



Original Article

บทความวิชาการ

Intrusion phenomenon and rebound of a natural tooth located between two implant supported crowns: case report

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Abstract

This case report describes the intrusion of a natural tooth located between two implant-supported crowns after 7 months in function. The intruded first molar was 2.5–3 mm infraoccluded and tilted lingually. After 4 months of serial proximal contact adjustment, the intruded tooth was gradually rebounded to its normal position in complete occlusion with the opposing tooth. A new crown was fabricated for the molar to obtain the optimal proximal contact with the adjacent crowns. At the six-month follow up the tooth was still in its normal position. The potential mechanisms of tooth intrusion are described and discussed.

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Key words: *implant-supported prostheses; natural tooth intrusion; proximal contact adjustment*

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Introduction

An implant-supported restoration has become a common treatment for partially edentulous patients. Various complications associated with dental implants have been reported.¹⁻⁶ In addition to the complications of bone loss^{1,2,5}, peri-implant soft tissue problems^{1,2,5}, mechanical complications^{1,3-5}, and esthetic failures^{1,3-5,6} natural tooth intrusion has also been described. The survey⁷ from 2,786 dentists treating 79,806 patients with a natural tooth connected to an implant by a prosthesis for a fixed partial denture indicated a tooth intrusion rate of 3.5%. In an international survey of natural tooth abutment intrusion, Rieder and Parel⁸ reported that intrusion most often occurred within the first year of function. Hoffmann⁹ reviewed 15 clinical studies of natural tooth intrusion finding it was more frequent in cases using nonrigid connections (0-66%) than in cases with rigid connections (0-44%). Carrillo¹⁰ conducted a literature review of 20 articles and found the incidence of natural tooth intrusion ranged from 0-5.6%.

Several interesting theories^{8,11} have been suggested to explain the intrusion of natural tooth connected with implant supported prosthesis.

Disuse atrophy is described as muscle atrophy occurring when the muscle is not in use. Cohn^{12,13} used an animal model in the simulation of loss of function of the periodontal ligament (PDL). He found that there was a shrinkage of a non-stimulated periodontal membrane complex in a tooth that had lost function. Hence fibers of the PDL also may atrophy when the tooth is splinted to a dental implant and cause intrusion.

Impaired rebound memory is hypothesized to occur when there is a constant pressure (stress or traumatic) on the PDL of a tooth causing the PDL to lose its elastic memory and remodel to a new position that

results in less pressure. Then the tooth will continue to move further apically until the PDL is no longer under stress.

The ratchet effect, or mechanical binding, has been described as when a tooth with a semi precision attachment joint moves vertically because of stress, it is prevented from returning to its original position when the path of insertion of the attachment joint is different from axis of the tooth.

In the dental literature, There is only one case report¹⁴ mentioned an intrusion of natural tooth located in between of implant supported crowns. Wang *et al.*¹⁴ described the intrusion of a free standing crowned natural second premolar tooth bounded by implant prostheses. They explained that intrusion was caused by excessively tight proximal contact from both implant prostheses. After 5 months of gradual proximal contact correction, the natural tooth rebounded back to its original position.

The present clinical case report describes the intrusion of a natural first molar tooth abutment bounded by implant prostheses after 7 months in function and described the technique used to correct the proximal contacts allowing the tooth to rebound back to its original position.

Case report

A 46-years-old partially edentulous male patient presented to the Esthetic and Implant Clinic at the Faculty of Dentistry, Chulalongkorn University, Bangkok, Thailand desiring implant placement to replace a missing tooth. His medical history was unremarkable. He had a habit of bruxism, which was being treated by wearing a hard acrylic splint while sleeping. The lower left second premolar and lower left second molar were found to have root fractures,

and were extracted. Straumann implants (Institute Straumann AG, Basel, Switzerland) with a 4.8 mm diameter 12 mm long wide neck tissue level and a 4.1 mm diameter 12 mm long bone level were placed at tooth 37 (left mandibular second molar) and tooth 35 (left mandibular second premolar), respectively. During implant healing, the leakage at the distal margin of a PFM crown on an endodontically treated tooth 36 (left mandibular first molar) was detected and crown replacement was planned. Three and five months after implant insertion, the implant-supported prostheses (a cemented single crown on implant 35 and a screw-retained single crown on implant 37) were delivered and a PFM crown at tooth 36 was cemented, respectively (Fig. 1A). At 1-week recall, all prostheses appeared normal in function.

