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Effectiveness of Atraumatic Tooth Extraction in Minimizing Trauma and Pain: A Case Report

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ABSTRACT

Background: *The atraumatic tooth extraction technique aims to minimize tissue trauma and pain, thereby promoting optimal healing and supporting the success of future prosthetic rehabilitation.*
Objective: *This case report aims to describe the application of atraumatic tooth extraction techniques in various tooth extraction indications and to evaluate their clinical outcomes.*
Methods: *The technique was applied to four patients with different extraction indications. The procedure was performed using optimal anesthesia, specialized instruments such as luxating elevators and atraumatic forceps, as well as root sectioning when necessary.*
Results: *All patients reported minimal pain during and after the procedure, requiring only a single dose of mild analgesics. Soft tissue healing occurred more rapidly than with conventional extractions, with one-week evaluations showing that the wounds were almost completely closed. No significant complications were observed, except for one case of mild emphysema, which resolved within five days.*
Conclusion: *Atraumatic tooth extraction techniques are effective in reducing tissue trauma, accelerating healing, and preserving the supporting tooth structures. This technique can be recommended as the primary choice for various extraction cases, particularly for patients scheduled for prosthetic rehabilitation or implant placement.*

1. INTRODUCTION

Damaged teeth should be preserved whenever possible so that they can remain within the dental arch and function properly. However, under certain conditions, these teeth cannot be maintained and must be extracted (Fragiskos, 2007; Hupp et al., 2019). Teeth with severe infections or significant loss of their original structure have a high risk of infection spread and are typically indicated for extraction (Hupp et al., 2019; Lestari et al., 2023). Conventional tooth extraction is defined as the removal of a tooth from the alveolar bone socket (Hupp et al., 2019). This technique is generally performed using elevators and forceps (Hung, 2023). Although effective in removing teeth, conventional extraction often pays less attention to potential post-extraction complications. Commonly reported complications include tooth fractures, alveolar bone damage, soft tissue tears, and excessive bleeding (Brown, 2014; Le et al., 2005; Kershaun, 2017; Inggas, 2025). One study reported that complications can occur in 20–30% of conventional extraction procedures, particularly in cases involving fragile teeth or chronic infections (Salian, 2023).

As an alternative, atraumatic (minimally invasive) tooth extraction techniques have become increasingly popular. This approach aims to minimize trauma to both hard and soft tissues, thereby promoting faster healing and reducing the risk of complications (Lande, 2015). Key advantages of atraumatic techniques include: Minimal or no pain (painless), Minimal trauma to hard and soft tissues, Faster wound healing and reduced risk of infection, Better preservation of the alveolar bone and soft tissues, thereby supporting future prosthetic or implant treatment plans (Salian, 2023; Singla, 2020).

In principle, atraumatic techniques are similar to conventional extraction but are modified in terms of instrument use to minimize trauma. Instruments used include periotomes,

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desmotomes, luxating elevators, and specialized forceps. Nevertheless, mastery of the technique and proper instrument handling are crucial, as improper use of these tools can still lead to complications (Le, 2005). Several recent studies have shown that atraumatic techniques can reduce complication rates by up to 30% compared to conventional methods and improve the quality of the remaining tissues for subsequent treatments (Salian, 2023; Hupp et al., 2019). Based on this evidence, this article discusses the application of atraumatic tooth extraction techniques in several clinical cases to evaluate their effectiveness in minimizing trauma and post-extraction pain.

2. METHOD

Case Report

Case 1

A 24-year-old female patient presented to Dentes Purwokerto Clinic with a chief complaint of severely decayed teeth accompanied by frequent pain. The patient requested tooth extraction but expressed fear that the procedure would be painful, as she had never undergone tooth extraction before.

Based on the subjective examination, the patient denied any history of drug allergies and reported no systemic diseases. She works as an entrepreneur in her daily life. The objective examination revealed that tooth #46 had extensive caries with significant loss of tooth structure. Pulp vitality testing was negative, percussion testing was negative, and tooth mobility was negative. Based on the clinical findings, the dentist diagnosed necrosis of the pulp in tooth 46.

Figure 1. Clinical condition of tooth 46

The dentist approached the patient and engaged in effective communication to help the patient remain calm and alleviate her fear. The patient was cooperative with both the dentist and the dental therapist. After ensuring the patient was comfortable, the dentist obtained informed consent. The dentist explained the dental condition and diagnosis, the planned atraumatic tooth extraction procedure, and the potential complications. The patient provided consent to proceed with the extraction. Based on the examination and diagnosis, the dentist assessed that the tooth scheduled for extraction could not be removed using simple instruments. Therefore, the dentist developed a treatment plan for atraumatic tooth extraction using the split technique.

