[Downloaded free from http://www.jresdent.org on Wednesday, September 25, 2013, IP: 194.27.186.243] || Click here to download free Android application for this journal

Case Report

Different treatment approaches in a multiple dental traumatic injury

Kürşat Er, Bora Bağış[1], Tamer Taşdemir[2], Kadir Tolga Ceyhanlı[2]

Departments of Endodontics, Faculty of Dentistry, Akdeniz University, Antalya, [2]Karadeniz Technical University, Trabzon, [1]Department of Prosthodontics, Faculty of Dentistry, Izmir Katip Celebi University, Izmir, Turkey

Address for correspondence: Dr. Kür at Er, Akdeniz Universitesi, Dis Hekimligi Fakultesi, Endodonti Anabilim Dali 07058 Antalya, Turkey. E-mail: kursater@akdeniz.edu.tr

ABSTRACT

This case report describes the management of crown- and root-fractured maxillary and mandibular anterior permanent teeth in a 22-year-old patient because of a bicycle accident. Six teeth (11, 21, 22, 23, 31, and 32) of patient were affected by trauma. A nonsurgical endodontic treatment was performed to coronal root fragments of teeth 11, 21, and 22. The coronal parts of the canals were filled with mineral trioxide aggregate (MTA). These teeth were restored with a fiber-reinforced hybrid composite resin bridge. Other root-fractured teeth 23 and 32 were healed spontaneously. The tooth 31 with complicated crown-fractured was prepared and filled with gutta-percha and sealer. After, a glass-fiber post was applied, the restoration of this tooth was performed a hybrid composite resin using an incremental technique. The teeth were in function with satisfactory clinical and radiographic results after 24-month. Healing was achieved without any need for further endodontic surgical intervention. This case shows that traumatized teeth can be managed with endodontic and prosthetic treatments, which can result in satisfactory periradicular healing.

Keywords: Crown fracture, dental trauma, mineral trioxide aggregate, root fracture, splint

INTRODUCTION

Dental trauma is a significant problem that may have serious medical, esthetic, and psychological consequences on patients. Frequencies of traumatic dental injuries in the primary and permanent dentition have been reported in different studies.[1-8] According to the reports, incisors are most frequently involved teeth and the largest proportion of injuries in permanent dentition occurs in the form of crown fractures (26-76%).[6] These fractures can cover a wide spectrum from enamel fracture to uncomplicated/complicated crown fractures, with or without pulp exposure.[7,8] Luxation injuries are seen less frequently (3.5-26%) and root fractures are among the least seen dental injuries (0.2-7%).[3] Root fractures are a combined injury that involves pulp, dentin, cementum, and tooth supporting tissues. They often occur in fully erupted teeth with complete root formation.[2] A single fracture occurs in most cases and multiple root fracture is a rare finding. The dentist plays a great role in the prognosis of the traumatized tooth. The prognosis of the traumatized tooth depends on his accurate diagnosis and treatment procedures.

The aim of the present case report is to describe the different treatment approaches for severe trauma caused by a multiple dental injuries to the anterior region of a patient and to discuss the treatment decisions and outcomes.

Access this article online	
Quick Response Code:	Website: www.jresdent.org
	DOI: 10.4103/MPWK-0017.118905

CASE REPORT

A 22-year-old boy was referred to our clinic within the 6 days after the dental trauma with a complaint of a severe traumatic injury that occurred in his mouth because of a bicycle accident. Past medical history of patient was noncontributory. Extraoral evaluation revealed slight soft tissue injury on lips and no apparent pathosis on other tissues. Clinical exam showed slight swelling of

[Downloaded free from http://www.jresdent.org on Wednesday, September 25, 2013, IP: 194.27.186.243] || Click here to download free Android application for this journal