Seven months later, however, the patient complained tooth 36 seemed abnormally tilted to the lingual side, and an inter-occlusal space was present. He also reported pain at this tooth when chewing. Based on oral examination and radiographic examination, we determined that this molar had intruded (Fig. 1B, 2A, 2B). The tooth was intruded 2.5–3 mm vertically and tilted 2 mm lingually. Dental floss was used to check

the tightness of the proximal contacts. There was very tight proximal contact both mesially and distally of this natural tooth. Both adjacent implant prostheses were located at the same position as 7 months ago with optimal occlusal contact. A periapical radiograph taken at this time showed intrusion of the tooth compared to radiograph taken at the time of restoration placement. The implant-supported crown on implant 37 (distal to the natural tooth) was unscrewed and removed. The natural tooth 36 exhibited mobility without sign of periodontal attachment loss.

Because the intrusion of a natural tooth bounded by implant crowns results from excessive proximal contact tightness, the treatment plan in this case was to gradually adjust the proximal contact of between the adjacent implant crowns (implant 35 and 37) and the natural intruded tooth until the natural tooth 36 rebounded to its original position.

To allow for the natural intruded tooth to rebound, the proximal contacts between the adjacent implant crowns and tooth 36 were adjusted by reducing the contact areas on the natural tooth and the implant crowns using a rubber wheel (Kerr corporation, Orange, CA, USA) until the dental floss could pass

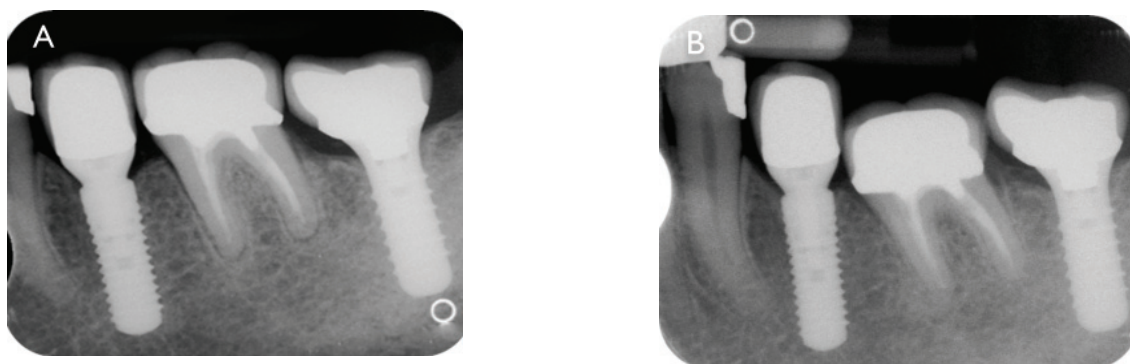


Fig. 1 Periapical radiographs, A) implant-supported crowns and crown on natural tooth in original position, B) an intrusion of natural tooth 36.

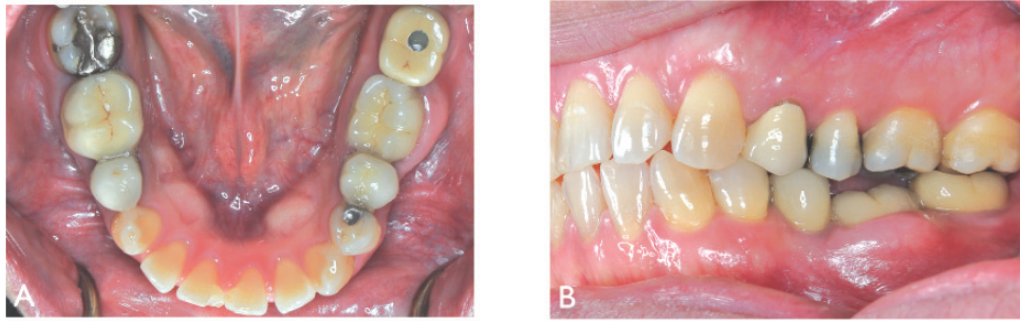


Fig. 2 A) occlusal view shows an intrusion of natural tooth 36, B) lateral view of an intrusion of natural tooth 36.

