Figure 2 shows an example of a form in Turkish that contains the index codes as a table to enable eas of use.

* Training of the personal is necessary before collecting data on recording trauma cases in dental clinics.

* A training program is necessary for the study team and inter and intra- examiner reliability should be calculated. A Kappa equal to +0.65 or better should be achieved.

* If one is uncertain about the codes to select, the severe code that will affect the treatment plan should be chosen. For example, if you are unsure about the location of the root fracture, since the fracture line close to the gingival margin has a lower success rate and the patient will need an intense treatment protocol with longer splinting time, it is advised to choose the severe code.

* If there is more than one code at the same digit, always record the most severe code that will affect the treatment. For example, if there is enamel fracture (code 1) on the mesial incisal edge of a permanent first incisor and complicated crown-root fracture (code 5) on the distal part of the tooth, one must record 5 as the first digit.

* Third digit that records the luxation injuries only include bodily movement of the tooth in the socket, not the movement of the tooth fragment. But a study may plan to include luxation injuries related to root fragments and this should be clearly stated in the study protocol. For example, extrusion of the broken tooth fragment is probable finding of the dislocation and is not coded as the 3rd digit but if preferred the index has the potential to record that data as well.

İZMİR İL SAĞLIK MÜDÜRLÜĞÜ
ACİL DENTAL TRAVMA VAKASI VEYA REPLANTASYON FORMU

Barkod :

Hastanın :

Adı : _ _ _ _ _ _ _ _
Soyadı : _ _ _ _ _ _ _ _
Yaşı : _ _ _ _ _ _ _ _
Cinsiyeti : E K
☐ ☐

Adli vaka kaydı yapıldı mı ?

Evet ☐   Hayır ☐

Yaralanma Tarihi : _ _ _ _ _ _ _   Muayene Tarihi : _ _ _ _ _ _ _
Yaralanma Saati : _ _ _ _ _ _ _   Muayene Saati : _ _ _ _ _ _ _

Yaralanma ile ilgili bilgileri Tablo 1'e göre kodlayınız.

	Diş No	Kron Kırığı	Kök Kırığı	Lüksasyon	Kök Gelişimi	Alveol Kemiği
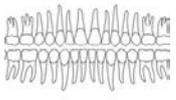
Kırık hatlarını şekil üzerinde gösteriniz.

Tablo 1

Kron Kırığı	Kök Kırığı	Lüksasyon Yaralanması	Kök Gelişimi	Alveol Kemikte Kırık
0 Yok	0 Yok	Y Yok	(i) immatür	(+) Var
1 Mine Kırığı	1 Apikal Üçlü	K Konkuzyon	(m) matür	(-) Yok
2 Mine + Dentin Kırığı	2 Orta Üçlü	S Süblüksasyon	(r) rezorpsiyon	
3 Komplike Kron Kırığı	3 Servikal Üçlü	E Ekstrüzyon		
4 Kron - Kök Kırığı		L Lateral Lüksasyon		
5 Komplike Kron Kök Kırığı		İ İntrüzyon		
		A Avülsiyon		

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Figure 2: Dental Trauma Form in Turkish that includes 'Eden Baysal Dental Trauma Index' as a table for easy use

Presenting results with the index

The dental literature reports the prevelance of dental injuries according to the classifications and the most used classification is the Andreasen's classification. Eden Baysal Dental Trauma Index also records the injuries according to this classification and will easily provide data on prevalance for each trauma type for dental hard tissues and the neigboring soft tissues. In addition to the prevelance of each trauma type, multiple injuries can also be reported with the index.

The relation with the maturity of the apex and the injury type can be calculated. The correlation among the injury type and the accompanying bone fracture can also be reported.

The long term outcomes of the treatments that are recorded with the index can be reported in relation with the treatment type, accompanying injuires and according to the maturity of the apex.

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CONTACT INFORMATION

Prof.Dr. Ece EDEN

Ege University
School of Dentistry
Department of Pedodontics

35100 Bornova-İzmir
Turkey

ece.eden@ege.edu.tr

eceeden@yahoo.com