The instruments and materials prepared included:

Instruments:

Diagnostic set
Dental syringe (Osung)

Handpiece (NSK)
Endo-access bur
Luxating elevator (Osung)
Forceps
Bone curette (Osung)
Spooling syringe
Cotton buds

Materials:

4% articaine anesthetic solution
Topical anesthetic
Povidone-iodine
Sterile saline
Gauze
Tampon

Atraumatic extraction procedure using the split technique:

- Asepsis of the working area
- Mandibular block anesthesia, buccal infiltration (long buccal), and intraligamentary anesthesia using a dental syringe
- Tooth separation into two segments (mesial and distal) using a handpiece and endo-access bur
- Separation of Sharpey's trans-septal fibers using a luxating elevator
- Wedge of insertion and clockwise–counterclockwise motions to sever the periodontal ligament of the mesial-distal and buccal-lingual roots, starting interproximally, using a luxating elevator
- Push-and-twist motion to elevate the tooth roots using a luxating elevator
- Luxation and traction using forceps
- Examination for root or crown fracture
- Hemostasis using a tampon and suction
- Socket exploration with a bone curette (no granuloma was found)
- Spooling with sterile saline
- Prescription of NSAID (Ibuprofen 400 mg, 3×1 as needed for pain), antiseptic mouth rinse (to be used gently after 24 hours), and Vitamin CDR 1×1
- Post-extraction instructions and counseling (KIE): Bite on the tampon for 30–60 minutes, Avoid eating for 2 hours, Avoid drinking hot water, Avoid vigorous rinsing, Do not disturb the extraction site with the tongue or fingers, Take medications as prescribed by the dentist, If bleeding persists for more than 8 hours, seek immediate care at the emergency department

Following the tooth extraction, the patient expressed relief as the anesthetic and extraction procedures were painless. One week later, a follow-up evaluation was conducted. The patient reported no pain after the extraction and only required a single dose of analgesic following the procedure. She also stated that the wound healed quickly and painlessly.

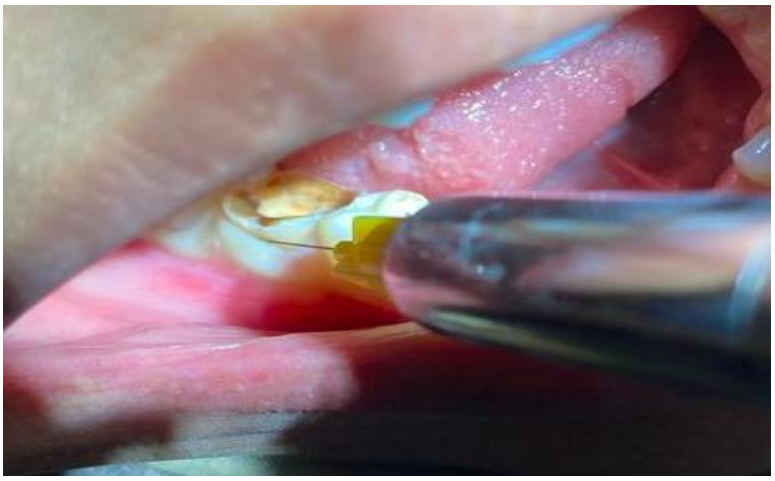

Figure 2. Intraligamentary anesthesia of tooth 46

Figure 3. Tooth 46 after split (separation)

Figure 4. Condition of the surrounding tissues post-extraction

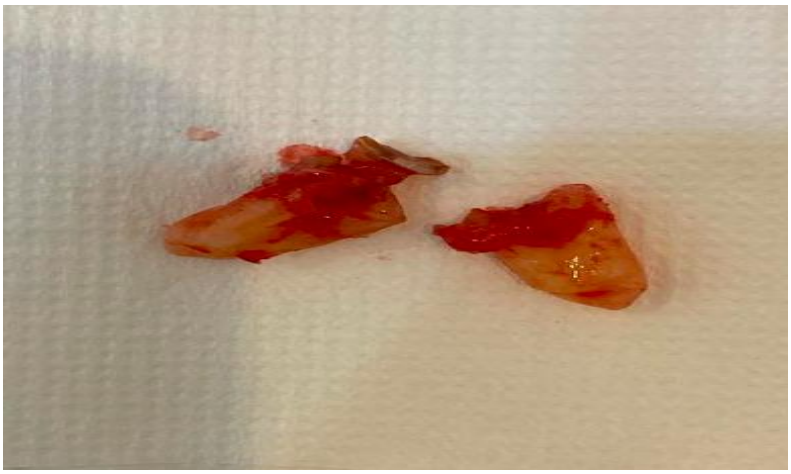

Figure 5. Extracted and separated tooth 46

Case 2

A 23-year-old female patient was referred by an orthodontic dentist to Dentes Purwokerto Clinic for tooth extraction as part of orthodontic treatment. The patient reported that she had never undergone tooth extraction before. She denied any drug allergies and had no history of systemic disease. Clinical and radiographic examinations revealed that tooth 35 was mesioangularly impacted, trapped between teeth 34 and 36. The mental foramen was not

radiographically visible near the root apex of tooth 35. Clinical findings showed that the crown of tooth 35 was free of caries, slightly intruded mesioangularly, and impinged between teeth 34 and 36 (Figures 6 and 7). Pulp vitality testing was positive, percussion testing was negative, and tooth mobility was negative. The dentist assessed that the tooth could not be extracted using simple instruments and techniques. Therefore, a treatment plan was made for atraumatic tooth extraction using the mesial cusp odontomy technique.