the vestibule mucosa in the left maxillary anterior region and pain in maxillary and mandibular anterior regions. There were complicated crown fracture of tooth 31 and uncomplicated crown fracture of teeth 11 and 21 in his mouth [Figure 1]. Besides, the teeth 21 and 22 were slightly extruded. A discomfort was noted on percussion to teeth 11, 21, 22, 23, 31, and 32. Electronic pulp testing (Electric Pulp Tester; Parkell, Farmingdale, NY, USA) and cold application (ice stick) were negative for the teeth 11, 21, 22, and 31 and positive for other incisors. Also, all of the adjacent teeth showed positive response to sensitivity test. Teeth 21 and 22 were exhibited grade II mobility and positioned buccally. But, the mobility of other teeth was within normal limits. Periapical radiographs were analyzed [Figures 1-3]. Root fractures in the teeth 11, 21, 22, 23, and 32 were seen in views [Figures 1, 2a and b and 3a]. The apical fractured root fragments were radiographically normal. There was no other hard tissue injury detected in that region. Based on these findings, the patient was diagnosed as having a multiple dental traumatic injuries. Afterwards, the patient was informed of the long-term prognosis of the teeth, and a decision was made to perform conventional endodontic treatments. If no healing of the roots occurred, the plan was to perform apical surgery or extraction.

At the same appointment, a nonrigid splint was accomplished by using an orthodontic wire with resin composite to labial surfaces of canine to canine maxillary teeth. Under local anesthesia, the root canal treatment was initiated on teeth 11, 21, 22, and 31. Access cavities were prepared and rubber dam was applied. Pulp tissues were extirpated. The working length (WL) was estimated as being 1 mm short of the radiographic apex for tooth 31. But, WL of teeth 11, 21, and 22 were estimated 1 mm short of the radiographic root fracture lines. The coronal fractured root fragment canals of teeth 11, 21, and 22 and all the root canal of tooth 31 were instrumented with size 15-40 K-files (Dentsply-Maillefer; Ballaigues, Switzerland) using a step-back technique. The root canals were frequently irrigated with 1% NaOCl solution followed by a final rinse with 5 ml of distilled water solution using a 27-gauge endodontic needle. Subsequently, the canals were dried with sterile paper points and calcium hydroxide (Sultan; Englewood, NS, USA) was placed as a temporary dressing. The access cavities were temporarily sealed with zinc oxide-eugenol (ZOE) cement (Austenal; Harrow, UK).

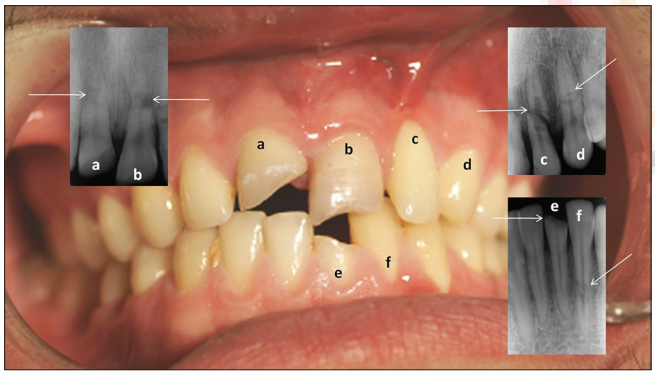


Figure 1: Intraoral and radiographic views. (a-d, f) Radiographs of root-fractured teeth. (e) Radiograph of complicated crown-fractured tooth

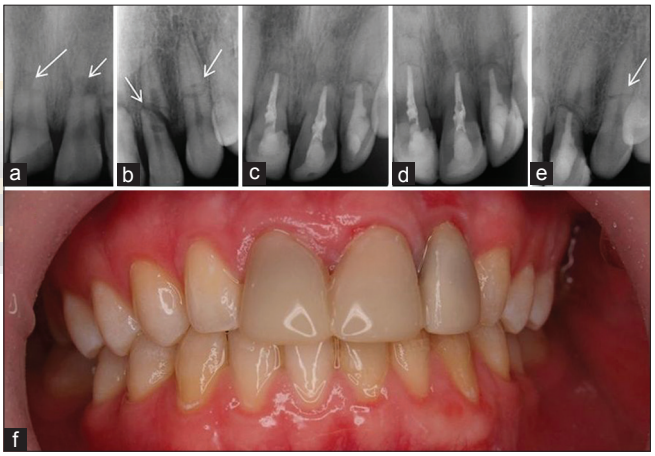


Figure 2: (a and b) Initial radiographs of teeth 11, 21, 22, and 23. (c) Radiograph after root canal fillings with MTA. (d) Twelve-month follow-up radiograph. (e) Twenty-four-month follow-up radiograph. (f) Restoration of teeth

