

## Case Report

# Undiagnosed & Diagnosed Entity - Altered Passive Eruption, Review And Case Report

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### ABSTRACT

Smile esthetics have been shown to play a major role in the perception of whether a person is attractive, and whether they are perceived as friendly, trustworthy, intelligent, and self-confident. A proposed major esthetic problem in dentistry is what is termed excessive gingival display, better known by laypeople as a “gummy smile”. Eruption involves two phases, active and passive. Active eruption ceases when the teeth come into contact with the opposing dentition. The additional step involved in the normal eruption pattern of teeth involves passive eruption, which is the migration of the epithelial attachment apically to expose the anatomic crown of the tooth. A delay or failure of this to occur can result in the appearance of short clinical crowns and excessive gingival display. In present case report, A 25-year-old female patient presented to the dental clinic expressing to be discontent with her smile, due to the display of gingiva when she smiles. Before choosing the adequate treatment, esthetics and periodontal factors were analyzed. In the present case report, surgical crown lengthening along with osseous recontouring was the treatment chosen. Through a correct diagnosis and technique, it was possible to obtain harmony in the smile.

### Introduction

An esthetic smile is an important aspect of a person’s beauty. The relationship between teeth and gingival tissue is a major component of the esthetic smile. Tooth-gingiva relationships differ throughout one’s lifetime. To achieve excellent periodontal esthetics, it requires a treatment planning with the evaluation of all factors that interfere with the harmony and symmetry of the smile elements. <sup>1,2</sup> There is an increased desire for ideal esthetics in today’s society. Recently there has been more attention dedicated in the orthodontic literature to achieving the perfect smile. Sarver (2001) proposed that orthodontists evaluate the posed smile on the basis of two major characteristics: the amount of incisor and gingival display, and the transverse

dimension of the smile. <sup>15</sup> Further breaking down smile esthetics was Garber and Salama, <sup>16</sup> The esthetic appearance of a smile has been suggested to have three components: the teeth, the lip framework, and the gingival scaffold. There are three kinds of smile: high, medium and low. The high smile is considered normal when presented with exposed gingiva of 1 to 3 mm. If the exposure presents more than 3 mm, the gummy smile is characterized. <sup>3</sup> The medium smile is known to be more attractive and it is characterized by presence of tooth, interdental gingiva and the edge of free gingiva around the cervical portion of the teeth, and is completely exposed.

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### Little about ideal esthetics

Cosmetic dentistry literature contains many definitions on characteristics of tooth esthetics. Tooth heights, widths, proportions, connectors and even gingival contours on individual teeth have all been outlined. Townsend (1993)<sup>17</sup> states that maxillary central incisors and canines should be at the same length and the lateral incisor should be 1 to 2 millimeters shorter. The author also mentioned that the maxillary central incisor crown height should be 13.5 millimeters and the maxillary lateral incisors should have a 12 millimeter crown height. Wheelers' (1974) textbook *Dental Anatomy, Physiology and Occlusion* suggest slightly different dimensions of individual teeth. The maxillary central incisor should be 10.5 millimeters from incisal edge to the cemento-enamel junction and 8.5 millimeters from mesial contact to distal contact. The mandibular central incisor should be 9.0 millimeters from incisal edge to the cemento-enamel junction and 5.0 millimeters from mesial contact to distal contact. The ideal maxillary incisor should be 80% width compared to height (Gurel 2003).<sup>18</sup> Gillen et al.<sup>19</sup> conducted a study to determine the average dimensions of the six anterior maxillary teeth. They measured casts from 54 patients ranging in age from 18 to 35. Using these measurements they calculated the following ratios: length to width, width to width, and length to length. Gillen concluded that central incisors and canines were equal in length and 20% longer than lateral incisors. Length-to-width ratio of canines and lateral incisors were similar (1:2.1), and the length-to-width ratio of central incisors was 1:1.1. There were gender-based differences in the length of the maxillary anterior teeth. The crown heights of males were significantly larger than those of females.