Figure 6. Clinical condition of tooth 35

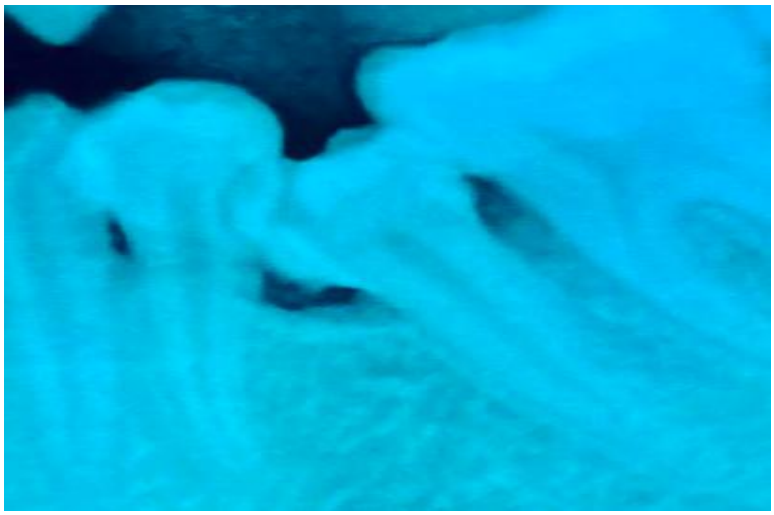

Figure 7. Radiographic image of tooth 35

Instruments and materials prepared:

Instruments:

Diagnostic set
Dental syringe (Osung)
Handpiece
Endo-access bur
Luxating elevator (Osung)
Forceps
Bone curette (Osung)
Spooling syringe
Cotton buds
Suturing set

Materials:

4% articaine anesthetic solution
Topical anesthetic
Povidone-iodine
Sterile saline
Gauze
Spongostan
Tampon

Atraumatic extraction procedure using the mesial cusp odontomy technique:

- Asepsis of the working area
- Mandibular block anesthesia, mental nerve anesthesia, and intraligamentary anesthesia using a dental syringe (Figure 8)
- Mesial cusp sectioning of tooth #35, adjusted to the tooth's inclination to remove the undercut, using a handpiece and endo-access bur (Figures 9 and 10)
- Separation of Sharpey's trans-septal fibers using a luxating elevator
- Wedge of insertion and clockwise–counterclockwise motions to sever the periodontal ligament at the mesial and distal roots, starting interproximally, using a luxating elevator
- Push-and-twist motion to elevate the tooth roots using a luxating elevator
- Luxation and traction using forceps
- Examination for root or crown fracture
- Hemostasis with tampon and suction
- Socket exploration using a bone curette (no granuloma was found)
- Spooling with sterile saline
- Placement of Spongostan and figure-of-eight suturing (Figure 13)
- Prescription of NSAID (Ibuprofen 400 mg, 3×1 as needed for pain), antiseptic mouth rinse (to be used gently after 24 hours), and Vitamin CDR 1×1
- Post-extraction instructions and counseling (KIE): Bite on the tampon for 30–60 minutes, Avoid eating for 2 hours, Avoid drinking hot water, Avoid vigorous rinsing, Do not disturb the extraction site with the tongue or fingers, Take medications as prescribed by the dentist, If bleeding persists for more than 8 hours, immediately visit the emergency department, After the tooth extraction, the patient reported no pain during the procedure. The patient returned for a follow-up visit one week later for suture removal and wound evaluation. The follow-up showed rapid wound healing at the tooth socket.
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Figure 8. Intraligamentary anesthesia of tooth 35