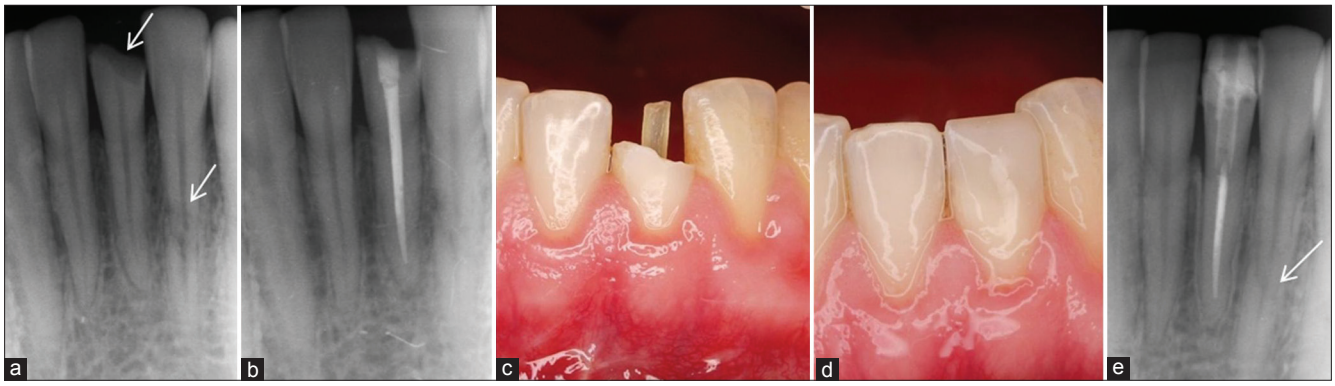


Figure 3: (a) Initial radiographs of teeth 31 and 32. (b) Radiograph after root canal filling of tooth 31. (c) Glass fiber post application. (d) Restoration of tooth 31. (e) Twenty-four-month follow-up radiograph of teeth 31 and 32

[Downloaded free from http://www.jresdent.org on Wednesday, September 25, 2013, IP: 194.27.186.243] || Click here to download free Android application for this journal

No treatments were applied to root fractured teeth 23 and 32 for monitored spontaneous healing.

Fifteen days later, the patient returned. At this appointment, the root canals were reopened and the calcium hydroxide remnants removed. After, irrigation with distilled water solution, the canals was dried with sterile paper points. The coronal root fragment canals of teeth 11, 21, and 22 were filled with mineral trioxide aggregate (MTA) (Dentsply; Tulsa, OK, USA). MTA was prepared according to the manufacturer's recommendations by mixing with the proportion of one-third. An endodontic plugger adequate for the length of the canal was used and the stopper was fixed 1 mm behind the WL. MTA was inserted into the canal with a messing gun and further pushed with a plugger. All the canals were filled with MTA in this way. A cotton pellet moistened with distilled water was placed over the MTA, and the access cavities were sealed with a temporary filling. After 24 h, the temporary filling material and cotton pellet were removed. Then, the remaining coronal canal spaces were filled with glass ionomer cement (Ketac-Molar Easymix; 3M ESPE, Seefeld, Germany) as a coronal plug. After that, the temporary restorations of these teeth were accomplished with a composite resin (Z250; 3M ESPE, St. Paul, MN, USA). Radiographies were taken to ensure the control of the filling [Figure 2c].

The root canal of tooth 31 was filled with lateral compaction of gutta-percha combined with AH Plus sealer (Dentsply) [Figure 3b]. After that, the access cavity was sealed with a temporary filling. One day later, gutta-percha was partly removed with the aid of Gates-Glidden burs until 4-5 mm of filling material was left apically to maintain a good seal. Because of the enough supporting tooth tissue, fiber length was not designed longer. The lengths of glass-fiber posts (ever Stick POST; Stick Tech, Turku, Finland) needed were measured using a periodontal probe. The length and the ends of the posts were designed to fit the holes. Clear, filler, and solvent-free, light curable Stick Resin (Stick Tech) needed to wet fiber sheets were brushed over the fiber-reinforced posts. The root and crown parts were etched with 37% phosphoric acid gel (Scotch bond Etchant; 3M ESPE, St. Paul, MN, USA) for 20 s, rinsed for 20 s, and dried with a gentle stream of air. The bonding agent (Adper Single Bond; 3M ESPE), a dual curing luting system (Rely X ARC; 3M ESPE) and fiber posts were sequentially applied according to the manufacturer's instructions using a light-emitting diode device (Mini LED, Satelec Acteon Group, Merignac, France) [Figure 3c]. Finally, to satisfy esthetic requirements, contouring of the restoration was performed with a hybrid composite resin (Filtek Z-250, 3M ESPE) using an incremental technique and occlusal adjustments were made. The occlusion was evaluated with articulating paper, and premature contacts were eliminated. Polishing was accomplished using Sof-Lex finishing and polishing discs and strips (3M ESPE) [Figure 3d].

