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(Case Report)

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Local Application of 35 kDa hyaluronic acid fragment gel–soaked cotton balls in patients with tooth and gingival pain and swelling: A case series

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Abstract

Dental procedures such as tooth restoration, tooth transplantation, tooth extraction, scaling, and local anesthetic injection frequently induce acute tooth and gingival pain, often accompanied by inflammatory manifestations including gingival swelling. These postoperative symptoms can negatively affect patients' oral comfort and overall quality of life. In this case series, a 0–10 numeric rating scale (NRS) was used to evaluate the clinical effects of locally applying cotton balls soaked in 10% high-concentration 35 kDa hyaluronic acid fragment (HA35) gel in nine patients experiencing maxillofacial pain and gingival swelling following dental procedures. The results suggested that this intervention may help relieve tooth and gingival pain associated with dental procedures and may contribute to the reduction of gingival swelling. The treatment exhibited both rapid analgesic activity and clear anti-inflammatory effects, suggesting promising clinical value for the immediate management of postoperative oral symptoms.

Keywords: 35 kDa Hyaluronic Acid Fragment; Dental Procedures; Maxillofacial Pain; Gingival Swelling; Local Analgesia; Anti-Inflammation

1. Introduction

Dental procedures commonly cause acute injury and inflammation of dental and periodontal tissues in clinical practice. Mechanical cavity preparation during tooth restoration, trauma to the extraction socket during tooth extraction, periodontal stimulation during scaling, and tissue puncture during local anesthetic injection may directly or indirectly stimulate periodontal nerve endings and connective tissues. These stimuli can lead to immediate or short-term postoperative tooth and gingival pain [1], often accompanied by gingival vasodilation, tissue edema, and other manifestations of swelling [1]. Although these acute symptoms are generally self-limiting, pain and discomfort during the early postoperative period can reduce patients' acceptance of dental treatment. In some cases, local inflammatory responses may be exacerbated, resulting in prolonged symptoms. Therefore, there is a clinical need for a safe, rapid-acting, and easy-to-apply local intervention for the management of postoperative dental pain and gingival swelling.

Hyaluronic acid is a natural component of human connective tissue and plays important physiological roles in tissue hydration, anti-inflammatory regulation, and tissue repair [2]. Its biological activity is closely associated with molecular weight. Previous studies have shown that HA35 possesses enhanced anti-inflammatory and analgesic properties [3]. Our previous research demonstrated that a 10% high-concentration HA35 gel can improve gingival recession and gingival inflammation, and can also relieve superficial skin itching and somatic pain. After 42 days of treatment with this preparation, four patients with mild gingival recession showed an average gingival regeneration of 1.2 mm, accompanied by complete resolution of inflammatory symptoms [4]. The underlying mechanisms may involve modulation of TRPV1/TRPA1 calcium channels and activation of the lymphatic endothelial receptor LYVE-1, which

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together may reduce inflammatory responses by inhibiting pain signal transmission and promoting local lymphatic circulation [3,5].

Based on the biological activity of hyaluronic acid fragments and the clinical need for improved postoperative symptom management in dentistry, the present study applied 10% high-concentration HA35 gel delivered via cotton ball carriers to painful and swollen maxillofacial sites following dental procedures. The aim was to evaluate its clinical analgesic and anti-inflammatory effects and to explore a practical approach for the local management of acute postoperative maxillofacial pain and gingival swelling.

2. Case reports

2.1. Clinical Data of Patients

A total of nine patients presenting with tooth and gingival pain accompanied by gingival swelling after dental procedures were included in this study. The cohort consisted of 3 males and 6 females, aged 40–72 years, with a median age of 57 years. All patients had no history of allergy to hyaluronic acid preparations and no systemic conditions that might influence inflammatory responses, including severe periodontitis, diabetes, or immune dysfunction. None of the patients had a long-term history of analgesic or anti-inflammatory drug use. The observed pain and swelling were directly associated with the current dental procedure, and symptom onset occurred within 12 hours after treatment.