Connectors are a broad area where two adjacent teeth appear to touch. The esthetic relationship between anterior teeth is known as the 50-40-30 rule. This is defined by the connector between central maxillary incisors to be 50% of the length of the tooth. Maxillary central incisor's connector with the maxillary lateral incisor should be 40% of the length of the central incisor. Optimum connector length between the maxillary lateral incisor and maxillary canine should be 30% of the length of the lateral incisor (Morley, Eubank 2001).<sup>20</sup>

A smile is framed by the lips and therefore defines the esthetic smile zone. Goldstein (1976)<sup>21</sup> defined the lip lines as being high, medium, or low. A low lip line only shows a portion of the teeth below the lower border of the upper lip. A high lip line shows extra gingiva extending from the lower border of the upper lip to the free gingival margin. A medium lip line is deemed most attractive in western culture. During a smile, 1-3 millimeters of gingiva from the apical border of the free gingival margin to the lower border of the upper lip is displayed (Garber, Salama 1996). Sarver (2001) defined an ideal smile arc by having the maxillary incisal edge curvature parallel to the curvature of the lower lip upon smile.

Two important aspects of gingiva affect the final esthetic outcome: gingival shape and gingival contour. Gingival shape is the curvature of the gingival margin of the tooth, determined by the cemento-enamel junction and the osseous crest (Sarver 2004).<sup>22</sup>

Townsend (1993) reported that there should be an interdental papilla of 4.5 to 5 millimeters from the tip of the papilla to the depth of the marginal scallop, and



**Pre-operative View**



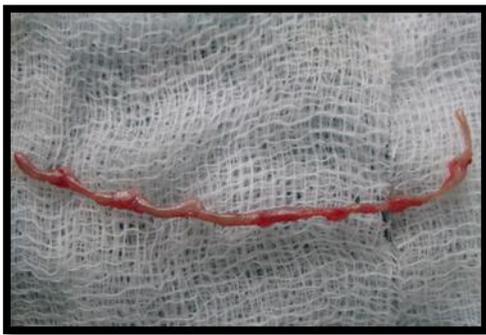
**After Osseous Recontouring**



**Internal-Bevel Incision**



**Sutures**



**Removal Of Gingival Collar Strip**



**Post operative view after 1 yr**



**Osseous Recontouring**

the most apical part of the gingival scallop should reflect the angle of the long axis of the tooth. According to the accreditation criteria for the American Academy of Cosmetic Dentistry, “The gingival shape of the mandibular incisors and the maxillary laterals should exhibit a symmetrical half-oval or half-circular shape. The maxillary centrals and canines should exhibit a gingival shape that is more

elliptical. Thus, the gingival zenith is located distal to the longitudinal axis of the maxillary centrals and canines. The gingival zenith of the maxillary laterals and mandibular incisors should coincide with their longitudinal axis (Sarver 2004).”

### **Eruption of teeth**

Eruption used to mean for many authors the very first appearance of the crown or part of it through the gingiva, others referred to it as the point when the crown of the tooth is halfway to its full projection into the mouth. Gron (1962)<sup>23</sup> defined emergence for a tooth as that time when the tooth has just pierced the gingiva but is no more than 3 millimeters from the incisal edge. Garn et al. (1958)<sup>24</sup> investigated associations among data for age of alveolar emergence of the mandibular premolar and molar teeth. Alveolar eruption was defined as the earliest time at which there is no longer apparent alveolar bone over the erupting tooth. Sturdivant et al. (1962)<sup>25</sup> defined eruption as the age at which the alveolar mucosa is pierced and exposure of the crown of a tooth approximates one millimeter in diameter. Fanning (1961)<sup>26</sup> stated “that emergence is a fleeting moment in the continuous process of the tooth eruption; and the chance that the time of inspection coincides with the actual moment of emergence is a whole small.” According to Tanner (1955)<sup>27</sup> in longitudinal studies, the date of eruption of a tooth is at a time between two consecutive examinations. He said the best estimate of the age at eruption in such data, therefore, is the age at second examination less half the time elapsed since the first examination. Failure to make this correction, Tanner felt, has led much of the literature on tooth eruption derived from longitudinal studies to quote mean eruption figures which are typically six months too high. Savara (1978)<sup>28</sup> agreed when he said that teeth