At the 1 month appointment, mobility of tooth 22 was still observed, so fixation was maintained for another 2 months. During this period, patient was warned to pay attention to his oral hygiene because of bacterial plaque accumulation. At the 3-month appointment, the splint was removed and then started with prosthetic restoration of teeth 11, 21, and 22. The teeth were splinted from tooth 11 to 22 with the aid of grooves and fiber-reinforced composite (everStick, Stick Tech). Because of the need for mechanical support, a horizontal groove was made in the mid-palatal section of the adjacent teeth (11 and 22) to accommodate the width and thickness of reinforcement material in the middle third of the tooth. The required length of fiber to cover width of the palatal surface of the supporting teeth was measured using dental floss. The palatal and proximal surfaces of the teeth and the fractured teeth were etched with 37% phosphoric acid, and then rinsed with water and air-dried. Bonding agent (Stick Resin, Stick Tech) was applied and light-cured according to the manufacturer's instructions using LED illumination. A thin layer of flowable composite resin (Stick Flow, Stick Tech) was applied to the palatal grooves and proximal surfaces of the adjacent teeth. The prepared fiber was pressed into the resin with the aid of a Stick Stepper hand instrument (Stick Tech) to ensure that it was seated in the grooves, and then light-cured from multiple directions for 20 s and the fibers were entirely covered with composite resin and finally the teeth were contoured again with the hybrid composite resin (Filtek Z-250, 3M ESPE) for splinting the teeth and to give a more esthetic appearance to the patient in this temporary period [Figure 2f]. The patient was warned to protect his restored teeth from any trauma and advised to use dental floss in addition to brushing. During the 2 year follow-up, patient was informed several times that the maxillary teeth might be restored with splinted ceramic crowns for stronger and better esthetic results; but patient did not want a ceramic restoration.

After 12- and 24-month recalls, radiographs showed no pathology [Figure 2d and e, and 3e]. The teeth 23 and 32 were protected pulp vitalities. Clinical examination showed no sensitivity to percussion or palpation, and the soft tissues were healthy.

DISCUSSION

This case report describes the management of a severe dental traumatic injury involving the crown and root fractures of maxillary and mandibular anterior

[Downloaded free from http://www.jresdent.org on Wednesday, September 25, 2013, IP: 194.27.186.243] || Click here to download free Android application for this journal

permanent teeth in a 22-year-old patient because of a bicycle accident. The treatment protocols were based on the guidelines suggested in the literature for the treatment of traumatic injuries.

General principles for root fractured teeth involve maintaining pulp vitality by immobilizing the coronal segment.[9] When no bacteria enter the coronal pulp space through the disrupted epithelial attachment and proper fixation is used, the fractured teeth can heal spontaneously.[10] Four types of healing can be observed following root fractures: Healing with calcified tissue, interposition of connective tissue, interposition of connective tissue and bone, and interposition of granulation tissue (no healing).[10] Although the outcome of a root fracture is generally favorable; complications such as pulpal necrosis, radicular resorption, and pulpal canal obliteration can arise.[11] When pulp necrosis arises, the apical part of the fractured tooth generally remains vital.[9] To date, different procedures (such as stabilization of tooth with a splint only, filling of the coronal fragment, surgical removal of the apical fragment, removal of the coronal fragment and orthodontic or surgical extrusion of the apical fragment, endodontic implants, and intraradicular splinting to unite the fracture) have been successfully applied for treatment of root fractures.[9-16] Also, spontaneous healing of the root fractures without treatment has been documented.[17,18] In the present case, we treated five root-fractured teeth. Three of root-fractured teeth with necrotic pulps were instrumented and then coronal fragment canals filled with MTA. Apical root fragments were seen to have protected their vitality during follow-ups. There were no pathosis in periradicular regions upon radiographic controls. The other root-fractured teeth with vital pulps were healed spontaneously. According to us, the root-fractured tooth 23 was healed with connective tissue, but tooth 32 was healed with calcified tissue.