Figure 9. Mesial cusp sectioning of tooth 35

Figure 10. Condition of the mesial cusp

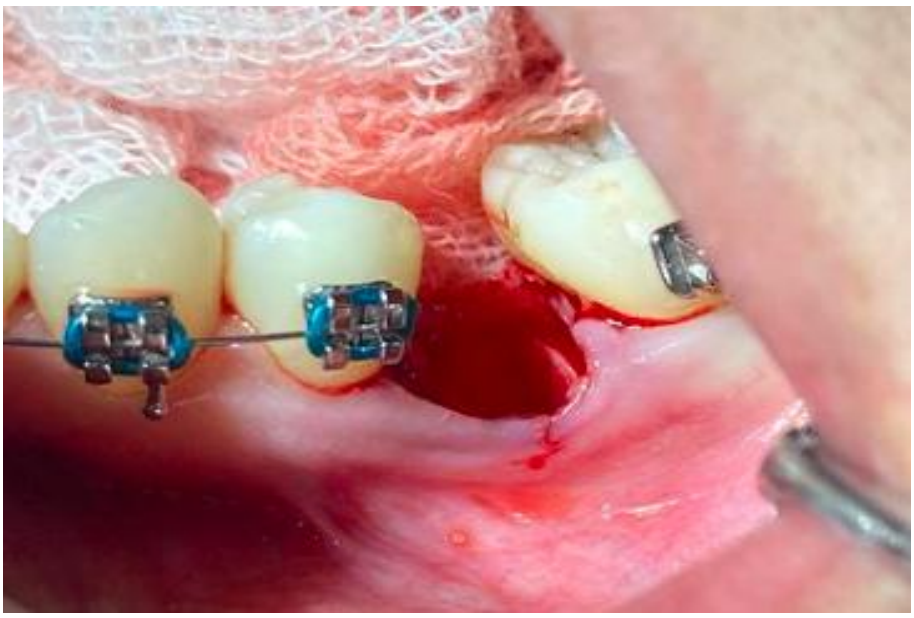

Figure 11. Socket condition post-extraction

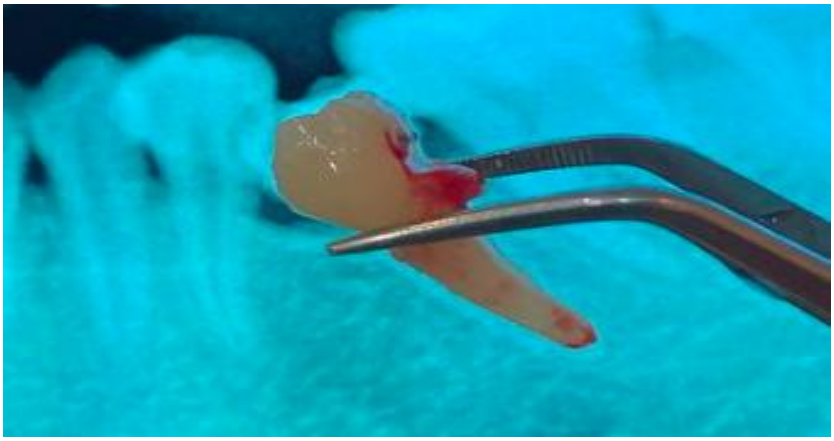

Figure 12. Extracted tooth

Figure 13. Figure-of-eight suturing of the socket

Figure 14. Condition of the extracted tooth

Case 3a

A 28-year-old female patient was referred by her orthodontist to Dentes Dental Clinic for the extraction of her third molar (38). The patient reported severe trauma from previous tooth extractions (teeth 15 and 25). She was in good general health and denied any systemic illnesses. Based on panoramic radiographic examination, tooth 38 was classified as an impaction class 1A,

with the root located directly above the mandibular canal (Figure 14). The patient's mouth opening was normal, and no infection was present. Pulp vitality testing was positive, percussion testing was negative, pressure testing was negative, and mobility was negative.

