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Clinical Management of a Maxillary First Molar with Two Distobuccal Canals: A Rare Case

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ABSTRACT

Objectives: Unusual root canal configurations in maxillary first molars (MFMs) continue to challenge diagnosis and treatment. Distobuccal (DB) canal variations are uncommon and easily missed. A 34-year-old male presented with persistent pain in the upper left first molar (FDI tooth 26) after emergency access at a private clinic. The tooth diagnosis was pulp previously initiated with symptomatic apical periodontitis. Non-surgical root canal treatment was performed. Under magnification, five canals were identified: MB1, MB2, P, and two DB canals (DB1, DB2). The DB canals were separated coronally and converged at the mid-root, continuing to a single apical foramen. Standard rotary shaping with NaOCl/EDTA irrigation and cold lateral condensation were performed. Clinical and radiographic observations confirmed a Vertucci type II configuration of the DB root. Two DB canals that merge mid-root can occur in MFMs. Thorough knowledge of dental anatomy, vigilant inspection under magnification, judicious troughing, and multiple angled radiographs help prevent missed anatomy.

Keywords: Anatomy, Maxillary, Morphology, Root canal anatomy, Tooth, Vertucci classification.

1. Introduction

A thorough understanding of root canal morphology is indispensable for predictable endodontic outcomes (1,2). Variations in the canal systems of permanent teeth have been extensively documented, and their clinical importance repeatedly highlighted (2). Nevertheless, when these variations occur in an uncommon form, they can present diagnostic and procedural challenges, especially to clinicians who have limited exposure to such configurations.

Missed canals remain among the principal causes of endodontic failure, as uninstrumented spaces can harbor persistent microbial infection and necrotic tissue, thereby contributing to the development and persistence of apical periodontitis (1). Among all teeth, the maxillary first molar (MFM) is considered one of the most anatomically complex (3,4). The configuration of three roots (mesiobuccal, distobuccal, and palatal) with three canals, is frequent, but the most common variation involves a second mesiobuccal canal (MB2), the reported prevalence of which could range from 64% to 74.% depending on the population (3).

In contrast, variations within the distobuccal (DB) root are rare. Reports in the literature confirmed that a second DB canal in maxillary molars is uncommon. Cleghorn et al. reviewed 14 studies encompassing 2576 teeth and calculated an overall incidence of 1.7% (5). More recent investigations, summarized in several cone-beam computed tomography (CBCT), micro-CT, clearing, and clinical studies, have shown similarly low, but variable, rates. Briseño-Marroquín et al. (micro-CT) observed DB2 canals in 1.2 % of 179 teeth, whereas

Silva et al. (CBCT) reported 2.55 % among 314 teeth (6,7). Kim et al. (CBCT) documented 1.23 % across 814 samples, and Zheng et al. recorded 1.12 % in 775 CBCT scans (8,9). Several case reports have described maxillary molars presenting a second distobuccal canal in conjunction with additional anatomical abnormalities, including atypical root numbers, cervical deformity, or mandibular molar like morphology (10,11). Collectively, this data emphasizes that, although DB2 canals are possible, their detection is infrequent, and published clinical cases describing actual treatment of molars with two distobuccal canals remain scarce. Such cases are easily overlooked clinically and on standard periapical radiographs, because the orifices could be in close proximity on the chamber floor (8).

Unusual root morphologies in MFMs extend beyond DB variations. Kottoor et al. described a five rooted MFM (12). Reports of MFMs with two palatal canals, double palatal roots, or even five roots further illustrate the breadth of possible deviations (12,13). Such findings emphasize that even the "less complex" DB root warrants careful evaluation.

Cone-beam computed tomography has emerged as a valuable adjunct in identifying atypical anatomy (3,13). However, conventional periapical (PA) radiographs are indispensable and remain the first-line imaging modality for initial endodontic diagnosis (14).

Although inherently two-dimensional and subject to superimposition, careful interpretation of PA radiographs taken at multiple horizontal and vertical angulations can reveal subtle clues to complex anatomy, such as bifurcating canals or unexpected root outlines, that may be invisible on a single straight view. Slight mesial or distal tube-shift techniques can separate overlapping structures, making hidden canals more apparent. Even in an era where CBCT is increasingly accessible, mastering the use of angled PA radiographs remains critical for initial assessment, minimizing radiation exposure, and guiding efficient access refinement before advanced imaging is considered (14).