In root fracture treatment, if the coronal fragment is nonvital, root canal treatment should be performed.[19] The use of calcium hydroxide dressing may provide a hard tissue barrier at the apical end of the coronal fragment.[20] But, it requires a long treatment time and this application needs periodic changes of the material. For these reasons, MTA is an alternative material in dental trauma cases. It has been shown to be biocompatible and can be used safely when placed adjacent to pulp and periradicular tissues.[21] It can also provide an environment that supports cementum regrowth.[22] Sealing ability, low solubility, and antibacterial characteristics are some of the other properties of MTA. Thus, it appears to be the most promising material for use in a variety of clinical applications; including vital pulp treatments, root-end fillings, apexification, regenerative endodontic treatments, repair of root perforation and resorption, and as a root canal filling material. But prolonged setting time and manipulation difficulties are major disadvantages of MTA. There are limited reports in the literature regarding the use of MTA in root fractures. Recently, Yildirim and Gençoğlu,[15] Kusgoz *et al*.,[16] and Er *et al*.,[13] reported that the use of MTA in root-fractured teeth as an apical plug or filling gave excellent clinical results. Therefore, MTA was selected in the treatment of the present three of the root fracture cases.

The primary purpose of the treatment of fractured teeth is to maintain the vitality of the teeth. For this reason, repositioning of the coronal fragment as soon as possible if needed and stabilization with a flexible splint for 1 month, reduction and recall for at least 1 year was recommended.[23] Whereas, Andreasen *et al*.,[9] have found no differences for healing of teeth splinted for 2 months or less and for longer splinting periods. The planned stabilization period for this case was 2-4 weeks; however, the splint was retained in place for a longer time because of mobility of tooth 22.

The literature indicates that many factors may influence the type of healing that occurs for crown fractures. For crown fractures, factors include size of the exposure, the interval between injury and treatment, and the maturity of the tooth.[6,24] This type of fractures can be treated with direct pulp capping, partial pulpotomy, and pulpectomy protocols.[6] To date, different procedures (such as composite resin restorations with and without pins, post-core restoration, and reattachment of the fragment) have been successfully applied for treatment of crown fractures. In the present case, we treated complicated crown-fractured tooth 31 was instrumented and then filled with gutta-percha and sealer. This tooth was restored with fiber post-core and hybrid resin composite restoration.

Long-term follow-up of patients with traumatic dental injuries is quite important as pathological changes can occur several years following the accident. For this reason, clinicians should do close monitoring of the teeth, including clinical and radiographic examinations. Besides, the restorations and occlusal relationships should be controlled to prevent the potential problems.

CONCLUSION

This case shows that traumatized teeth can be managed with endodontic and prosthetic treatments, which can result in satisfactory periradicular healing. Also, treatment of the fractured teeth with MTA was considered successful as evidenced by clinical and radiographic findings. This may be due to biological properties of the MTA.

[Downloaded free from http://www.jresdent.org on Wednesday, September 25, 2013, IP: 194.27.186.243] || Click here to download free Android application for this journal