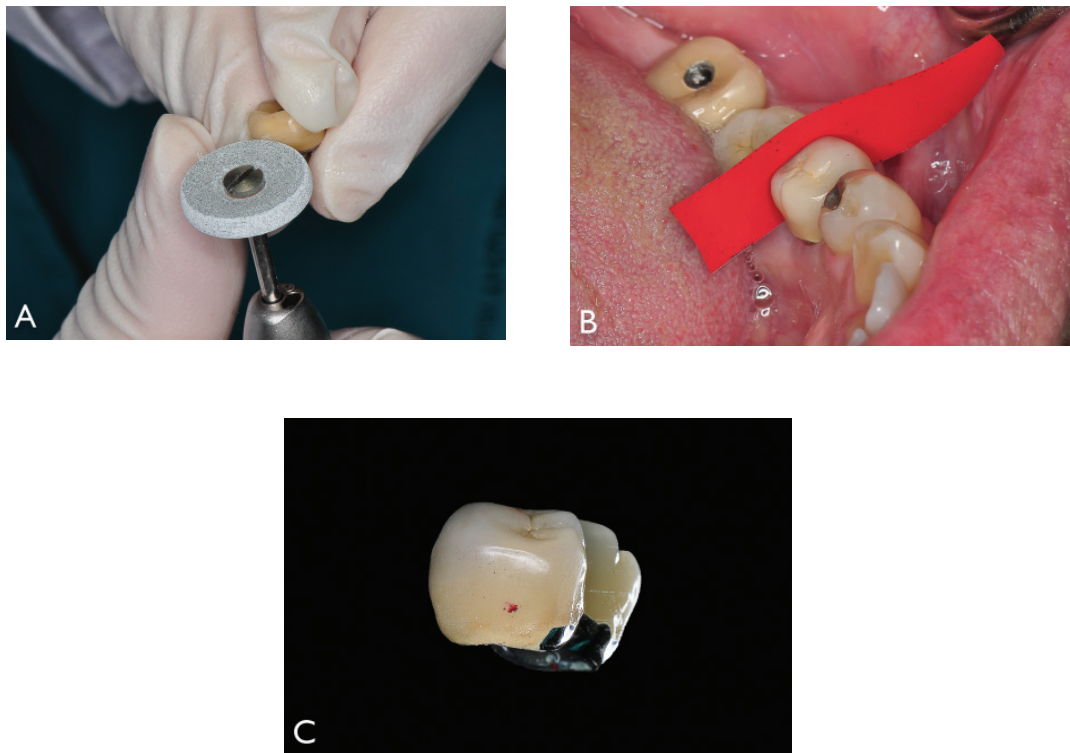


Fig. 3 A) the proximal contact of screw retained crown on implant 37 was adjusted, B) cement retained crown on implant 35 was removed and the proximal contact was checked, C) the proximal contact of cement retained crown on implant 35 was adjusted.

