

Simplified Method of Schilder's Root Canal Technique: A Case Series

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Abstract

Introduction: The objective of this study was to describe the Kubokura Single Root Canal Therapy (K.SRCT) method which is simplified method of Schilder's root canal technique and determine the predictability of root canal therapy done using this method.

Methods: The K.SRCT method utilizes a standard canal preparation using simple and inexpensive instruments, a two-step filling process creating an apical pad to ensure a complete seal and entombment of the canal space and a thermoplasticized method of warm vertical compaction. Three cases are presented, showing healing of the periapical bone following non-surgical root canal therapy (NSRCT) of #7 and #10 using the K.SRCT method and healing of the periapical bone and regeneration of the sinus floor following NSRCT of #14 using the K.SRCT method.

The prognosis of 418 cases (167 retreatment cases and 251 initial RCT cases) was analyzed prospectively.

Results: Using the K.SRCT method, 94.4% of retreatment cases demonstrated an improvement in outcome with an average follow-up of 3 years. 95.6% of initial root canal therapy cases done using the K.SRCT method demonstrated an improvement in outcome with an average follow-up of 3 years.

Conclusion: This method allows for predictable root canal outcomes following a streamlined treatment protocol, a necessity under the current Japanese universal healthcare system that requires short chair time and use of inexpensive materials and equipment in order to attain adequate reimbursement.

Keywords: Endodontics; Root Canal Therapy; Retreatment; Japanese Universal Healthcare System

Introduction

Though Japan is well-known for having high-quality universal healthcare and dental benefits, low fees and reimbursements put pressure on clinicians to increase their efficiency and reduce supply costs. In endodontics, single-visit therapy is well-accepted as equivocal to multi-visit therapy in regards to debridement, postoperative pain and flare-up and healing of the periapical radiolucency [1-3]. However, in Japan, single-visit endodontic therapy accounts for only 6.9% of root canal therapy in single-rooted teeth and 2.1% of teeth with three

or more canals [4]. The Japanese Ministry of Health, Labor and Welfare mandates dental materials that may be used for reimbursed procedures and no coverage is available for expensive materials including nickel titanium rotary instruments and correspondingly tapered gutta percha points. This may correspondingly have some influence on Japanese dental education, which focuses on hand instrumentation and obturation of canals using cold lateral condensation.

These factors necessitate the development of treatment protocols that prioritize efficiency using low-cost materials while maximizing predictable treatment outcomes. In this case series, we present a unique methodology developed by Dr. Kubokura that balances efficiency with predictable treatment outcomes. The basic concept of the Kubokura Single Root Canal Therapy (K.SRCT) method includes utilizing simple and inexpensive instruments that can be completed in a single visit. The procedure centers on closure of the root apex and any side branches with an “apical pad” to entomb any residual pulp and associated infectious debris as well as to minimize any overextension of root canal filling materials that might create a foreign body reaction. In this report, the K.SRCT was introduced with several cases and the prognosis of 248 cases (96 Re-treatment cases and 152 initial RCT cases) was analyzed prospectively.

Step by step description of the K.SRCT method

The K.SRCT method involves three main stages, described as follows.

Confirmation and enlargement of apical foramen

Standard protocols for access, cleaning and shaping are followed, including isolation of the tooth with a rubber dam [5] and access using carbide burs and gates glidden drills. The apical foramen is enlarged to ISO size 20 using K-files and irrigation with copious amounts of 5.25% sodium hypochlorite (NaOCl) in between files was done. The apical size chosen allows for an apical stop to ensure appropriate placement of the apical pad. Forcible enlargement beyond a size #20 file is not performed and apices that are naturally or iatrogenically already greater than size #20 size are not further enlarged.

Root canal debridement and shaping

Unlike in the United States where single-use nickel titanium rotary instruments are utilized for crown-down canal shaping, in Japan, low reimbursement rates do not support the use of these costly instruments. Hand instrumentation using stainless-steel files combined with the use of Gates Glidden drills were used following the step-back technique [6].