Although MB2 prevalence in Jordanian MFMs is well documented (15), to our knowledge, based on a targeted search of PubMed and Google Scholar using combinations of keywords, such as 'maxillary first molar', 'distobuccal canal', and 'Jordan', no published reports have documented dual distobuccal canals in this population. The present report details a rare case of a maxillary first molar exhibiting two DB canals that begin separately and merge at the mid-root level (Vertucci type II). The case underscores the importance of magnification, meticulous access refinement, and clear PA RGs with angulation use to avoid missed anatomy and ensure long-term success.

2. Clinical Report

A 34-year-old male, otherwise medically fit, was referred to the postgraduate endodontic clinic at Jordan University of Science and Technology (JUST) for completion of root canal therapy on the upper left first molar (FDI tooth 26). One week earlier, he had visited a private clinic for emergency management after experiencing persistent dull pain in the left maxillary posterior region. At that visit, an access cavity had been prepared, partial instrumentation performed, and a temporary restoration placed. The discomfort subsided only briefly and returned, prompting referral.

The patient described the pain as intermittent, but increasing in intensity over several days, occasionally radiating to the zygomatic region. There was no reported history of trauma or occlusal parafunction. Extraoral findings were within normal limits. Intraoral examination revealed a previously initiated endodontic access cavity extending occluso-mesially, with remaining temporary restoration material and no signs of swelling or sinus tract. Percussion elicited tenderness; palpation of buccal and palatal mucosa was non-tender. Periodontal probing depths were ≤ 3 mm around tooth #26. Adjacent teeth responded normally to thermal and electric pulp testing. Tooth #26 failed to respond to Endo-Ice and electric pulp tester. A pre-operative PA radiograph (Figure 1A) showed periapical radiolucencies associated with the MB, DB and P roots, and no obvious suggestion of canal duplication in any of the roots. The diagnosis was pulp previously initiated with symptomatic apical periodontitis. The treatment plan was the completion of non-surgical root canal therapy.

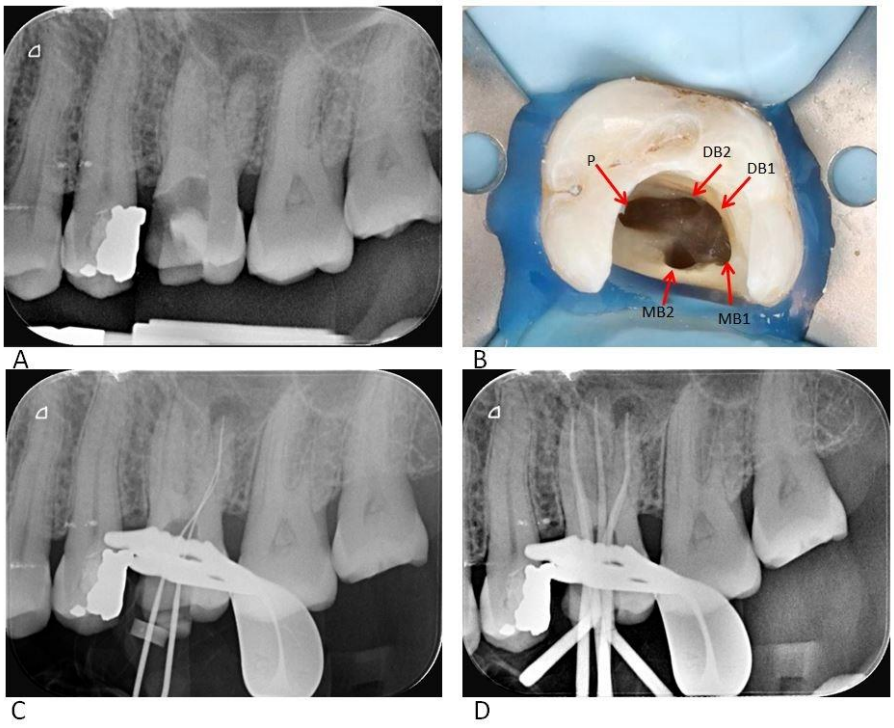

Figure 1: (A) Pre-operative periapical radiograph of tooth 26 showing occluso-mesial access cavity with remaining temporary restoration material and periapical radiolucencies associated with the MB and DB roots. (B) Clinical access cavity view after troughing revealing five canal orifices, including two adjacent and distinct DB orifices (DB1, DB2); MB1/MB2 and palatal canals also visible. Arrows indicate the location of the identified canal orifices. (C) Working length periapical radiograph taken with a mesial horizontal angulation (tube-shift technique), demonstrating separation of the DB1 and DB2 canals and their convergence at the mid-root level. (D) Master cone radiograph confirming canal configuration and working lengths