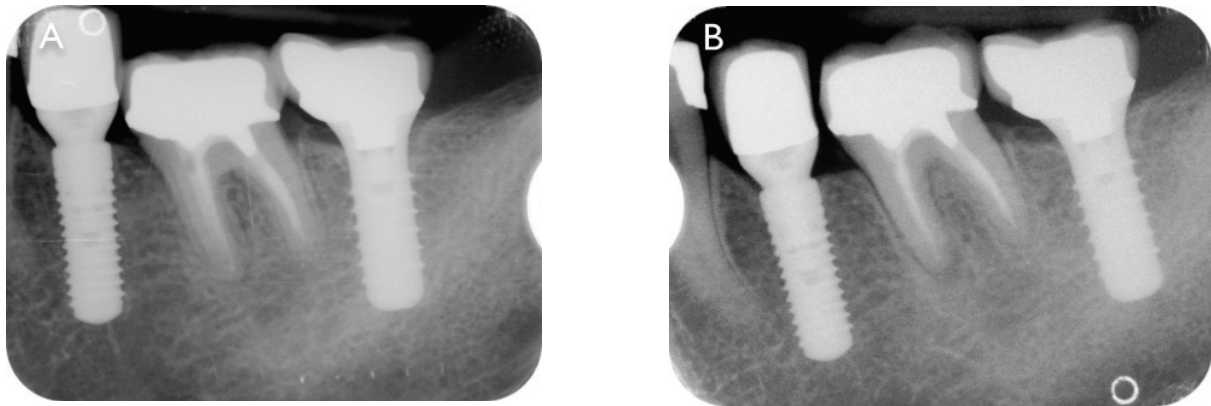


Fig. 4 Periapical radiographs A) present of partially rebounded of natural tooth 36, B) natural tooth 36 rebounded back to original position.



Fig. 5 A) clinical conditions of partially rebounded of natural tooth 36, B) lateral view of partially rebounded of natural tooth 36.

through the contact area (Fig. 3A, 3B, 3C). Two weeks after the first proximal adjustment, the contact area between the natural tooth and the implant crowns became tighten again. This indicated that the natural tooth had slightly rebounded towards its original position (Fig. 4A, 5A, 5B). The proximal adjustment was repeated every two weeks. After four months, the intruded natural tooth had rebounded back to its original position (Fig. 4B, 6A, 6B). The use of shim stock (Arti-Fol, Koln, Germany) indicated the natural tooth could establish occlusal contact with the opposing teeth. After three months of observation, the natural tooth maintained a stable position. At this stage, because light proximal contact at the mesial of the

natural tooth was still present, a new crown was fabricated for tooth 36 (Fig. 7A, 8A, 8B). And the 6-month follow up the tooth was observed to remain at its normal position, in occlusion and also present of a proper interproximal contacts. (Fig. 7B, 9A, 9B)

Discussion

Several theories have been suggested to explain the intrusion of a natural tooth connected to an implant supported prosthesis.^{8,11,15-17} Most of the theories revolve around the idea of the exertion of excessive force onto the natural tooth (differential energy

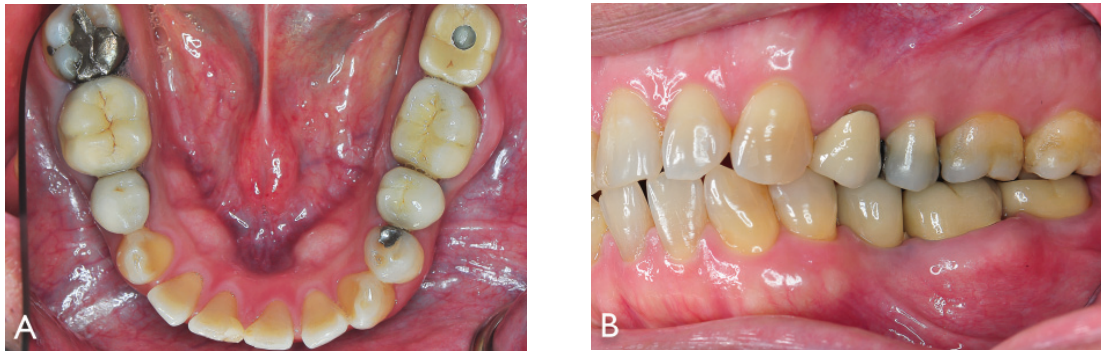


Fig. 6 A) clinical examination of natural tooth 36 rebounded back to original position, B) lateral view of natural tooth 36 rebounded back to original position.