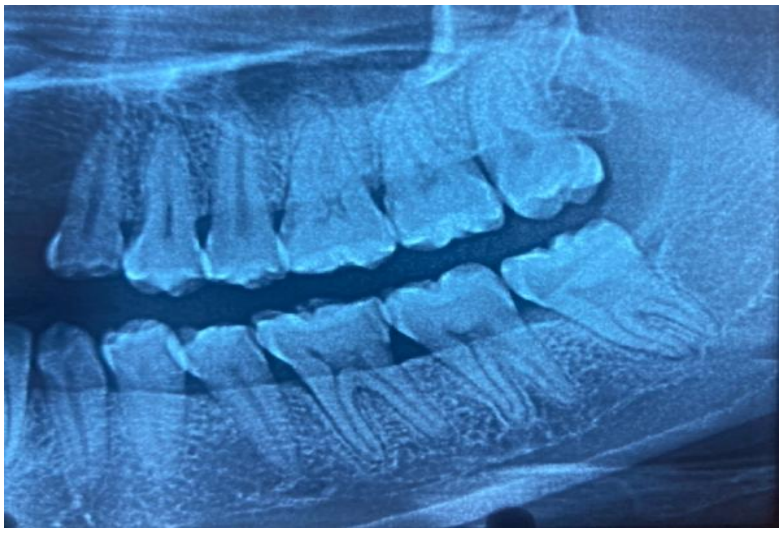

Figure 15. Panoramic radiograph

Based on the examination results, the dentist planned an atraumatic or minimally invasive extraction of tooth 38. Before the procedure, informed consent was obtained from the patient. The extraction procedure included the following steps: Asepsis of the working area and administration of mandibular block anesthesia, long buccal nerve anesthesia, and intraligamentary anesthesia to enhance anesthetic efficacy, followed by evaluation of anesthesia success. Separation of Sharpey's trans-septal fibers and performing a wedge of insertion and clockwise–counterclockwise motion using a luxating elevator (Osung) to sever deeper periodontal ligaments. This was followed by a push-and-twist motion with controlled, gentle force to further loosen the tooth. Elevation was then performed using an elevator (Osung) to lift the tooth and disrupt additional periodontal ligament fibers. Luxation and traction were performed in a controlled manner using forceps, with luxation directed buccally. Once the tooth was extracted, the tooth and socket were inspected. The tooth was removed intact without root fractures, and the socket showed no granuloma or sharp bone edges. Hemostasis was achieved, and the socket was irrigated with sterile saline, followed by placement of Spongostan and suturing (Figure 16).

Figure 16. Post-extraction clinical condition

The patient was prescribed Analtram for the first postoperative day, followed by Ibuprofen for pain management, prophylactic antibiotics (Amoxicillin), and a vitamin B complex to promote healing. Post-extraction instructions (KIE) were also provided. After the extraction, the patient expressed surprise that the procedure was painless and performed quickly.

Case 3b

A 35-year-old female patient presented to Dentes Dental Clinic requesting the extraction of her lower right third molar (48). She reported that the tooth had previously been carious and restored with a filling but became painful and swollen after treatment. She had a history of prior extractions without complications. The patient was in good general health and reported no drug allergies.

Figure 17. Clinical condition of tooth 48

Clinical examination revealed impacted tooth #48 with evidence of composite restoration and a trepanation hole on the mesial aspect. Pulp vitality testing was positive, percussion testing was positive, and mobility was negative. There was no swelling. Panoramic radiographic examination revealed a large radiolucent area on the mesial crown. Tooth #48 had two roots (mesial and distal) with slight apical divergence. Periodontal space widening was observed on the distal root, and the roots were in close proximity to the mandibular canal. The diagnosis was mesioangular impaction, class 1A (Figure 18).

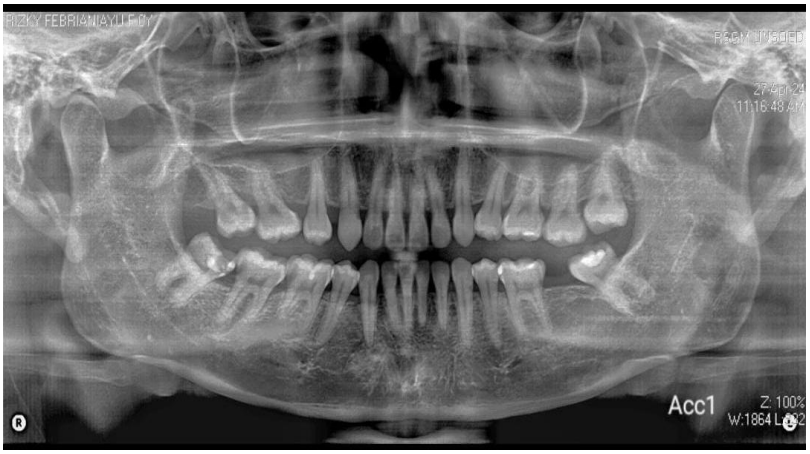

Figure 18. Panoramic radiograph

The dentist decided to perform an atraumatic extraction with tooth separation into mesial and distal sections. The extraction procedure was as follows: Asepsis of the working area and administration of mandibular block anesthesia, long buccal nerve anesthesia, and

intraligamentary anesthesia, followed by anesthesia efficacy evaluation. Tooth separation into mesial and distal sections using a handpiece and endo-access bur (Figure 19). The buccal and lingual grooves served as reference points for separation. Once the tooth was visibly separated, the sections were further separated using a luxator or elevator.

Figure 19. Tooth separation using a handpiece

Separation of Sharpey's trans-septal fibers and performing wedge of insertion and clockwise–counterclockwise motions using a luxating elevator (Osung) to sever deeper periodontal ligaments. Push-and-twist motions with controlled force were applied, followed by elevation with an elevator (Osung) for each section of the tooth. Luxation and traction using forceps, applying buccal-lingual movements, slight rotation, figure-of-eight (waving) movements, and buccal traction. Each tooth section (mesial and distal) was extracted intact without root fractures (Figure 21).