After explaining the proposed procedure and obtaining verbal consent, 2% lidocaine with 1:100,000 epinephrine was administered via buccal infiltrations. The tooth was isolated with a rubber dam, and remaining temporary restoration removed. The chamber was flushed with 2.5 % sodium hypochlorite to eliminate debris and residual medicament. Complete caries removal was conducted and complete deroofing and proper access preparation was carried out.

Under magnification of a dental operating microscope (DOM; OPMI Pico, Zeiss), three canal orifices were initially visible: MB, DB and palatal. Careful exploration of MB2 was conducted. Ultrasonic troughing (Piezon Master 700, EMS, Switzerland) with Start-X #3 ultrasonic tips (Dentsply Sirona), along the MB groove revealed a second small orifice mesio-palatal to the main MB canal (Figure 1B). During MB2 exploration, attention was also directed to the distobuccal groove. Subtle clinical indicators, including a slight developmental groove and asymmetry in the pulpal floor anatomy, raised suspicion of additional canal anatomy in the DB root. Careful inspection under magnification and gentle troughing of the DB groove led to identification of a fifth orifice adjacent to the main DB canal. A size #10 K-file entered the canal smoothly, confirming a separate canal path from DB1. Both DB canals exhibited independent glide paths coronally.

Working lengths (WLs) were established using an apex locator (Root ZX, Morita). An angled PA radiograph (Figure 1C) was taken to verify the working lengths and canal paths for the DB1 and DB2 canals. The radiograph demonstrated two distinct canal paths in the coronal third that gradually converged into a single radiolucent pathway toward the mid-root level, indicating canal merger consistent with a Vertucci type II configuration. Cleaning and shaping were carried out

with ProTaper Gold rotary files (Dentsply Sirona). All MB and DB canals were prepared to F2, while the palatal canal was enlarged to F3. Irrigation between instruments included copious 2.5% sodium hypochlorite (approximately 10–15 mL per canal in total), followed by a final rinse with 17% EDTA (5 mL per canal) for one minute to remove the smear layer, and saline. No irrigation activation method was employed. According to Ahmed's classification system, which describes root and canal morphology using a structured notation, the tooth may be expressed as: 3 26 MB2 DB2-1 P1 (three roots; mesiobuccal root with two canals; distobuccal root with a 2-1 canal configuration; and a single canal in the palatal root).

After drying with sterile paper points, matched gutta-percha cones and AH-Plus sealer (Dentsply DeTrey) were placed. Cold lateral condensation was used for all canals. In the distobuccal root, both DB1 and DB2 canals were prepared separately. Due to their confluence at the mid-root level, a matched master cone was placed to full working length in the main DB canal. In the secondary canal (DB2), a gutta-percha cone was trimmed apically to the level of canal convergence and used to obturate the coronal and middle thirds, ensuring a continuous and well-adapted fill. A post-operative PA radiograph with angulation confirmed adequate obturation of MB1, MB2, palatal, and a confluent DB canal apically (Figure 2A-B). The access cavity was sealed temporarily with Fuji IX glass ionomer and a permanent composite restoration was placed one week later. The patient was reviewed at one month: he reported no discomfort, and the tooth was negative to percussion with healthy surrounding tissues. Institutional ethics approval was not required for a single case report. Written informed consent for publication of clinical details and images was obtained prior to inclusion.