REFERENCES

1. Andreasen JO. Etiology and pathogenesis of traumatic dental injuries. A clinical study of 1,298 cases. Scand J Dent Res 1970;78:329-42.
2. Jacobsen I. Root fractures in permanent anterior teeth with incomplete root formation. Scand J Dent Res 1976;84:210-7.
3. Oikarinen K, Kassila O. Causes and types of traumatic tooth injuries treated in a public dental health clinic. Endod Dent Traumatol 1987;3:172-7.
4. Hovland EJ. Horizontal root fractures. Treatment and repair. Dent Clin North Am 1992;36:509-25.
5. García-Godoy F, Pulver F. Treatment of trauma to the primary and young permanent dentitions. Dent Clin North Am 2000;44:597-632.
6. Olsburgh S, Jacoby T, Krejci I. Crown fractures in the permanent dentition: Pulpal and restorative considerations. Dent Traumatol 2002;18:103-15.
7. Spinas E, Altana M. A new classification for crown fractures of teeth. J Clin Pediatr Dent 2002;26:225-31.
8. Rauschenberger CR, Hovland EJ. Clinical management of crown fractures. Dent Clin North Am 1995;39:25-51.
9. Andreasen JO, Andreasen FM, Mejàre I, Cvek M. Healing of 400 intra-alveolar root fractures. 2. Effect of treatment factors such as treatment delay, repositioning, splinting type and period and antibiotics. Dent Traumatol 2004;20:203-11.
10. Sübay RK, Sübay MO, Yilmaz B, Kayataş M. Intraradicular splinting of a horizontally fractured central incisor: A case report. Dent Traumatol 2008;24:680-4.
11. Majorana A, Pasini S, Bardellini E, Keller E. Clinical and epidemiological study of traumatic root fractures. Dent Traumatol 2002;18:77-80.
12. Koyuturk AE, Kusgoz A. Multiple dentoalveolar traumatic injury: A case report (3 years follow up). Dent Traumatol 2008;24:e16-9.
13. Er K, Celik D, Taşdemir T, Yildirim T. Treatment of horizontal root fractures using a triple antibiotic paste and mineral trioxide aggregate: A case report. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2009;108:e63-6.
14. Erdemir A, Ungor M, Erdemir EO. Orthodontic movement of a horizontally fractured tooth: A case report. Dent Traumatol 2005;21:160-4.
15. Yildirim T, Gençoğlu N. Use of mineral trioxide aggregate in the treatment of horizontal root fractures with a 5-year follow-up: Report of a case. J Endod 2009;35:292-5.
16. Kusgoz A, Yildirim T, Tanriver M, Yesilyurt C. Treatment of horizontal root fractures using MTA as apical plug: Report of 3 cases. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2009;107:e68-72.
17. Ozbek M, Serper A, Calt S. Repaired of untreated horizontal root fracture: A case report. Dent Traumatol 2003;19:296-7.
18. Cobankara FK, Ungör M. Spontaneously healed horizontal root fracture in maxillary first premolar: Report of a case. Dent Traumatol 2007;23:120-2.
19. Trope M, Myaltz DO, Tronstad L. Resistance to fracture of restored endodontically treated teeth. Endod Dent Traumatol 1985;1:108-11.
20. Rafter M. Apexification: A review. Dent Traumatol 2005;21:1-8.
21. Apaydin ES, Shabahang S, Torabinejad M. Hard-tissue healing after application of fresh or set MTA as root-end-filling material. J Endod 2004;30:21-4.
22. Hakki SS, Bozkurt SB, Hakki EE, Belli S. Effects of mineral trioxide aggregate on cell survival, gene expression associated with mineralized tissues, and biomineralization of cementoblasts. J Endod 2009;35:513-9.
23. Flores MT, Andersson L, Andreasen JO, Bakland LK, Malmgren B, Barnett F, *et al*. International Association of Dental Traumatology. Guidelines for the management of traumatic dental injuries. I. Fractures and luxations of permanent teeth. Dent Traumatol 2007;23:66-71.
24. Orhan K, Orhan AI, Oz FT. Management of untreated traumatized permanent incisors with crown and root fractures: A case report. Quintessence Int 2009;40:647-54.

How to cite this article: Er K, Bagis B, Tasdemir T, Ceyhanli KT. Different treatment approaches in a multiple dental traumatic injury. J Res Dent 2013;1:90-4.

Source of Support: Nil, **Conflict of Intrest:** Nil.

New features on the journal's website

Optimized content for mobile and hand-held devices
HTML pages have been optimized of mobile and other hand-held devices (such as iPad, Kindle, iPod) for faster browsing speed.
Click on **[Mobile Full text]** from Table of Contents page.
This is simple HTML version for faster download on mobiles (if viewed on desktop, it will be automatically redirected to full HTML version)

E-Pub for hand-held devices
EPUB is an open e-book standard recommended by The International Digital Publishing Forum which is designed for reflowable content i.e. the text display can be optimized for a particular display device.
Click on **[EPub]** from Table of Contents page.
There are various e-Pub readers such as for Windows: Digital Editions, OS X: Calibre/Bookworm, iPhone/iPod Touch/iPad: Stanza, and Linux: Calibre/Bookworm.

E-Book for desktop
One can also see the entire issue as printed here in a 'flip book' version on desktops.
Links are available from Current Issue as well as Archives pages.
Click on View as eBook