unerupted at one visit but listed as present at the next visit, must be reported as erupting midway into the period. The eruption of permanent dentition has been studied quite extensively and provides a criterion of physiological maturity covering the ages of six to thirteen. Cumulative incidence curves showing the percentage of children at each age with a given tooth erupted have been developed by various authors. Means and standard deviations of time of eruption of each tooth have been derived from these data. Newman (1994)<sup>29</sup> proposed that eruption continues on throughout life. “The evidence clearly indicates that tooth eruption, in both ancient and modern human population does not stop once the teeth reach the occlusal plane, but continues through adult life, and apparently, in modern dentitions, in the absence of marked functional tooth wear. As a result, the attachment apparatus may come to lie on cementum, in the absence of chronic periodontitis.” This supported Barker’s (1975)<sup>30</sup> statement that “there is widespread acceptance of the theory that, with advancing age, there is continuous eruption of the teeth from their sockets with recession of the gingiva onto the cementum, and this so-called ‘passive eruption’ may lead to elongated clinical crowns in the absence of attritional wear.” More recently there has been a turn in the trend of eruption from focusing on the actual time point of the moment of eruption to the process of erupting. An erupting tooth can be categorized as undergoing one of two phases of eruption: active eruption or passive eruption.

### **Active Eruption**

Active eruption has been described as the eruption process of a tooth and their alveoli through the gingival tissues (Moshrefi 2000).<sup>31</sup> This phase ends when the tooth makes contact with the opposing

dentition but may continue with occlusal wear or loss of opposing teeth (Dolt 1997).<sup>32</sup> Morrow et al. (2000)<sup>33</sup> described active eruption as the maxillary central incisor erupting into the mouth at approximately six years of age and continue to erupt until it comes into contact with the opposing teeth. At this point approximately 50 % of the anatomic crown is covered with gingiva. Active eruption is divided into two types of eruption: pre-functional active eruption and functional active eruption (Weinberg 1996)(Weinberg 2000).<sup>34,35</sup> Pre-functional active eruption is defined by the movement of the tooth from the developmental position inside the jaw, through the oral epithelium, into the oral cavity, to a final position of functional occlusion. Functional active eruption begins when the tooth is in a functional occlusion and continues throughout life. Normal attrition of a tooth is compensated by slight tooth eruption for occlusal contact maintenance and for the continued vertical growth of the face (Weinberg 1996)(Weinberg 2000).

#### **Passive eruption**

Passive eruption begins once active eruption has completed. This takes place as the dentogingival unit migrates in the apical direction until it is adjacent to the cemento enamel junction (CEJ) (Evian et al. 1993).<sup>36</sup> The passive eruption process has been historically characterized by four stages (Gargiulo 1961).<sup>37</sup>

**Stage 1:** The dentogingival junction is located on enamel.

**Stage 2:** The dentogingival junction is located on enamel as well as cementum.

**Stage 3:** The dentogingival junction is located entirely on cementum, extending coronally to the CEJ.

**Stage 4:** The dentogingival junction is on cementum, and the root surface is exposed as a result of further

migration of the dentogingival junction on the cementum (gingival recession).

Stages 1 through 3 are physiological processes. Stage 4 is typically caused by inflammation and is known as a pathological process. Throughout this whole process the width of the junctional epithelium diminishes. The width of the connective tissue remains relatively constant with a mean average of 1.07 millimeters. The length of the junctional epithelium has a mean average of .97 millimeters (Gargiulo 1961). This is commonly known as the biological width (Cohen 1962).<sup>38</sup>

Normally, the CEJ lies just apical to the gingival margin of the anatomic crown. Sulcus depth usually measures 1 to 3mm. In cases of altered passive eruption, the CEJ might be up to 10mm apical to the gingival margin. There may be no other clinical signs of disease such as bleeding upon probing, suppuration, inflammation or radiographic bone loss. In some cases, excess gingival tissue interferes with oral hygiene and contributes to plaque accumulation. Probing depth often reveals a deep sulcus associated with marginal inflammation of the gingival tissues.

#### **Excessive gingival display**

Excessive gingival display is a condition commonly called “gummy smile.” It is characterized by excessive exposure of the maxillary gingiva during smiling. Foley et al. (2003)<sup>39</sup> stated this condition is caused primarily by a skeletal deformity in which there is vertical excess of maxillary tissue, a soft-tissue deformity in which there is a short upper lip or a combination of the two. Another cause of excessive gingival display is insufficient clinical crown length.

Garber and Salama (1996) state the gummy smile can result from two problems:

- vertical maxillary excess and
- altered passive eruption.