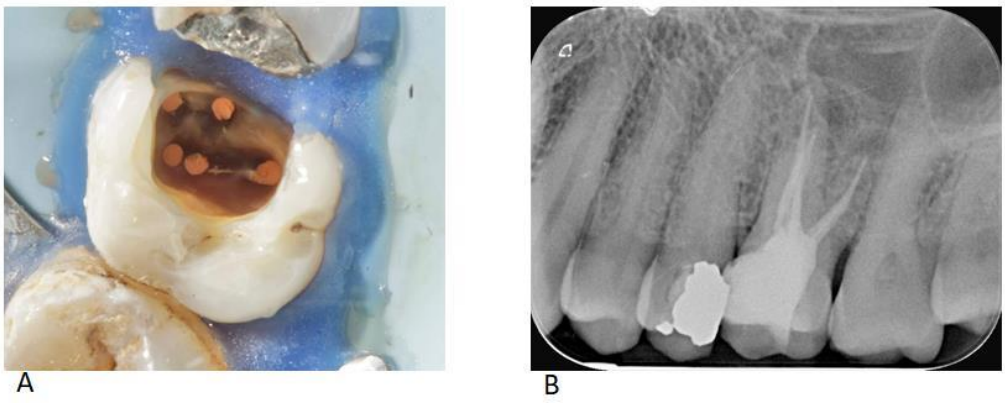

Figure 2: (A) Clinical view after obturation under rubber dam isolation. (B) Immediate post-operative periapical radiograph showing obturation of MB1, MB2, P, and a confluent DB fill after mid-root merger

3. Discussion

The DB root of the MFM typically presents a single canal from chamber to apex (2). Nevertheless, CBCT and clinical series have documented extra DB canals and complex patterns (e.g., separate/merging pathways) (6,7). In several cohorts, a second DB canal was reported infrequently (≈1.2-2.5%), with rates influenced by imaging modality and inclusion criteria (5-7). Compared with the wealth of data on MB2, population-specific estimates for DB variants remain sparse, and very limited for Middle Eastern cohorts. Therefore, this case provides a region-specific observation, underscoring the importance of recognizing that low-probability events can occur and must be accounted for to prevent clinical oversight.

Recent large-scale multinational studies have further highlighted the influence of population variability on root canal morphology (16). A recent study analyzed root and canal configurations across 22 countries using standardized classification systems, demonstrating significant geographic variation and emphasizing the importance of population-specific data (16). In addition, advanced statistical approaches, such as Bayesian hierarchical modeling, have been applied to assess morphological variability across populations, allowing more robust estimation of rare anatomical configurations (17). Although these studies focused on premolars, their methodological frameworks underscore

the need for similarly designed, population-based investigations of molar anatomy in Middle Eastern cohorts, where data remains limited.

When a second DB canal is present, the orifices are often close and asymmetric (8). A narrow dentin ridge may partially obscure the secondary orifice. Practical tips include: extend access to fully deroof, remove secondary dentin shelves, and trough the DB groove conservatively with ultrasonics under high magnification. Small, pre-curved stainless steel files (#8–10) help differentiate a "false shelf" from a true orifice. These steps are consistent with best-practice approaches also emphasized in reports of additional palatal canals and other rare variants (13).

The apparent scarcity of reported distobuccal canal variations in Jordanian populations may reflect underreporting rather than true absence. Several factors may contribute to this, including reliance on two-dimensional imaging modalities, limited routine use of CBCT in clinical practice, and the subtle anatomical presentation of DB canals, which are easily overlooked without magnification and advanced exploration techniques. In addition, several recent regional CBCT-based studies have evaluated root canal morphology in Jordanian populations across different tooth groups, including anterior teeth, mandibular molars, and premolars; however, these investigations have not specifically addressed distobuccal canal variations in maxillary first molars, which may contribute to their under-recognition (15,18). These observations underscore the need for contemporary, population-based investigations employing advanced imaging modalities to more comprehensively characterize root canal morphology in Middle Eastern cohorts.

In the present case, the diagnostic and treatment procedures relied primarily on conventional periapical radiographs taken at multiple horizontal angulations. While CBCT provides superior three-dimensional visualization of root canal morphology and is recommended when complex anatomy is suspected or when conventional imaging is inconclusive, its use was not feasible in this case, as the patient declined additional imaging. According to the AAE/AAOMR joint position statement (19), CBCT should be considered in cases of suspected complex root canal systems to enhance diagnostic accuracy. It is important to acknowledge that although multiple angled periapical radiographs can reveal certain anatomical features, they remain limited by their two-dimensional nature and cannot fully characterize complex three-dimensional canal configurations. Recent evidence also emphasizes the importance of high-quality imaging in the assessment of endodontic outcomes, as CBCT has been shown to overcome the limitations of periapical radiography and improve the detection of periapical pathology and treatment outcomes (19). Therefore, while conventional radiography combined with clinical findings allowed successful management in this case, the use of CBCT would have provided a more comprehensive assessment of the canal system.