In the K.SRCT method, the root canal is divided into three parts (Figure 1):

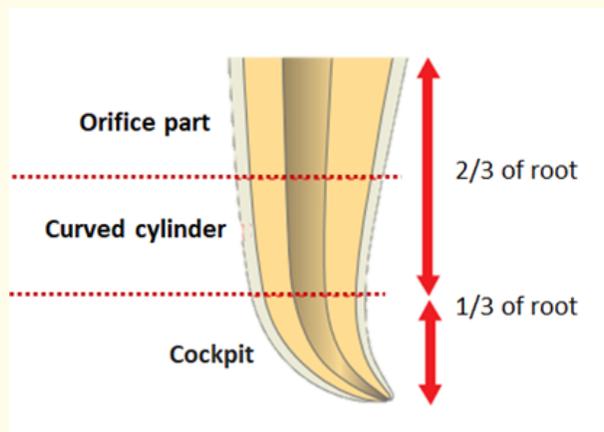


Figure 1: Three parts of root canal.

1. **Orifice part:** The coronal one-third of the canal space. In the K.SRCT method, it is utilized for gutta percha containment when commencing the filling process.
2. **Curved cylinder:** The middle one-third of the canal space. In the K.SRCT method, the gutta percha will slide through this area to meet the established apical pad.
3. **Cockpit:** The apical one-third of the canal where the apical pad of gutta percha is found.

A main feature of the K.SRCT is the standard and linear relationship between the orifice portion and the curved cylinder portions of the canals. This allows for entry of a #9 Schilder plugger to enter the canal and extend to a point 6 mm short of the working length. In other words, if a canal has a working length equal to 26 mm, the root canal shaping is considered complete when the #9 Schilder plugger extends to 20 mm from the coronal reference point (Figure 2).

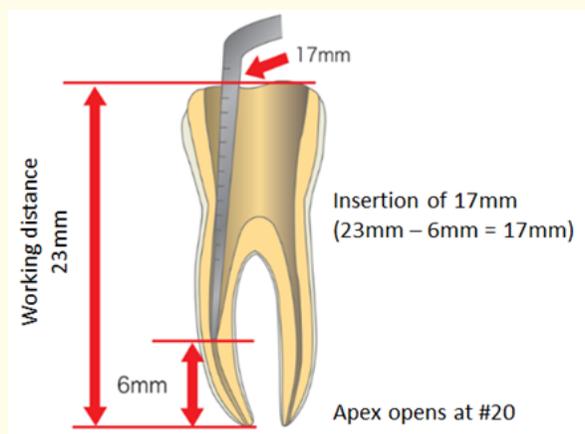


Figure 2: The working length measurement.

Canal shaping begins with flaring of the orifice opening by the Gates Glidden drill. A #20 stainless steel K file is used to debride the curved portion of the canal. Irrigation is completed using 10 mL of 5.25% NaOCl, followed by 17% EDTA for a minute and ending with 5.25% NaOCl for another minute. Ultrasonic cleaning with Solfy F (Morira, Kyoto, Japan) is used during irrigation. Nickel titanium instruments are generally not used, but if they are, they should not be used beyond the curved cylinder portion of the canal. Magnification, either by the surgical operating microscope or loupes, is essential to assure no remaining debris.

Root canal filling

The K.SRCT method is based upon a variant of warm vertical compaction, wherein thermoplasticized gutta percha is introduced in its softened state and pushed to the apex to create an apical plug [7]. A #70/02 tapered gutta percha point is cut, leaving a 5 mm apical segment that is attached to a syringe needle (Clinpro sealant dispensing tip, 3M-Japan, Tokyo), which was sharpened by a bur before attaching the gutta percha. The tip of the gutta percha is baked under a commercially available lighter or flame and dipped into eucalyptus oil to soften the gutta percha so that it conforms to the shape of the canal when inserted. Excess oil is gently wiped off with gauze and the

gutta percha is lightly coated with eugenol-based root canal sealer. The gutta percha tip is inserted into the root canal space and separated from the syringe tip using slight vibration. The remaining cut gutta percha is then attached to the syringe tip, heated, dipped in Eucalyptus oil and inserted above the previously placed 5 mm gutta percha in the canal. A #9 Schilder plugger is then used to push the gutta percha point to length (Figure 3). As with root canal debridement, the use of a surgical operating microscope or loupes is crucial for accurate visualization of this step. Different variations of gutta percha have different flows, though the authors recommend Pierce's brand gutta percha (Biomed, Korea).