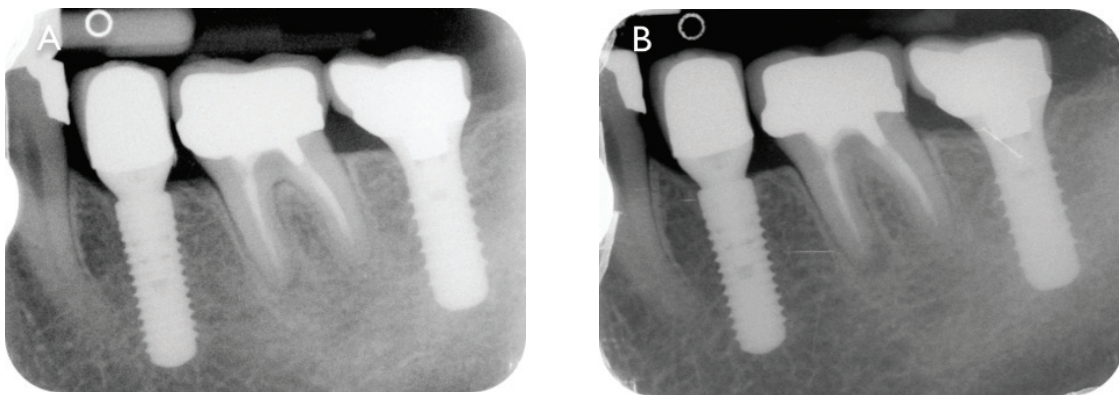


Fig. 7 Periapical radiograph A) after cementation of new crown on tooth 36, B) tooth 36 remain in normal position after 6-month follow up.

dissipation, mandibular flexure and torsion, and flexure of the fixed partial framework). These theories can be supported based on the principle of orthodontic tooth movement stated by Proffit¹⁸ as the precise application of a light continuous force. While an *in vitro* photoelastic stress analysis by Srinivasan¹⁷ indicated that the force transmitted and distributed to a natural tooth connected to an implant was not light and continuous, the heavy and intermittent pathological forces observed can cause tooth intrusion. The presence of osteoclastic activity before and during tooth intrusion and the normal appearance of PDL¹⁶ argue against the disuse atrophy theory. The osteoblastic and

cementoblastic as well as the unchanged periodontal space observed at the intruded tooth disprove the disuse atrophy theory.¹⁹ Schlumberger¹⁵ has concluded that the cause of intrusion remains unknown. Sheets¹⁶ suggested that the cause of intrusion is multifactorial and intrusion is a reversible process.

In the present case report, the intrusion of a natural tooth occurred when implant crowns bounded a single natural tooth with very tight proximal contacts, Therefore, a plausible explanation could be impaired rebound memory with mechanical binding. The excessive occlusal stress on the PDL caused the PDL to lose its elastic memory and remodel to a less traumatic and

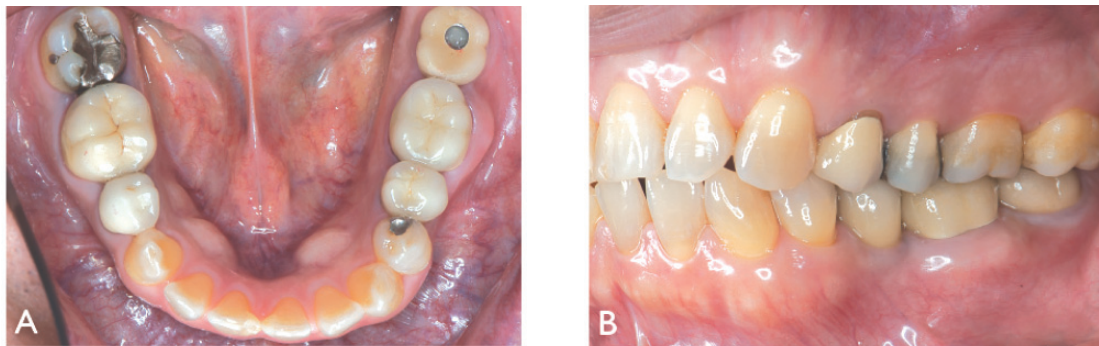


Fig. 8 A) clinical conditions after cementation of new crown on tooth 36, B) lateral view after cementation of new crown on tooth 36.

