Comparative analysis of the amount of postoperative drainage after intraoral vertical ramus osteotomy and sagittal split ramus osteotomy

Hyunyoung Kim, Seung-Won Chung, Hwi-Dong Jung, Hyung-Sik Park, Young-Soo Jung
Department of Oral and Maxillofacial Surgery, Oral Science Research Institute, College of Dentistry, Yonsei University, Seoul, Korea

Abstract (J Korean Assoc Oral Maxillofac Surg 2014;40:169-172)

Objectives: The purpose of this retrospective study was to compare the amount of postoperative drainage via closed suction drainage system after intraoral vertical ramus osteotomy (IVRO) and sagittal split ramus osteotomy (SSRO).

Materials and Methods: We planned a retrospective cohort study of 40 patients selected from a larger group who underwent orthognathic surgery from 2007 to 2013. Mean age (range) was 23.95 (16 to 35) years. Patients who underwent bilateral IVRO or SSRO were categorized into group I or group II, respectively, and each group consisted of 20 patients. Closed suction drainage system was inserted in mandibular osteotomy sites to decrease swelling and dead space, and records of drainage amount were collected. The data were compared and analyzed with independent t-test.

Results: The closed suction drainage system was removed at 32 hours postoperatively, and the amount of drainage was recorded every 8 hours. In group I, the mean amount of drainage was 79.42 mL in total, with 31.20 mL, 19.90 mL, 13.90 mL, 9.47 mL, and 4.95 mL measured at 0, 8, 16, 24, and 32 hours postoperatively, respectively. In group II, the mean total amount of drainage was 90.11 mL, with 30.25 mL, 25.75 mL, 19.70 mL, 8.50 mL, and 5.91 mL measured at 0, 8, 16, 24, and 32 hours postoperatively, respectively. Total amount of drainage from group I was less than group II, but there was no statistically significant difference between the two groups (P=0.338). There was a significant difference in drainage between group I and group II only at 16 hours postoperatively (P=0.029).

Conclusion: IVRO and SSRO have different osteotomy design and different extent of medullary exposure; however, our results reveal that there is no remarkable difference in postoperative drainage of blood and exudate.

Key words: Sagittal split ramus osteotomy, Intraoral vertical ramus osteotomy, Postoperative complications, Closed suction drainage system, Drainage

[paper submitted 2014. 5. 15 / revised 2014. 6. 16 / accepted 2014. 6. 18]
The amount of postoperative drainage was checked every 8 hours for 32 hours total. Then the closed suction drainage system was removed. The amount of postoperative drainage was reported into the electronic medical record system. Data was collected and analyzed with independent t-test using the PASW Statistics 18.0 software (IBM Co., Armonk, NY, USA).

### III. Results

Results were described as the amount of postoperative drainage from a drain bulb per person every 8 hours postoperatively. (Table 2, Fig. 1) Immediately after the operation, the mean (SD) amount of drainage was 31.20 (12.31) mL and 30.25 (20.72) mL in group I and group II, respectively; however, the difference was not statistically significant ($P=0.861$). At 8 hours postoperatively, the mean (SD) amount of drainage was 19.90 (10.94) mL and 25.75 (18.08) mL in group I and group II, respectively; however, the difference was not statistically significant ($P=0.225$). At 16 hours postoperative-

### Table 1. Baseline characteristics of groups I and II

| Characteristic          | Group I          | Group II         |
|-------------------------|------------------|------------------|
| Method                  | IVRO             | SSRO             |
| Patients (n)            | 20               | 20               |
| Age (yr)                | 22.1             | 25.8             |
| Sex (n)                 | Male 11          | Female 9         |
|                         | Female 9         |                  |
| Only 2-jaw (n)          | 19               | 16               |
| 1-Jaw (n)               | 1                | 3                |
| 2-Jaw with genioplasty (n) | 0              | 1                |

(IVRO: intraoral vertical ramus osteotomy, SSRO: sagittal split ramus osteotomy)

Hyunyoung Kim et al: Comparative analysis of the amount of postoperative drainage after intraoral vertical ramus osteotomy and sagittal split ramus osteotomy. J Korean Assoc Oral Maxillofac Surg 2014

![Fig. 1. Amount of drainage from a bulb after orthognathic surgery. (SSRO: sagittal split ramus osteotomy, IVRO: intraoral vertical ramus osteotomy)](imageurl)
The healing of fractured bone occurs in four phases. The first phase is the inflammatory phase, which includes formation of hematoma, extravasation, release of cytokines, and aggregation of immune cells. These are causes of postoperative swelling and exudate. The second phase of fractured bone healing is formation of a soft callus characterized by cartilage around a fractured bone to connect a bony gap. Then the soft callus becomes a hard callus in the third phase, and the final phase of bone healing is the remodeling phase. In the remodeling phase, old bone is replaced with new bone. Immediately after an orthognathic surgery, these same four phases of bone healing begin with exudate and swelling in the inflammatory phase.