Vertucci's system remains a useful shorthand for canal pathways; the DB root in this case is Vertucci type II (4). For whole-tooth clarity, Ahmed et al.'s taxonomy provides root-wise labeling that avoids ambiguity across publications and facilitates meta-analysis (e.g., 3 26 MB2 DB2-1 P1) (2). Adopting both, Vertucci for the specific root and Ahmed for tooth level summary, improves comparability across studies and case reports (13).

Untreated canal spaces harbor residual biofilm and necrotic debris, driving persistent apical periodontitis and poorer outcomes (1). Adequate access cavity preparation, accurate working length control, and copious NaOCl/EDTA irrigation, collectively mitigate this risk (20). Meticulous DB exploration, despite low prevalence, can translate into meaningful gains in success rates at the tooth level (1,20). In addition to adequate debridement, several factors have been shown to influence endodontic success. Studies demonstrated that both the preoperative periapical status and the technical quality of root canal filling are significant predictors of treatment outcome (20). Teeth presenting with periapical radiolucency may have a comparatively reduced healing potential, whereas high-quality obturation with adequate length and density is associated with improved prognosis (20). In the present case, despite the presence of periapical radiolucency, careful chemomechanical preparation and satisfactory obturation may contribute positively to treatment outcome.

In addition to endodontic factors, the long-term prognosis of endodontically treated teeth is also influenced by the quality of the final restoration and adhesive strategies (21,22). Recent evidence suggests that endodontic irrigation protocols may alter the chemical composition and structural integrity of coronal

dentin, thereby affecting bonding performance and restoration durability (23). Therefore, appropriate restorative management following root canal treatment is essential to ensure coronal seal, structural reinforcement, and long-term clinical success.

This case has certain limitations. Although a pre- or postoperative CBCT scan could have provided more comprehensive visualization of the unusual root canal anatomy, the combined use of magnification, ultrasonic troughing, and multiple angled periapical radiographs was sufficient to identify the second distobuccal canal. Additionally, the relatively short follow-up period represents a limitation, as longer-term clinical and radiographic monitoring is necessary to fully assess treatment success and periapical healing.

Reports from Jordanian population document high MB2 prevalence in MFMs (15), but DB variants remain largely unreported. This case adds a documented second DB canal with Vertucci type II configuration to the regional record and may encourage more systematic CBCT-based mapping in Middle Eastern cohorts.

4. Conclusions

Two distobuccal canals, that converge at the mid-root level, consistent with a Vertucci type II configuration, can occur in MFMs. A structured approach, including adequately prepared access, magnification-guided troughing, and multiple angled periapical radiographs or CBCT when complex anatomy is suspected or when clinical findings are incongruent with radiographic appearance, reduces the risk of missed anatomy and supports predictable outcomes. This case extends regional knowledge where DB variations have not been well characterized.

Conflict of Interests

The authors declare no conflicts of interest regarding the publication of this paper.