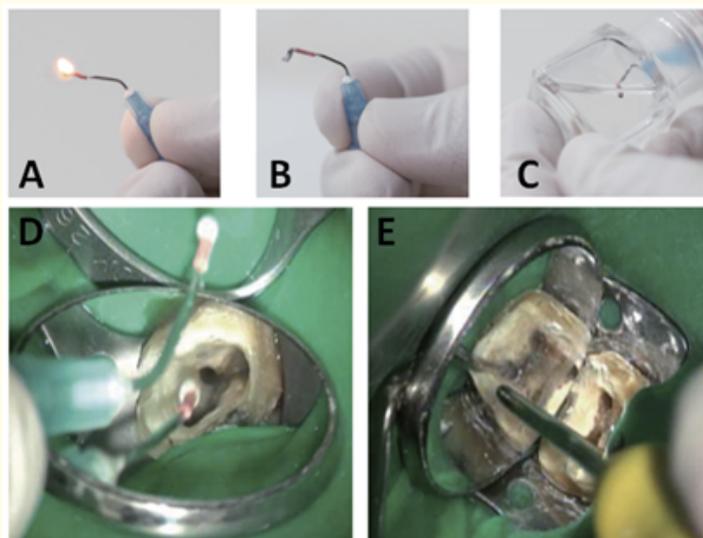


Figure 3: The K.SRCT method of obturation. A, The tip of the cut 5mm gutta percha segment attached to the syringe needle is baked under a flame. B, The flame is put out. C, The tip of the gutta percha is softened by dipping into eucalyptus oil. D, The gutta percha is lightly coated with eugenol-based root canal sealer and inserted into the canal. E, The gutta percha is separated from the syringe tip using slight vibration.

Postoperative radiographs are critical to assure an accurate and complete root filling, including visualization of the apical pad. If the apical pad is not formed, the existing fill should be removed and the process repeated. Periapical imaging is generally sufficient, but in curved teeth, such as molars, CBCT imaging may be required to visualize the apical pad.

As with traditional methods for non-surgical root canal therapy postoperative bite sensitivity is common for several days following treatment with the K.SRCT method and appropriate expectations and pain management should be advised [8].

Case 1

A 35-year-old woman female with non-contributory medical history was referred for a large periapical lesion extending to the palatal aspect of the root of tooth #7 on 05/24/2011. The patient stated that "my tooth never healed, although I was in treatment for a year at another dental office." The root apex was widened by K file #100 when patient presented. The retreatment was performed using the K.SRCT method. At eight-month follow-up after K.SRCT of #7, healing of the periapical bone was observed on CBCT. At seven-year follow-up, continued healing of periapical bone was observed (Figure 4).