We inserted a closed suction drainage system into bilateral mandibular osteotomy sites to decrease postoperative swelling, seroma, and incidence of infection. Some studies have demonstrated that a closed suction drainage system is not effective. Clifton et al. performed a systematic review with a closed suction drainage system after operation for hip fracture and demonstrated that there was no significant difference in the occurrence of complications between a drained wound and an undrained wound. Though there is some debate about its necessity, closed suction drainage is considered a useful device for decreasing postoperative complications in various fields. He et al. performed a systematic review of randomized controlled trials studying insertion of a drain after axillary lymph node dissection for breast cancer. In comparison with undrained wounds, drained wounds showed significantly lower incidence of seroma formation without infection. Therefore, we inserted closed suction drainage systems into osteotomy sites, expecting a decrease in postoperative complications.

Ueki et al. showed that the amount of intraoperative bleeding was lower after IVRO than after SSRO. The study demonstrated that blood loss was 216.6 mL after SSRO and 125.5 mL after IVRO. Yet, there is no comparative study examining the amount of postoperative drainage from osteotomy areas after IVRO and SSRO. Therefore, we measured the amount of postoperative drainage after each type of operation by inserting a closed suction drainage system into mandibular osteotomy sites after orthognathic surgery. Some clinicians assume that the amount of intraoperative bleeding and postoperative exudate from osteotomy areas is larger after IVRO than after SSRO because bone segments after IVRO are not fixed by screws. Bone segments after SSRO are fixed and faced. We hypothesized that the amount of postoperative drainage might be larger after SSRO than IVRO because sagittal split osteotomy on ramus causes more extensive medullary exposure than vertical osteotomy on ramus.

We inserted a closed suction drainage system into bilateral mandibular osteotomy sites after surgery. The study demonstrated that blood loss was 216.6 mL after SSRO and 125.5 mL after IVRO. Yet, there is no comparative study examining the amount of postoperative drainage from osteotomy areas after IVRO and SSRO. Therefore, we measured the amount of postoperative drainage after each type of operation by inserting a closed suction drainage system into mandibular osteotomy sites after orthognathic surgery. Some clinicians assume that the amount of intraoperative bleeding and postoperative exudate from osteotomy areas is larger after IVRO than after SSRO because bone segments after IVRO are not fixed by screws. Bone segments after SSRO are fixed and faced. We hypothesized that the amount of postoperative drainage might be larger after SSRO than IVRO because sagittal split osteotomy on ramus causes more extensive medullary exposure than vertical osteotomy on ramus.

These data allowed comparison of drainage output from the bulb of a closed suction drainage system between group I and group II. Our findings may help determine which method can reduce postoperative swelling, seroma formation, and risk of infection. Although patients in group I showed less postoperative drainage than group II, these data did not show any statistically significant difference between the groups (P=0.338). Thus, surgeons do not need to consider postopera-

| Period (h) | Group | Volume (mL) | σ | P-value |
|-----------|-------|------------|---|---------|
| Immediate | I     | 31.20      | 12.31 | 0.861   |
|           | II    | 30.25      | 20.72 |         |
| 0-8       | I     | 19.90      | 10.94 | 0.225   |
|           | II    | 25.75      | 18.08 |         |
| 8-16      | I     | 13.90      | 6.37  | 0.029   |
|           | II    | 19.70      | 9.38  |         |
| 16-24     | I     | 9.47       | 5.2   | 0.658   |
|           | II    | 8.50       | 8.29  |         |
| 24-32     | I     | 4.95       | 4.57  | 0.601   |
|           | II    | 5.91       | 6.67  |         |
| Total     | I     | 79.42      | 23.86 | 0.338   |
|           | II    | 90.11      | 42.85 |         |

Group I: with intraoral vertical ramus osteotomy, Group II: with sagittal split ramus osteotomy.

Statistical analysis by Student’s t-test.

Hyunyoung Kim et al: Comparative analysis of the amount of postoperative drainage after intraoral vertical ramus osteotomy and sagittal split ramus osteotomy. J Korean Assoc Oral Maxillofac Surg 2014

IV. Discussion

The healing of fractured bone occurs in four phases. The first phase is the inflammatory phase, which includes formation of hematoma, extravasation, release of cytokines, and aggregation of immune cells. These are causes of postoperative swelling and exudate. The second phase of fractured bone healing is formation of a soft callus characterized by cartilage around a fractured bone to connect a bony gap. Then the soft callus becomes a hard callus in the third phase, and the final phase of bone healing is the remodeling phase. In the remodeling phase, old bone is replaced with new bone. Immediately
tive drainage when determining which method is preferred for mandibular surgery.