Vertical maxillary excess results from hyperplastic growth of the maxillary base. This causes the teeth to be further away from the maxillary base causing excess gingiva to be on display when smiling. Diagnosis involving vertical maxillary excess requires ruling altered passive eruption in combination with maxillary hyperplasia. These cases should be first treated for altered relationships between gingiva and the cemento-enamel junction. The combined cases require for optimal treatment a multidisciplinary approach to treatment planning involving an orthodontist, a periodontist, an orthognathic surgeon and a restorative dentist. Evaluation of short clinical crowns is also an important aspect of esthetics. This may be the primary cause of excessive gingival display. Common causes of short clinical crowns include coronal destruction resulting from traumatic injury, caries or incisal attrition, as well as coronally situated gingival complex resulting from tissue hypertrophy, or altered passive eruption (Levine, McGuire 1997).<sup>40</sup>

#### **Altered passive eruption (APE)**

Goldman and Cohen<sup>4</sup> defined APE as the situation in which “the gingival margin in the adult is located incisal to the cervical convexity of the crown and removed from the cemento-enamel junction of the tooth”. In the literature, the condition is also referred to as “retarded passive eruption” or “delayed passive eruption”<sup>5</sup>. In any case, this clinical situation is attributed to failure in concluding the passive eruption phase.

Coslet et al classified APE into two distinct types<sup>6</sup>:-

- Type I: Excessive amount of gingiva measured from the free gingival margin to the mucogingival junction

- Type II: measurement from the free gingival margin to the mucogingival junction shows a normal dimension of gingiva.

#### **Diagnosis of APE**

The first step in diagnosis is to observe the patient in both smiling and repose. Further data is required if excess gingiva is displayed. First the maxillary lip needs to be evaluated for both length and activity. The average length of the maxillary lip in repose is 20 to 22 millimeters in females and 22 to 24 millimeters in males (Peck 1992).<sup>41</sup> If the maxillary lip is the cause of a gummy smile, there is no treatment necessary. Next, location of the cemento-enamel junction needs to be identified with a probe subgingivally. If the cemento-enamel junction is located in a normal position in the gingival sulcus, then the short clinical crown is probably due to incisal wear on abnormal tooth morphology. When the cemento-enamel junction is not detected in the sulcus a diagnosis of altered passive eruption can be made. The next step is bone sounding. A measurement from the gingival crest to the alveolar crest is taken. This should be approximately 3 millimeters. Usually the cemento-enamel junction approximates the base of the sulcus; in altered passive eruption this measurement can be used to determine the relationship between the cemento-enamel junction and the alveolar crest. Normal relationships require approximately 2 millimeters for both epithelial and connective tissue attachment between the cemento-enamel junction and alveolar crest; therefore, a decision can be made which treatment is necessary (Moshrefi 2000) (Dolt 1997). Radiographic viewing of the cemento-enamel junction position can facilitate diagnosis of altered passive eruption. If the clinical crown length is less than the anatomical crown length measured on the radiograph,

then altered passive eruption is present (Hempton, Esrason 1999).<sup>42</sup>

### **Treatment options of APE**

It has been proposed that treatment of altered passive eruption should be evaluated by the following criteria: periodontal involvements, restorative requirements, orthodontic requirements (Evian et al. 1993). Periodontal involvements can be treated one of two ways surgically. Performing a gingivectomy is the first option for periodontal correction. When it is determined that the osseous level is appropriate, that greater than 3 millimeters of tissue exists from bone to gingival crest, and that an adequate zone of attached gingiva will remain after surgery a gingivectomy is indicated (Dolt 1997). An apically positioned flap with ostectomy is required when the osseous levels are approximating the cemento-enamel junction. Osseous recontouring is necessary when insufficient root is exposed to allow for a proper biologic width (Evian et al. 1993). The timing of periodontal surgery is a source for debate. Orthodontic treatment typically precedes periodontal surgery, since movement of teeth may affect gingival harmony (Foley 2003). Dolt (1997) recommended that if clinical crowns are short due to altered passive eruption, crown lengthening should be performed prior to orthognathic surgery. Garber and Salama (1996) suggested a two-phase approach: initial periodontal surgery before orthognathic surgery with a second alteration following orthognathic surgery if necessary. Restorative concerns of altered passive eruption come from difficulty of restoring a tooth with excess tissue. Also the appearance of short clinical crowns needs to be properly diagnosed. If incorrectly diagnosed, crown and bridgework performed to lengthen tooth appearance will leave patient with unaesthetic appearance and an extreme deep bite.

Orthodontic therapy can be affected by excess gingival tissue from altered passive eruption. Excess gingiva can make orthodontic treatment more difficult. From placing brackets and bands to oral hygiene a number of procedures are affected. Evian (1993) suggests removing tissue prior to orthodontic therapy. This allows the orthodontist to evaluate esthetic and functional needs more accurately because the entire crown is visible.