Figure 20. Post-extraction socket of tooth 48

Figure 21. Extracted tooth in separated condition

After extraction, the socket was inspected for granuloma and sharp bone edges, with none observed. Hemostasis was achieved, and the socket was irrigated with sterile saline. Spongostan was placed, and suturing was performed (Figure 22).

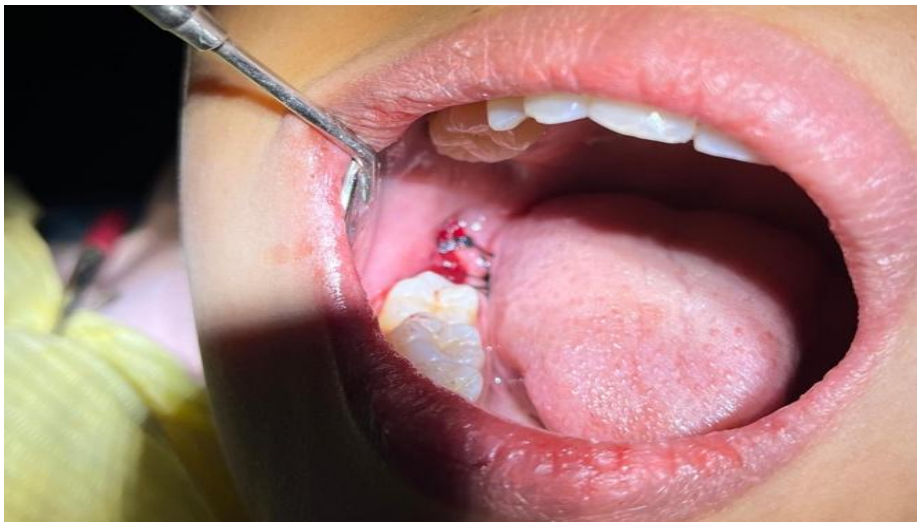

Figure 22. Sutured socket

Postoperative medications included Analtram (for the first postoperative day), Ibuprofen (for pain control after Analtram), prophylactic antibiotics (Amoxicillin), and a vitamin B complex. Post-extraction instructions (KIE) were provided. On the second postoperative day, the patient reported bruising under the cheek area, resembling a hematoma. The dentist instructed the patient to return immediately. Upon examination, mild emphysema was observed (Figure 23). The dentist performed irrigation and warm compresses on the affected area. Prophylactic antibiotic therapy was extended, and the patient was advised to apply warm compresses to the affected area 3–4 times daily.

Figure 23. Emphysema complication

Five days later, the patient returned for follow-up. The extraction site and emphysema area were evaluated. Sutures were removed, irrigation was performed, and the emphysema was assessed. The follow-up revealed complete resolution of the emphysema and good healing of the extraction site (Figure 24).

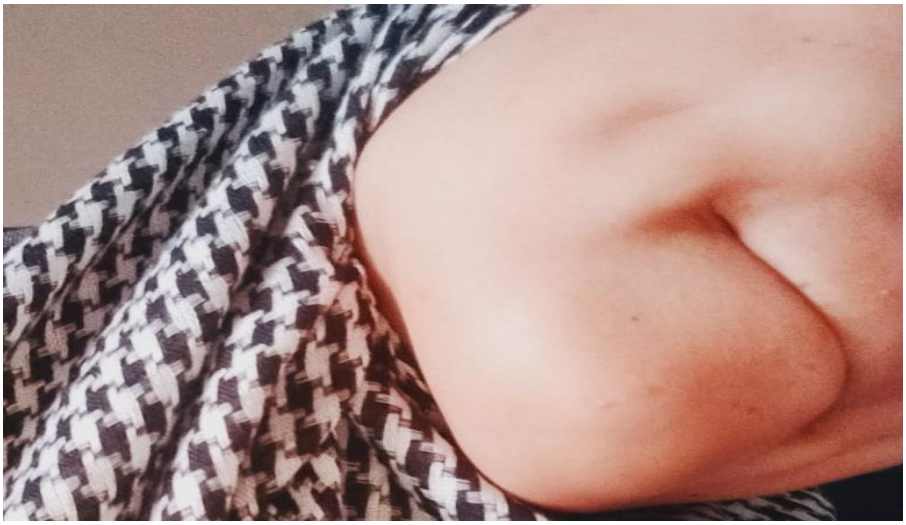

Figure 24. Healed emphysema

3. DISCUSSION

An ideal tooth extraction involves the complete removal of a tooth or its root from the socket with minimal trauma and as little pain as possible, ensuring proper wound healing and minimizing future prosthetic complications. The concept of atraumatic tooth extraction encompasses these principles, distinguishing it from conventional tooth extraction techniques (Lande, 2015).