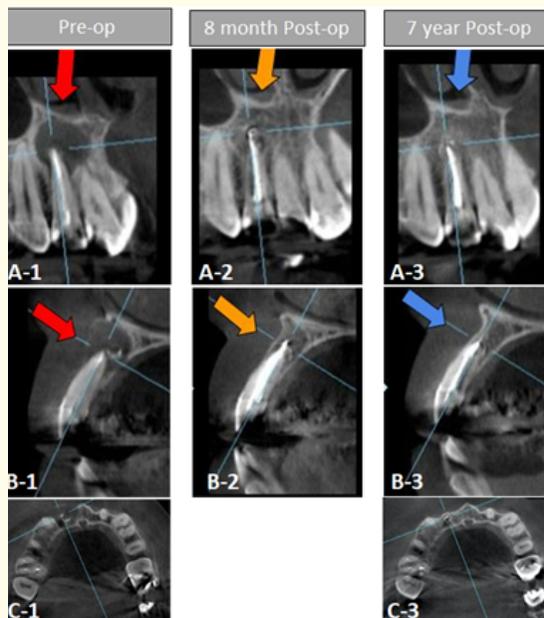


Figure 4: Retreatment of tooth #7 using the K.SRCT method (Case 1). In the pre-operative CBCT, a large periapical lesion can be seen around the root apex of tooth #7. At eight-month follow-up, healing of the periapical bone was observed. At seven-year follow-up, continued healing of the periapical bone was observed.

Case 2

A 27-year-old woman with non-contributory medical history presented with chief complaint of discomfort on tooth #10. On radiograph, there was a large periapical lesion around the root apex of #10. The K.SRCT was performed on the tooth in a single visit. Four-month follow up, the size of the periapical lesion decreased and significant bone regeneration was confirmed (Figure 5).

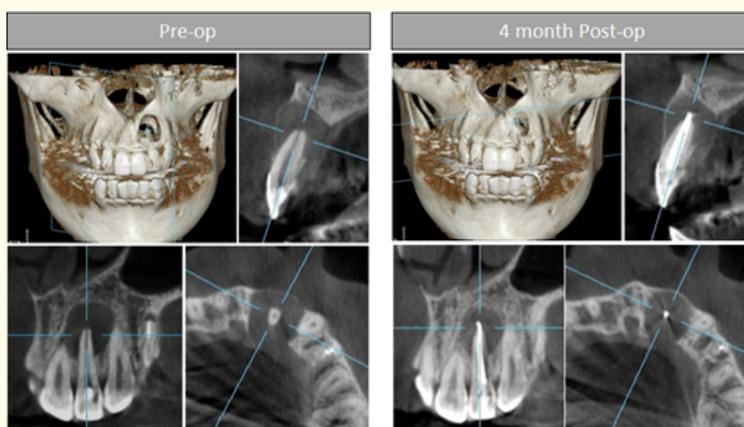


Figure 5: Retreatment of tooth #10 using the K.SRCT method (Case 2). In the pre-operative CBCT, a large periapical lesion can be seen around the root apex of tooth #10. At four-month follow-up, the size of the periapical lesion decreased and significant bone regeneration was observed.

Case 3

A 53-year-old female with non-contributory medical history presented with chief complaint of pressure sensitivity in her upper left tooth. On radiograph, tooth #14 had a large periapical lesion perforating into the adjacent maxillary sinus, with associated maxillary sinus mucositis. Follow-up imaging two years following K.SRCT of #14 showed healing of the periapical bone, regeneration of the sinus floor and resolution of the maxillary sinus mucositis (Figure 6).

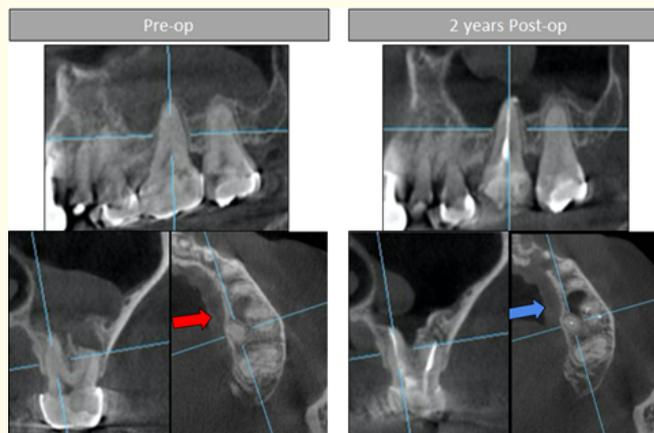


Figure 6: Retreatment of tooth #14 using the K.SRCT method (Case 3). In the pre-operative CBCT, a large periapical lesion perforating into the adjacent maxillary sinus, with associated maxillary sinus mucositis can be seen. At two-year follow-up, healing of the periapical bone, regeneration of the sinus floor and resolution of the maxillary sinus mucositis was observed.

