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# Innovation in Pediatric surgery: the use of ultrasonic CVD tips: case report

*Inovação cirúrgica em odontopediatria: uso de pontas ultrassônica: relato de caso*

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## Abstract

The non-eruption of teeth due to highly keratinized gingival mucosa is a frequent event in the pediatric dentistry, which harms the oral aesthetics and function. A surgical excision of the involved area is indicated, exposing the non-erupted tooth. This procedure involves anesthesia and cutting instruments that may increase the fear and anxiety in young patients. The use of new technologies has avoided these instruments and has promoted more comfort to the patients. This study presents clinical cases in which gingivectomy was performed using the innovative method with an ultrasound-activated CVD tip. It was concluded that this method presented effectiveness, promoted more comfort, and less fear to the patients, making its use a viable alternative to pediatric surgery.

**Descriptors:** Surgical procedures operative; Pediatric dentistry; Ultrasonic therapy

## Resumo

O não-erupção dos dentes devido a mucosa gengival altamente queratinizado é um evento frequente na odontopediatria, o que prejudica a estética e função oral. A excisão cirúrgica da área envolvida é indicado, quando expondo o dente, não entra em erupção. Este procedimento envolve anestesia e instrumentos de corte que podem aumentar o medo e ansiedade em pacientes jovens. A utilização de novas tecnologias têm evitado esses instrumentos e promove mais conforto aos pacientes. Este estudo apresenta casos clínicos em que gengivectomia foi realizada usando o método inovador com uma ponta CVD acoplada ao aparelho ultrassônico. Concluiu-se que este método apresentou eficácia, promovido mais conforto e menos ansiedade aos pacientes, tornando o seu uso uma alternativa viável à cirurgia pediátrica.

**Descritores:** Procedimentos cirúrgicos operatórios; Odontopediatria; Terapia por ultrassom

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## Introduction

The non-eruption of teeth is a frequent event in the pediatric patient. The upper incisors are the most affected group. It represents an unpleasant aesthetical, psychological, and functional factor. The phenomenon may be determined by the presence of highly keratinized gingival mucosa, supernumerary tooth, an ectopic follicle, arch length shortage, faulty root resorption, large tooth size, or by presence of cysts and tumors<sup>1-2</sup>.

The dental eruption has been defined as the emergence movement of the tooth during the formation phase from within its follicle in the alveolar process of the maxilla or mandible into the function position in the oral cavity. The gingival emergence is the last phase of the dental physiological movement, which begins in the odontogenesis and continues along dental life. This movement finishes with the merge of the external enamel epithelium with those of oral cavity<sup>3</sup>.

Histologically, the dental crown eruption has been associated with degradation of the collagen fibers and gingival epithelium, as well as with cell death originated from the conjunctive tissue, that are covering the crown in eruption. These events are accompanied by the external enamel epithelium and gingival epithelium proliferation, which merge and origin the epithelial tump between the crown and oral cavity<sup>4</sup>.

The high-keratinized gingival tissue retards the tooth

eruption due to the presence of the dense conjunctive tissue upper to the crown. The conventional approach consists in a surgical excision of the gingiva at the level of its attachment, thus creating new marginal gingiva, exposing the tooth surface<sup>3</sup>.

In the pediatric dentistry practice, the surgical procedures are related to pain, anesthesia, besides, parent's anxiety that may influence the children's behavior, making the dental experience negative as well<sup>5-6</sup>. In this field, the role of the pediatric dentist is to conduct the child using adequate care methods, according to the age and psychology pattern of the child<sup>7</sup>.

The new technologies applied to pediatric dentistry have been used to provide more comfort to children and ensure a rapid procedure execution. In this context, the CVD technology refers to the chemical, vapor deposition-coated diamond tips (CVDentusUS, Clorovale Diamantes, São José dos Campos, Brazil, [www.cvdentus.com.br](http://www.cvdentus.com.br); 055.012.39441126), which are manufactured by the use of chemical vapor deposition (CVD) of continuous diamond coatings onto molybdenum shafts, with gases in an excess hydrogen environment. Following physicochemical interactions, a pure diamond film is formed on the shaft surface without metallic binders between the crystals<sup>8</sup>.