In earlier definitions, conventional tooth extraction was simply understood as the act of removing a tooth from its socket (Fragiskos, 2007). Based on this definition, an extraction was considered successful as long as the tooth was removed by any means (Le, 2005). However, in modern practice, a successful tooth extraction is not only measured by the removal of the tooth but also by the ability to minimize pain during anesthesia and the extraction process itself (Corputty, 2012; Gadhia, 2024; Hupp et al., 2019). Postoperative outcomes must also be considered. After a tooth extraction, complications should be prevented, pain must be minimized, and the hard and soft tissues should sustain minimal trauma (small wounds) to ensure rapid healing. Tooth extraction should therefore not focus solely on removing the tooth but also on minimizing the risk of complications before, during, and after the procedure (Dahong, 2010; Kershaun, 2017; Lande, 2015).

Atraumatic tooth extraction addresses these needs. The first major advantage of this technique is reduced pain or a painless experience. In reported cases, patients often reported no pain during the extraction procedure, a result achieved through effective pain management. Pain reduction or elimination begins with proper anesthetic techniques, even during the administration of the anesthetic itself. To achieve painless injections, the dentist must carefully select the instruments, including the syringe and needle. The sharper and more beveled the needle, the less pain is felt during insertion. Similarly, the smoother and slower the anesthetic is deposited, the lower the pressure and pain experienced. The anesthetic solution itself can also influence discomfort: the more diluted the solution, the less pain the patient experiences during infiltration (Malamed, 2019; Salian, 2023; Singla, 2020).

In addition, dentists must be proficient in handling syringes and understanding anatomical considerations, particularly the location and position of nerves targeted for anesthesia. This determines the choice of instruments, materials, and anesthetic techniques. For example, during the extraction of tooth #34 in a radix condition, anesthesia may be delivered using a disposable 3cc syringe with a 32mm 25–27G needle or a dental syringe with a short 1”, 27–30G needle. The anesthetic agents may include 2% lidocaine (plain or with epinephrine) or 4% articaine. In the maxilla, an infiltration technique is often sufficient because of the porous nature of the maxillary bone, allowing anesthetic diffusion to the superior alveolar nerves

(Razmara, 2021). In contrast, mandibular tooth extractions require a mandibular block because infiltration is less effective in the dense mandibular bone. Intraligamentary anesthesia may be added for improved efficacy. Adequate anesthesia contributes to a painless extraction. Postoperative analgesics should also be prescribed to manage or eliminate pain. Analgesic management must extend beyond the procedure itself, with NSAIDs and, in some cases, opioids recommended for pain control (Corputty, 2012; Malamed, 2019).

The second advantage of atraumatic tooth extraction is minimal trauma to the surrounding soft and hard tissues. This is a fundamental goal of the technique. Dentists must understand the process of tooth removal from its socket. Teeth are supported by the periodontium, which includes the periodontal ligament, cementum, alveolar bone, and gingiva. For a tooth to be extracted, the supporting tissues must be disrupted. Minimal trauma is achieved when only the periodontal ligament is severed, leaving other supporting tissues intact (Borwn, 2014; Hupp et al., 2019). The periodontal ligament is composed of various Sharpey's fibers, which must be severed to release the tooth without damaging the alveolar crest or gingival margins (Salian, 2023; Singla, 2020).

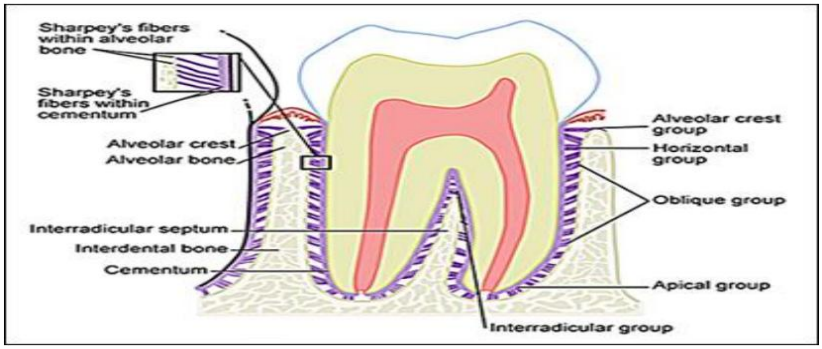

Figure 25. Periodontal tissues

To achieve minimal trauma, the dentist must use appropriate instruments and be skilled in their use. Innovations in instruments for atraumatic extractions include periotomes, Benex extractors, physics forceps, and powertomes, though these devices are not widely available in Indonesia. More accessible instruments include luxating elevators and forceps, which, although traditionally considered conventional tools, have been modified to suit atraumatic extraction principles (Le, 2005).

Tooth extraction requires severing the periodontal ligament located within the periodontal space, which typically measures 0.3–0.46 mm. Luxating elevators are designed with a very thin, sharp blade (approximately 0.5 mm; e.g., Osung brand) to fit into the periodontal space and sever the periodontal ligament without damaging the alveolar crest or free gingival margin. The instrument is inserted into the periodontal space using a wedge of insertion, followed by clockwise–counterclockwise motions to sever the ligament up to half the root length from the cementoenamel junction (CEJ) toward the apex. The push-and-twist motion is then used to elevate the tooth further and sever apical ligament fibers (Le, 2005; Salian, 2023; Singla, 2020).