References

1. Nair P. On the causes of persistent apical periodontitis: A review. Int Endod J. 2006;39:249-281.
2. Ahmed H, Versiani M, de-Deus G, Dummer P. A new system for classifying root and root canal morphology. Int Endod J. 2017;50:761-770.
3. Martins JN, Marques D, Silva EJNL, Caramês J, Mata A, et al. Second mesiobuccal root canal in maxillary molars: A systematic review and meta-analysis of prevalence studies using cone beam computed tomography. Arch Oral Biol. 2020;113:104589.
4. Vertucci FJ. Root canal anatomy of the human permanent teeth. Oral Surg Oral Med Oral Pathol. 1984;58:589-599.
5. Cleghorn BM, Christie WH, Dong CC. Root and root canal morphology of the human permanent maxillary first molar: A literature review. J Endod. 2006;32:813-821.
6. Briseño-Marroquín B, Paqué F, Maier K, Willershausen B, Wolf TG. Root canal morphology and configuration of 179 maxillary first molars by means of micro–computed tomography: An ex vivo study. J Endod. 2015;41:2008-2013.
7. Silva EJNL, Nejaim Y, Silva AI, Haiter-Neto F, Zaia AA, et al. Evaluation of root canal configuration of maxillary molars in a Brazilian population using cone-beam computed tomographic imaging: An in vivo study. J Endod. 2014;40:173-176.
8. Kim Y, Lee S-J, Woo J. Morphology of maxillary first and second molars analyzed by cone-beam computed tomography in a Korean population: Variations in the number of roots and canals and the incidence of fusion. J Endod. 2012;38:1063-1068.
9. Zheng Q-h, Wang Y, Zhou X-d, Wang Q, Zheng G-n, et al. A cone-beam computed tomography study of maxillary first permanent molar root and canal morphology in a Chinese population. J Endod. 2010;36:1480-1484.
10. Rodrigues E, Braitt AH, Galvão BF, da Silva EJNL. Maxillary first molar with 7 root canals diagnosed using cone-beam computed tomography. Restor Dent Endod. 2017;42:60-64.
11. Cai X, Tang R. Maxillary first molar with two distobuccal root canals and cervical deformity: A case report. Clin Case Rep. 2024;12:e8555.
12. Kottoor J, Hemamalathi S, Sudha R, Velmurugan N. Maxillary second molar with 5 roots and 5 canals evaluated using cone beam computerized tomography: A case report. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2010;109:e162-e165.
13. Al-Qudah A, Afaneh A, Hassouneh L. A case report of a maxillary second molar with two distinct palatal canals, confirmed by CBCT. Clin Cosmet Investig Dent. 2023:199-203.
14. Sarsam W, Davies J, Al-Salehi SK. The role of imaging

in endodontics. Br Dent J. 2025;238:448-457.
15. Alsaket YM, El-Ma'aita AM, Aqrabawi J, Alhadidi A. Prevalence and configuration of the second mesiobuccal canal in the permanent maxillary first molar in Jordanian population sample. Iran Endod J. 2020;15:217-220.
16. Pertek Hatipoğlu F, Magat G, Karobari MI, Madarati AA, Tulegenova I, et al. Root and canal configurations of maxillary first premolars in 22 countries using two classification systems: A multinational cross-sectional study. Sci Rep. 2025;15:19290.
17. Fatma PH, Magat G, Karobari MI, Buchanan GD, Kopbayeva M, et al. Bayesian hierarchical modeling of root canal morphology in mandibular first premolars across 21 countries. Int Endod J. Published online February 23, 2026.
18. Taha NA, Makahleh N, Hatipoglu FP. Root canal morphology of anterior permanent teeth in Jordanian population using two classification systems: A cone-beam computed tomography study. BMC Oral Health. 2024;24:170.
19. Fayad MI, Nair M, Levin MD, Benavides E, Rubinstein RA, et al. AAE and AAOMR joint position statement: Use of cone beam computed tomography in endodontics 2015 update. Oral Surg Oral Med Oral Pathol Oral Radiol. 2015;120:508-512.
20. García-Guerrero C, Delgado-Rodríguez CE, Molano-González N, Pineda-Velandia GA, Marín-Zuluaga DJ, et al. Predicting the outcome of initial non-surgical endodontic procedures by periapical status and quality of root canal filling: A cohort study. Odontology. 2020;108:697-703.
21. Hassouneh L, Jum'ah A, Ferrari M, Wood D.A micro-computed tomography analysis of marginal and internal fit of endocrowns fabricated from three CAD/CAM materials. Oper Dent. 2023;48:79-89.
22. Hassouneh L, Nawar NN, Atieh M, Yigit D, Nagendrababu V, et al. Influence of occlusal cusp inclination and restoration thickness on the biomechanical performance of lithium disilicate molar endocrowns: A 3D finite element analysis. Eur J Dent. Published online August 7, 2025.
23. Marques JA, Falacho RI, Fateixa S, Caramelo F, Santos JM, et al. Advancing adhesive strategies for endodontically treated teeth-Part I: Impact of endodontic irrigation protocols on the chemical composition and structural integrity of coronal dentin. J Esthet Restor Dent. 2025;37:1848-1864.