### **Case Report**

A 25-year-old female patient presented to the dept of periodontology at DMIMS University dental college and hospital and expressed complain with her smile, due to the display of gingiva when she smiles. The first esthetic factor analyzed was the proportionality among the teeth, which depends on the relation between length and width of the teeth and the arrangement and shape in the arch.<sup>7,8</sup> The initial examination verified the presence of short teeth in relation to the gingival margin, absence of inflammation and growth of the gingiva. In order to evaluate the periodontal condition, probing depth, periodontal attachment loss, gingival bleeding and suppuration examinations were performed. The periodontal examination verified and it was detected that the crest of the bone lies close to the CEJ. After evaluation of periodontal and esthetic aspects, the diagnosis of APE was established.

During the argument with the patient, it was noted that her posed smile did not display as much gingiva as her smile, which was noticeably wider. The patient showed a great amount of inserted gingiva, permitting the performance of the crown lengthening as a preference of treatment. The amount of inserted gingiva also permitted the confection of total lap with

internal-beveled and removal of a gingival collar following the osteotomy procedure.

The surgery procedure was performed in the following sequence:

- Infiltrative anesthesia
- Incision using a No. 15 blade: internal-bevel incision.
- Secondary intrasulcular incision
- Removal of gingival collar
- Full thickness mucogingival flap reflection
- Osseous recontouring & Root instrumentation followed by positioning and suture of the soft tissue flap followed by periodontal pack dressing

After surgery, a non-steroidal anti-inflammatory, IBUGESIC- Ibuprofen + Paracetamol, and antibiotic coverage consisting of Amoxicillin 500 mg three times a day were prescribed for 5 days. Patients were instructed not to brush the teeth in the treated area. All patients were placed on 0.12% chlorhexidine gluconate (Hexidine – ICPA) twice daily, for one minute, for one weeks. They were instructed not to disturb the pack and to avoid undue trauma to the treated site.

After 10 days, the suture was removed and appeared to have satisfactory healing. After 90 days, on a follow-up visit, a harmonic appearance of gingival tissue was showed. After 1 year of the postoperative period, total healing was observed and the patient was satisfied with the final result

### Discussion

It is incumbent upon the orthodontist to recognize that altered passive eruption will not resolve itself and will require a corrective periodontal procedure. The management of altered passive eruption may include periodontal surgery, crown lengthening, and in

selected cases, forced eruption. As with all periodontal treatment, the initial phase involves a proper diagnosis and control of etiology. In order to have an ideal choice of treatment, the important aspects to be evaluated by the periodontist are as follows:-

- Periodontal state
- Periodontal biotope/ Gingival biotype
- Smile line and gingival display
- Gingival Zenith
- Interdental papilla
- Gingival recession

The gingival margin of the maxillary lateral incisor is normally 1.0 mm below that of the adjacent maxillary central incisors/canines. An ideal smile design also depends on the dental midline of the maxillary and mandibular arch, besides the correct posterior tooth length.<sup>9,10,11</sup>

A 12.1% incidence of altered passive eruption was reported in a study of 1,025 patients with a mean age of 24.2 – 6.2 years (Volchansky and Jones 1974)<sup>12</sup>. The prevalence of excessive gingival display has been estimated at 10% of the population between the age of 20 and 30 years, and it is seen more in women than in men (Tjan and Miller 1984, Peck et al 1993)<sup>13</sup>.

In the present case, the appropriate treatment was CLP with osseous recontouring. The amount of initial keratinized gingiva was not enough, the performance of apical position flap was indicated. When the bone crest is less than 3 mm distant from the CEJ, regardless of the amount keratinized gingiva, it is necessary to perform osteoplasty and osteotomy, creating the necessary biological width (3 mm). however, the large amount of keratinized gingiva, permitting further lengthening of up to 3 to 4 mm after incision require only crown lengthening, with mucoperiosteal flap through internal-bevele.

Invasive techniques can be used to treat APE, such as orthognathic surgery and plastic surgery in cases involving extraoral causes of a gummy smile, such as vertical maxillary excess and hypermobile/short upper lip<sup>14</sup>.

### Conclusion

The biology of periodontal tissues and facial features must be identified before performing any surgery procedure. Then, the right diagnosis will be reached, which permits to choose the best treatment for that cases. Through skillful correct diagnosis and technique, it was possible to obtain harmony in the smile.

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