Retro-prospective analysis of prognosis

The prognosis of 418 cases (167 retreatment cases and 251 initial RCT cases) was analyzed prospectively. Five criteria were used as diagnosis code (Table 1). Prognosis was recorded based on difference between diagnostic code of pre-op and pot-op. If the number of diagnostic code is increased, these cases were categorized as “Improved”, decreased as “Deteriorated” and no changes as “Not improved”.

Criteria	Description
5	No pathology is detected by CBCT
4	No pathology is detected by periapical radiograph
3	No PARL is detected but widening of periodontal ligament space is observed
2	Small PARL is detected
1	Significant PARL or root fracture is detected

Table 1: Diagnosis criteria used.

Looking at the prognosis for retreatment cases done using the K.SRCT method, 94.4% of cases (n = 167) demonstrated an improvement in outcome with an average follow-up of 3.8 years (Table 2). Tooth-root crack occurred more often in cases that did not show improvement in healing.

Type of root	Number of case examined (in total 167 cases)	Average observation period (Year/Month)	Improved (%)	Did not improve (%)
Single root	74	3Y8M	98.6	1.4
2 roots	35	4Y2M	91.4	8.6
> 3 roots	58	4Y4M	93.1	6.9
Average		3.8	94.4	5.6

Table 2: Prognosis for the retreatment cases.

Looking at the prognosis for initial root canal therapy cases using the K.SRCT method, 95.6% of cases (n = 251) demonstrated an improvement in outcome with an average follow-up of 3 years (Table 3).

Type of root	Total case evaluated	Initial diagnosis code					Observation period (Year/Month)	Average of diagnostic code at follow up	Percentage of cases with diagnostic code "5" (%)
		1	2	3	4	5			
Single root	110	1	3	18	49	39	5Y8M	4.11	96.3
2 roots	55	0	2	8	25	20	5Y10M	4.15	96.4
> 3 roots	86	2	3	10	35	36	5Y5M	4.16	94.2
Average							9.40	4.14	95.6

Table 3: Prognosis for the initial RCT cases.

Discussion

The K.SRCT method for NSRCT is utilized to achieve efficiencies demanded by low reimbursements to providers in Japan. Simply put, providers can treat more patients per day when each procedure can be done more quickly, resulting in higher reimbursements because of the dental fee schedule of universal healthcare coverage in Japan. For the case of RCT, it is practically difficult to spend 60 minutes to complete RCT for one visit. Additionally, insurance claims for office visit and irrigation can be charged on each visit, this could be some compensation for multiple visit RCT approach. Extra steps add time to procedures and must demonstrate significant improvement in outcomes to justify doing. The number of treatments performed depends on the time needed per treatment, as appointments are kept short to maximize reimbursements. In the case of a pulpectomy treatment, if it is a single rooted tooth, it is completed in about 20 minutes in a single visit. A pulpectomy on a molar with 4 roots is usually done in 3 visits given the short appointment times. In the case of root canal re-treatment, the number of visits is usually higher due to the time it takes to remove old gutta-percha and any other previous materials used. The K.SRCT methodology offers better success and rates of healing compared to other available methods of NSRCT in Japan [12,13].

Conclusion

The K.SRCT method of NSRCT is a variant that utilizes a standard canal preparation using simple and inexpensive instruments, a two-step filling process creating an apical pad to assure a complete seal and entombment of the canal space and a thermoplasticized method

of warm vertical compaction. This method allows for predictable root canal outcomes following a streamlined treatment protocol, a necessity under the current Japanese universal healthcare system that requires short chair time and use of inexpensive materials and equipment for adequate reimbursement.

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Conflict of Interest

Authors have no financial interest or any conflict of interests.

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