The clinical characteristics of the patients were as follows: Case 1: A 40-year-old female developed gingival distension and pain after anterior tooth scaling without local anesthesia. Mild swelling was observed in the labial gingiva of the lower anterior teeth. The pain score was 2, and the swelling score was 1. Case 2: A 54-year-old male experienced occlusal pain after molar restoration without local anesthesia, accompanied by swelling of the buccal gingiva. The pain score was 3, and the swelling score was 2. Case 3: A 42-year-old female reported spontaneous dull pain following premolar restoration without local anesthesia, with swelling of the interdental gingiva. The pain score was 4, and the swelling score was 2. Case 4: A 67-year-old male developed distension and pain after anterior tooth transplantation due to inadequate anesthesia. Swelling of the gingival margin was observed. The pain score was 4, and the swelling score was 3. Case 5: A 60-year-old female experienced occlusal discomfort with pain after molar transplantation with insufficient anesthesia, accompanied by swelling of the buccal gingiva. The pain score was 4, and the swelling score was 3. Case 6: A 57-year-old female developed spontaneous pain after canine transplantation due to anesthesia failure, with swelling of the gingival papilla. The pain score was 5, and the swelling score was 3. Case 7: A 40-year-old male experienced pain in the extraction socket after wisdom tooth extraction with inadequate anesthesia. Swelling was observed in the surrounding gingiva. The pain score was 5, and the swelling score was 4. Case 8: A 72-year-old female reported distension and radiating pain in the extraction socket after molar extraction with anesthesia failure. Obvious gingival swelling was present. The pain score was 6, and the swelling score was 5. Case 9: A 59-year-old female experienced tingling pain in the extraction socket after premolar extraction with insufficient anesthesia, accompanied by swelling of the interdental gingiva. The pain score was 5, and the swelling score was 5.

All patients were able to clearly describe their symptoms, independently complete the pain and swelling scale assessments, and cooperate fully with the entire clinical observation process.

2.2. Intervention

The intervention consisted of 10% high-concentration HA35 gel, with sterile medical cotton balls used as carriers. During the procedure, at least two sterile cotton balls were thoroughly soaked with 12.5 mL of 35 kDa hyaluronic acid fragment gel. After ensuring that the cotton balls were completely saturated without dripping, they were carefully placed on the painful and swollen teeth and gingival regions. Patients were instructed to gently chew and hold the cotton balls in the mouth for 30 minutes, allowing continuous local contact with the lesion area (Figure 1). During this period, the cotton balls were maintained in close contact with the affected tissues to minimize gel loss and ensure adequate local drug concentration and contact time at the lesion site.

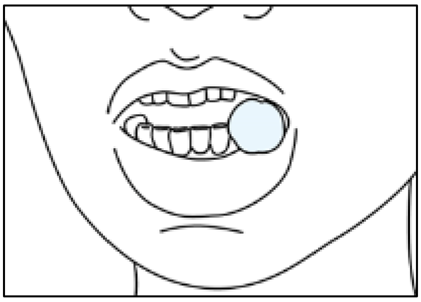

Figure 1 Operation and Usage Method

2.3. Efficacy Evaluation Indicators and Statistical Analysis

Three parameters were used to evaluate treatment efficacy: ① Pain intensity: Maxillofacial pain was assessed using a 0–10 NRS [6], where 0 indicated no pain and 10 indicated the most severe pain imaginable. Patients independently recorded pain scores before intervention and at 1, 30, and 60 minutes after treatment. ② Gingival swelling: The degree of gingival swelling was evaluated using a 0–10 Visual Analog Scale (VAS) [7], where 0 indicated no swelling and 10 represented severe gingival swelling with firm texture and marked tenderness. Patients assessed swelling by self-observation in a mirror combined with gentle palpation of the gingiva. Scores were recorded at the same time points as the pain assessment. The final scores were determined based on patients' subjective perception together with observable clinical manifestations. ③ Onset characteristics: The initial onset time of pain relief was recorded. In addition, intuitive clinical changes in gingival swelling were observed, including reduction in swelling area, color changes from bright red to pink, and decreased tenderness.

Pain and swelling scores from the nine patients were compiled. The data were expressed as mean ± standard deviation ($\bar{x} \pm s$) to illustrate the overall trend of symptom improvement following intervention [8].

3. Results

3.1. Changes in Pain and Gingival Swelling

After local application of 10% HA35 gel–soaked cotton balls, all nine patients showed varying degrees of improvement in both tooth and gingival pain and gingival swelling. Pain relief occurred rapidly after the intervention, with most patients reporting noticeable improvement shortly after application. Pain scores continued to decrease over time and were markedly reduced by 60 minutes after treatment (Table 1).

Gingival swelling also showed gradual improvement. Patients reported reduced gingival tension and tenderness, and clinical observation indicated a decrease in swelling extent, with gingival color gradually changing from bright red to pink in several cases (Table 2). No adverse reactions were observed during the observation period.