The CVD tip allows the diamond coating to be adhered to the shaft and results in the surface capable of

withstanding the vibratory oscillations from the ultrasonic activation<sup>6</sup>. The ultrasound determines a vibratory motion of the diamond-coated tip in a forward-to-backward direction, which promotes tissue cutting, while the adjacent surface of the tip promotes abrasion<sup>9-10</sup>.

Regarding this technology, studies *in vitro* have shown that CVD tip is effective in cutting hard tissues<sup>9,11</sup>. In relation to procedures *in vivo*, Mastrantonio *et al.*<sup>12</sup> used CVD tip to cavity preparation in a non-collaborated behavior patient, observing that this tip promotes more conservative cavities, providing more comfort to the patient and promoting the psychology care during the dental treatment.

Gondim *et al.*<sup>8</sup> performed gingival depigmentation using this technology due to the abrasion effect promoted by the adjacent surface of the tip. The authors concluded that the CVD tips was a practical, rapid, safe, low-cost, and painless procedure and presented satisfactory long-term aesthetics.

There are few studies concerning surgical procedures in the pediatric field and innovative methods. Thus, the aim of the present study was to report three clinical cases, which were use the use of ultrasound CVD-coated diamond tip to perform the gingivectomy by the abrasion of gingival mucosa of the non-erupted central incisors in patients with fear and anxiety facing to dentistry treatment.

### Case reports

A one-year, nine-month-old girl was referred to the Pediatric Clinic of Araraquara Dental School due to the delayed eruption of the anterior upper tooth. The intraoral examination revealed the absence of the primary right upper central incisor (Figure 1a). Other case, a nine-year-old girl did not present her permanent left upper central incisor, which was confirmed after clinical examination (Figure 1b). In the last case, an eight-year-old girl claimed the absence of her anterior upper teeth. After clinical examination, it was verified the absence of permanent upper central incisors (Figure 1c) and the radiographic exam showed that the teeth presented 2/3

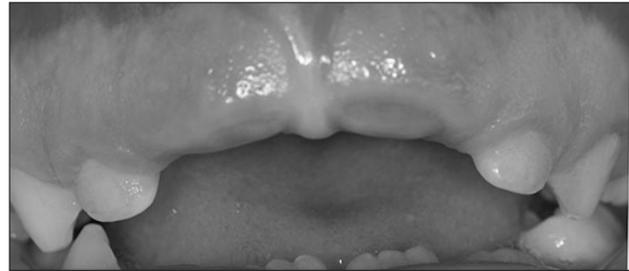


of root formation. After dental history, the girl's mothers revealed that there were not early dental losses or dental traumas in that affected areas. It was concluded that the etiology of the non-eruption of these cases was related to the high-keratinized gingival tissue. All patients presented a good systemic health and it was observed a non-collaborative behavior in relation to the dental treatment due to fear and anxiety during interventions.

The excision of gingival tissue with ultrasonic diamond-coated tips was conducted using the modified technique previously described by Gondim *et al.*<sup>8</sup>. Written consent was obtained by the mothers. Firstly, to improve patient comfort, a topical anesthesia (EMLA<sup>®</sup> Astra Pharmaceuticals, Wayne, USA) was applied to the gingival surfaces for three minutes. The CVD coated diamond tip was connected to the headpiece of the conventional ultrasound device adjusted from 60% to 70% of total oscillatory amplitude. After this, the water rate flow was regulated and the CVD tip was positioned allowing the adjacent surface of the tip to be in continuous contact with the tissue under light pressure and constant water cooling (Figures 2a). This movement in a forward-to-backward direction was performed until the part of the incisal cusp of the non-erupted teeth was visualized (Figure 2b). The teeth appeared after 7 days (Figures 3a and b), with exception of the left permanent upper central incisor. In this case, the procedure was repeated and after 15 days the tooth appeared in the patient's oral cavity (Figure 3c). During the procedure, the children presented a collaborative behavior



Figure 1. Clinical absence of the incisors, in the first case (a), second case (b), and third case (c)



**Figure 2.** The position of the CVD® tip to do the excision (a), and the presence of the cusp portion of the non-erupted tooth (b)



when gingival fibrosis occurs due to persistent trauma. When the procedure is postponed, the possible consequences are the space closure or teeth tipping<sup>15</sup>. Although this procedure is considered as a simple act, it may cause fear in children due to the anesthesia<sup>16-18</sup>.