These data further suggest that the closed suction drains may be removed 32 hours after orthognathic surgery, because the amount of postoperative drainage during the last 8 hours was below 10 mL in both groups. At that time, the risk of swelling, hematoma formation, and probability of infection would decrease.

There are some possible confounding factors in this study. First, the two surgeons usually performed SSRO only for mandibular advancement, whereas they did IVRO for mandibular setback. Mandibular segments had less exposed bone marrow after mandibular setback. Consequently, the differing surgical plan for each method may have affected our results. Second, cold pack application can decrease the amount of drainage. Also, hypotensive anesthesia or injection of tranexamic acid can decrease hemorrhage. Use of steroid decreases inflammation and swelling. The above variables may influence the amount of postoperative drainage from a closed suction drainage system. Further study is needed to confirm whether the above are confounding factors. There may also be some difference in the ability of our two surgeons, though they performed the same osteotomy technique for IVRO and SSRO. We thought that there would be little variability between the two surgeons. Thus influence by the surgeon was not considered a confounding factor.

V. Conclusion

IVRO and SSRO have different osteotomy design and different exposure of medullary bone; therefore, one might think that the amount of postoperative drainage from a closed suction drainage system is different from each method. Our results revealed that there was no statistically significant difference in postoperative drainage of blood and exudate from bilateral mandibular osteotomy areas after IVRO and SSRO.

Conflict of Interest

No potential conflict of interest relevant to this article was reported.

References

1. Ovington LG. Dealing with drainage: the what, why, and how of wound exudate. Home Healthc Nurse 2002;20:368-74.
2. Jones J, Barraud J. An evaluation of KerraMax Care in the management of moderate to heavily exuding wounds. Br J Community Nurs 2014;(Suppl);S48, S50-3.
3. Politis C, Kunz S, Schepers S, Vrielinck L, Lambrichts I. Obstructive airway compromise in the early postoperative period after orthognathic surgery. J Craniofac Surg 2012;23:1717-22.
4. Hwang K, Kim HJ, Lee HS. Airway obstruction after orthognathic surgery. J Craniofac Surg 2013;24:1857-8.
5. Yoshioka I, Khanal A, Tominaga K, Horie A, Furuta N, Fukuda J. Vertical ramus versus sagittal split osteotomies: comparison of stability after mandibular setback. J Oral Maxillofac Surg 2008;66:1138-44.
6. Abou-Khalil R, Colnot C. Cellular and molecular bases of skeletal regeneration: what can we learn from genetic mouse models? Bone 2014;64:211-21.
7. Clifton R, Haleem S, McKee A, Parker MJ. Closed suction surgical wound drainage after hip fracture surgery: a systematic review and meta-analysis of randomised controlled trials. Int Orthop 2008;32:723-7.
8. He XD, Guo ZH, Tian JH, Yang KH, Xie XD. Whether drainage should be used after surgery for breast cancer? A systematic review of randomized controlled trials. Med Oncol 2011;28(Suppl 1):S22-30.
9. Ueki K, Marukawa K, Shimada M, Nakagawa K, Yamamoto E. The assessment of blood loss in orthognathic surgery for prognathia. J Oral Maxillofac Surg 2005;63:350-4.
10. Morsi E. Continuous-flow cold therapy after total knee arthroplasty. J Arthroplasty 2002;17:718-22.
11. Song G, Yang P, Hu J, Zhu S, Li Y, Wang Q. The effect of tranexamic acid on blood loss in orthognathic surgery: a meta-analysis of randomized controlled trials. Oral Surg Oral Med Oral Pathol Oral Radiol 2013;115:595-600.
12. Zellin G, Rasmusson L, Pålsson J, Kahnberg KE. Evaluation of hemorrhage depressors on blood loss during orthognathic surgery: a retrospective study. J Oral Maxillofac Surg 2004;62:662-6.
13. Choi WS, Irwin MG, Samman N. The effect of tranexamic acid on blood loss during orthognathic surgery: a randomized controlled trial. J Oral Maxillofac Surg 2009;67:125-33.
14. Chegini S, Dharwal DK. Review of evidence for the use of steroids in orthognathic surgery. Br J Oral Maxillofac Surg 2012;50:97-101.
15. Weber CR, Griffin JM. Evaluation of dexamethasone for reducing postoperative edema and inflammatory response after orthognathic surgery. J Oral Maxillofac Surg 1994;52:35-9.