Table 1 Pain Scores (NRS) of Patients at Different Time Points

Case	Baseline	1 min	30 min	60 min
Case 1	2	1	0	0
Case 2	3	2	1	0
Case 3	4	3	2	1
Case 4	4	3	2	1
Case 5	4	3	2	1
Case 6	5	4	3	2
Case 7	5	4	3	2
Case 8	6	5	4	3
Case 9	5	4	3	2
Mean ± SD	4.22 ± 1.20	3.22 ± 1.20	2.22 ± 1.20	1.33 ± 1.00

Table 2 Gingival Swelling Scores (VAS) of Patients at Different Time Points

Case	Baseline	1 min	30 min	60 min
Case 1	1	1	0	0
Case 2	2	2	1	1
Case 3	2	2	1	1
Case 4	3	3	2	2
Case 5	3	3	2	2
Case 6	3	3	2	2
Case 7	4	4	3	2
Case 8	5	5	4	3
Case 9	5	5	4	3
Mean ± SD	3.11 ± 1.36	3.11 ± 1.36	2.11 ± 1.36	1.78 ± 1.09

3.2. Onset Characteristics of Symptom Relief

Rapid onset of analgesia was observed in most patients. Several patients reported subjective pain relief within 1 minute after the application of the HA35 gel–soaked cotton balls. In addition to pain reduction, clinical signs of gingival inflammation gradually improved. The swelling range decreased, gingival color shifted from bright red to light pink, and tenderness on palpation was reduced. These improvements became more evident within 30–60 minutes after treatment. No adverse reactions such as local irritation, allergic responses, or increased pain were observed during the observation period, which is consistent with the good biocompatibility of HA35 preparations [9].

4. Discussion

This case series included nine patients with maxillofacial pain and gingival swelling following dental procedures. After local application of 10% high-concentration HA35 gel–soaked cotton balls, varying degrees of symptom relief were observed in all patients, and no adverse reactions occurred. These findings suggest that HA35 gel applied locally may represent a simple and potentially useful approach for the management of acute postoperative dental discomfort.

Dental procedures frequently cause mechanical injury to dental and periodontal tissues, which can trigger inflammatory mediator release and activate peripheral nociceptors, resulting in postoperative pain and gingival swelling [10]. Although these symptoms are often self-limiting, they can significantly affect patient comfort during the early postoperative period. In the present study, patients showed a trend toward rapid pain relief and gradual reduction in swelling following HA35 application. This observation is consistent with previously reported anti-inflammatory and analgesic properties of hyaluronic acid fragments and their good biocompatibility [2,11], although the present study focuses primarily on clinical observation rather than mechanistic investigation.

Differences in symptom improvement were also noted among different dental procedures. Patients undergoing less traumatic treatments, such as scaling or tooth restoration, generally experienced faster symptom relief, whereas patients after tooth extraction showed slower reduction in swelling, likely due to more extensive tissue injury at the extraction site. This pattern is consistent with the typical inflammatory response observed after dental procedures [10].

The intervention method used in this study—continuous local application of HA35 gel-soaked cotton balls for approximately 30 minutes—may have contributed to the observed effects. Cotton balls act as a carrier that helps maintain the gel at the lesion site and reduce dilution by saliva, thereby prolonging contact between HA35 and gingival tissues [4]. In addition, the procedure is simple, inexpensive, and easy to perform, requiring no additional equipment and allowing immediate implementation after dental treatment.

Previous studies have reported that HA35 can improve gingival recession [4] and relieve superficial skin pain [12]. The findings of this study further suggest that HA35 may also have potential value in managing acute oral inflammatory pain and gingival swelling. However, the exact mechanisms involved were not explored in this study and require further investigation, though relevant studies have indicated that HA35 exerts anti-inflammatory effects through specific pathways [13]. The biological characteristics of HA35 have also been fully verified in previous studies [14], and its role in inflammatory regulation may be closely related to lymphatic system function [15,16,17].

Several limitations should be noted. The sample size was small, and this study lacked a control group, making it difficult to exclude the possibility that part of the observed improvement was related to the natural resolution of inflammation. In addition, the observation period was limited to 60 minutes after intervention, and longer-term effects were not evaluated. Future studies with larger sample sizes, controlled designs, and extended follow-up are needed to further assess the clinical value of HA35 gel in postoperative dental care.

5. Conclusion

Local application of 10% high-concentration 35 kDa hyaluronic acid fragment gel–soaked cotton balls may help relieve tooth and gingival pain associated with dental procedures and may contribute to the reduction of gingival swelling. In this small case series, the intervention showed rapid symptom improvement, good local tolerance, and convenient clinical application.

Given the limited sample size and the absence of a control group, these findings should be interpreted cautiously. Nevertheless, the results suggest that this method may represent a practical option for the local management of acute postoperative dental pain and gingival swelling, and further controlled clinical studies are warranted.

Compliance with ethical standards

Disclosure of conflict of interest

The authors declare that there is no conflict of interest regarding the publication of this article.

Statement of informed consent

The patient provided written informed consent authorizing the use of his data for the publication of this case.

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