The aim of the present study was to relate cases (Figures 1-3), using CVD tip in gingiva incision to provide comfort for the patient due to absence of needle drift, anesthesia sensation, lower noise, less pain, and consequently, fear and anxiety reduction (Figure 2b). Moreover, it is a less invasive technique, performing an exposure of the non-erupted teeth in the oral cavity. On the other hand, the usual technique involves total incisal/occlusal exposure teeth by the circumferential excision. The teeth appeared after 7 to 14 days into oral cavity showing the efficacy of the modified technique.

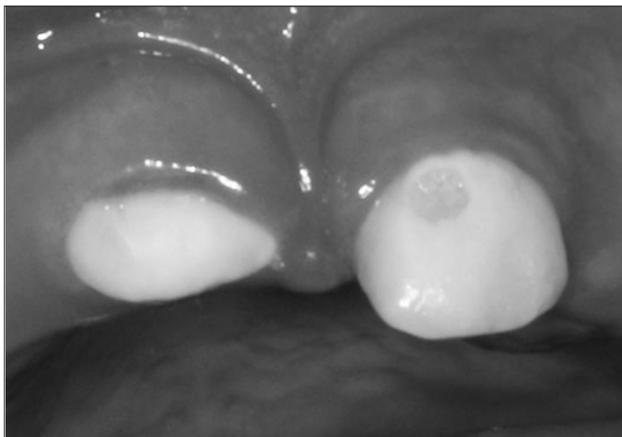
This innovative method is notable by less bleeding during and after the procedure (Figure 2b). This process

and absence of fear and anxiety in relation to the ultrasonic procedure.

### Discussion

When surgical procedures are performed in children, preoperative evaluation, dental/medical history, involved pathology, and prior considerations about infant knowledge should be taken into account<sup>13</sup>. Thus, special attention should be paid to determine the social, emotional and psychological condition of the child<sup>14</sup>.

Gingivectomy is represented by the removal of the fibrosis tissue that covers non-erupted teeth. This procedure must be done when the tooth eruption was delayed, and presents advanced level of root formation or



**Figure 3.** Presence of the tooth in the oral cavity. In the first and second cases after 7 days. (a and b). In the third case after 15 days (c)

can be explained by the formation of microbubbles due to transitory cavitation phenomenon caused by the ultrasound waves. When these cavitations occur in the blood there is a thrombogenic act, resulting in a destruction of eritrocites and platelets explaining the reduction of blood, minimizing the fear of the infant patients and contributing to their adaptation to dental treatment as a positive experience<sup>19</sup>.

Some children suffer from fear and anxiety related to the dental treatment. This behavior can be explained by fear of unknown acts or by relative's speeches, making a difficult relationship between patient and professional. In the first case report, the patient presented despite of the little age, this patient showed a collaborative performance during the surgical procedure.

In the other case reports, the patients were surprised and relieved, due to the minimum time spent for the procedure. Studies pointed out the efficacy of ultrasonic diamond-coated tips as in relation to patients' behavior, making the dental treatment more comfortable as well as favoring conservative and precise cavity preparations<sup>11-12,20</sup>.

It is valid to affirm the role of the professional to minimize patient's fear and anxiety. Among the dental field, the pediatric dentist should be careful with the good patient-professional relationship. Thus, it is very important the use of new techniques and update professionals, aiming to adapt the pediatric patient to the dental treatment, contributing to minimize fear and anxiety.

The use of ultrasonic diamond-coated tip to the gingivectomy procedure showed an effective technique with atraumatic approach and it was less invasive to fearful and anxious little aged patients.

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Received July 18, 2013  
Accepted October 23, 2013