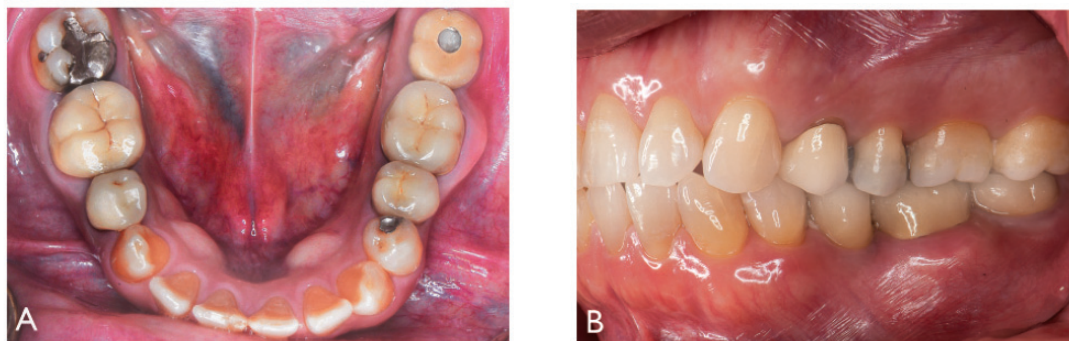


Fig. 9 A) occlusal view shows tooth 36 remain in normal position after 6-month follow up, B) clinical conditions shows tooth 36 remain in normal position after 6-month follow up.

stressful position with the tight proximal contacts preventing the tooth to rebound back to its original position. This mechanism resulted in the tooth moving into an intruded position. This process would repeat until either the occlusal force could no longer place on the PDL or the proximal contact began to loosen. At this point, tooth intrusion stops. Thus after the relief of both the intrusive force and the mechanical locking by the adjustment of the proximal contact, the intruded tooth can rebound to the normal position.

To avoid this type of complication, the interproximal contacts of implant supported crown should be carefully checked. Campagni²⁰ indicated that the

interproximal contacts should be modified until an 8 µg metallic shimstock can be dragged through the contact without tearing.

The technique used in the present clinical case report was serial proximal contact reduction to facilitate the gradual rebound of a natural tooth. We initially adjusted the proximal contacts of both implant crowns to allow the reversal the intruded tooth. However, without reducing the proximal contact areas of the intruded tooth, the contacts of both crowns on implant will not be properly contoured. Thus, we decided to adjust the proximal contact of the natural tooth. This method resulted in the natural tooth requiring a crown after it rebounded to its original position.

Conclusion

This report describes the complication of tooth intrusion, which developed after implant supported restoration and its clinical management. When a natural tooth is located between implant supported prostheses, the achievement of proper proximal contact of prostheses is vital. Proximal contact that is too tight for the dental floss to pass through can initiate intrusion of the natural tooth. Improper embrasures, infraocclusal contact and pain can also occur during intrusion. Importantly, intrusion is reversible subsequent to the correction of the proximal contacts, which allows the intruded tooth to rebound. Meticulous proximal contact adjustment is required to prevent the tooth intrusion from occurring.

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ปรากฏการณ์การดันเข้าและการกลับคืนตำแหน่งของฟันธรรมชาติซึ่งอยู่ระหว่างครอบฟันซึ่งบูรณะบนรากเทียม รายงานผู้ป่วย

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บทคัดย่อ

รายงานผู้ป่วยนี้บรรยายการดันเข้าของฟันธรรมชาติ ซึ่งอยู่ระหว่างครอบฟันซึ่งบูรณะบนรากเทียมสองตำแหน่ง หลังจากการใช้งานเป็นเวลา 7 เดือน ฟันกรามล่างขวาซี่ที่หนึ่งมีการดันเข้า 2.5-3 มิลลิเมตรต่ำกว่าระนาบสบฟัน และมีการเอนด้านลิ้น 4 เดือนภายหลังจากทำการปรับด้านประชิดของครอบฟันซึ่งบูรณะบนรากเทียม พบว่าฟันกรามล่างขวาซี่ที่หนึ่งมีการกลับคืนตำแหน่งอย่างช้า ๆ จนกลับคืนสู่ตำแหน่งปกติและสบกับฟันคู่สบ และหลังจากนั้นมีการทำครอบฟันใหม่เพื่อสัมผัสประชิดที่เหมาะสม จากการติดตามผลภายหลังการรักษาเป็นเวลา 6 เดือน พบว่าฟันกรามล่างขวาซี่ที่หนึ่งอยู่ในตำแหน่งปกติ กลไกของการดันเข้าที่เป็นไปได้ได้ถูกบรรยายและวิจารณ์ในรายงานผู้ป่วยนี้

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คำสำคัญ: การดันเข้าของฟันธรรมชาติ; การปรับด้านประชิด; สิ่งประดิษฐ์ชนิดปลูกฝัง

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