Figure 26. Wedge insertion with luxating elevator

After using the luxating elevator, the tooth is delivered from the socket with forceps. To minimize trauma, forceps should apply more rotational movements (for single-rooted teeth) and mesial–distal luxation rather than buccal–lingual forces. For multi-rooted teeth, the rotational movement is replaced with waving or figure-of-eight movements. The non-dominant hand is used to stabilize the periodontal tissues during luxation and traction. All movements must be soft and gentle (Le, 2005).

Figure 27. Rotational forceps movement

In cases of impacted teeth, malposition, severely damaged teeth, or undercuts that complicate the extraction, the undercut must be removed. Odontomy (tooth sectioning) is preferred over osteotomy (bone removal). Odontomy is performed using a handpiece and bur, preferably with an electric handpiece or a low-pressure air-driven handpiece to reduce the risk of emphysema (air entrapment in tissues). If emphysema occurs, warm compresses on the affected area and broad-spectrum antibiotics should be administered to promote absorption and prevent infection. In Case 1, Case 2, and Case 3b, odontomy was performed because simple atraumatic techniques were not feasible, enabling the tooth to be removed with minimal trauma. Emphysema occurred in Case 3b and was successfully managed with warm compresses and broad-spectrum antibiotics (Dahong, 2010; Le, 2005).

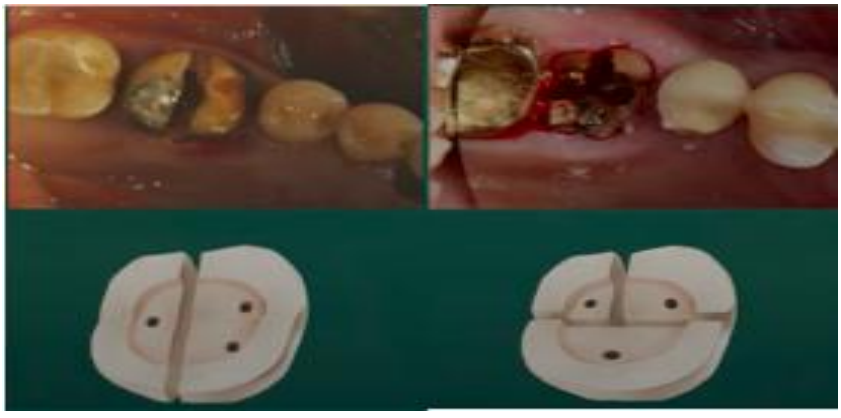

Figure 28. Odontomy (split technique)

By using luxating elevators (e.g., Osung) and forceps appropriately, dentists can perform atraumatic tooth extractions effectively. Mastery of instrument handling and gentle techniques is essential (Le, 2005; Salian, 2023; Singla, 2020). The third advantage of atraumatic extraction is faster and better wound healing, minimizing the risk of infection. Small wounds resulting from minimal trauma heal more quickly because they produce less inflammation and pain, which can typically be managed with mild to moderate analgesics. Larger wounds, on the other hand, take

longer to heal, provoke more inflammation and pain, and increase the risk of infection due to greater exposure of blood vessels and open tissue surfaces (Le, 2005; Salian, 2023; Singla, 2020).

The fourth advantage is the preservation of alveolar bone and soft tissue, which is crucial for future dental implant placement or prosthetic rehabilitation. Implant success depends on the integrity of the supporting hard and soft tissues. Insufficient alveolar bone volume reduces the likelihood of adequate osseointegration and can lead to implant failure. Therefore, preserving the supporting structures during tooth extraction is essential (Le, 2005; Salian, 2023; Singla, 2020). Atraumatic tooth extraction can be applied to a variety of cases, from simple extractions such as radix removals to complex impactions. When performed with the appropriate instruments and techniques, this method offers all of its advantages. Above all, the goal is to achieve minimal trauma to the surrounding tissues during tooth extraction, thereby avoiding significant postoperative complications (Le, 2005; Salian, 2023; Singla, 2020).

4. CONCLUSION

Atraumatic tooth extraction is considered the ideal technique for tooth removal, involving the complete extraction of the tooth or its root with minimal trauma and as little pain as possible. This approach ensures optimal wound healing and minimizes subsequent prosthetic complications. Dentists must have a thorough understanding of the philosophy behind tooth extraction to successfully apply this technique. Mastery of anatomical considerations and instrument handling is also essential, enabling the dentist to perform atraumatic tooth extractions in various indicated cases with minimal trauma as the outcome..

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