The new concept

- by the Cariology Research Unit of the Niigata University School of Dentistry in 1988.
- LSTR is short for Lesion Sterilization and Tissue Repair Therapy.
- NIET or Non Instrumental Endodontic Treatment
- “a new biologic approach in the treatment of carious lesions with or without pulpal and periapical involvement using a mixture of 3 antibiotics.”
Concept of LSTR
(Lesion Sterilization and Tissue Repair)

Study on the efficiency of 3Mix antibiotics against various forms of oral infection, including those of endodontic origin.

Hoshino et al 1990 and 1996
Sato et al 1993 and 1996
Continuous knowledge

• Revascularization
• Tissue engineering
• Regenerative endodontics
The Infection of the Root Canal System

• Polymicrobial infection and complex anatomy (mixed microorganism)

• Anaerobic and aerobic bacteria

• Single antibiotic results in ineffective sterilization
In situ: the mixed drug penetrate into lesions and sterilize them within 1 day.

Sato et al 1992
• 3 MIX has been shown to be very effective in eliminating endodontic pathogens in vitro and in situ.

• Alone, none of the drugs resulted in complete elimination of bacteria

  Hoshino 1996
  Sato et al 1993
  Sato et al 1996
Three Mix Antibiotics

3 Mix MP
- Ciprofloxacin 1
- Metronidazole 1
- Minocyclin 1
- Macrogol 1
- Propylene glycol 1

\[ \{ \text{Ciprofloxacin} + \text{Metronidazole} + \text{Minocyclin} + \text{Macrogol} + \text{Propylene glycol} \} = 7, 3 \]

Hoshino et al., 1996
The most promising drug combination

Metronidazole
Ciprofloxacin
Minocyclin

Hoshino et al. 1996
Sato et al. 1996

25-50 µg or
20 mg/ml each

Windley et al. 2005
Recently new medicament: tri-antibiotic: placement of the medicament for 1 month.

**Composition of 3Mix-MP**

- **Antibiotics (3Mix)**
  - Ciprofloxacin 200 mg
  - Metronidazole 500 mg
  - Minocycline 100 mg

- **Carrier (MP)**
  - Macrogol ointment
  - Propylene glycol

_Trope 2006_
Protocol for preparation

Antibiotics (3Mix)

– be sure to not cross-contaminate

• Remove sugar coating from tablets with surgical blade, crush individually in separate mortars

• Open capsules, crush individually in separate mortars

• Grind each antibiotic to a fine powder

• Combine equal amounts of antibiotics (1:1:1) on mixing pad
Protocol for preparation

Carrier (MP)

• Equal amounts of macrogol ointment and propylene glycol (1:1)
• Using clean spatula, mix together on pad
• Result should be opaque
• Separate out small portions of 3Mix and incorporate into MP using the following:
  • 1:5 (MP:3Mix)→creamy consistency
  • 1:7 (standard mix)→smears easily but does not crumble
• If result is flaky or crumbly, then too much 3Mix has been incorporated
Protocol for preparation

Storage

- Antibiotics must be kept separately in moisture-tight porcelain containers
- Macrogol ointment and propylene glycol must be stored separately
- Discard if mixture is transparent (evidence of moisture contamination)
**Clinical Application**

1. Revascularization of an immature permanent tooth with apical periodontitis
2. Indirect pulp capping to sterilize carious lesion = LSTR
3. Sterilize the root canal system = be one of the intracanal medication
4. Non instrumentation endodontic treatment in deciduous tooth = NIET
5. Indirect pulp capping in deciduous tooth
Revascularization is the most desirable healing response in the avulse immature tooth with an open apex because the tooth continues to develop to form strong root dentin.
Infected open apex tooth

Apexification

Thin root canal wall prone to fracture
**Principle of revascularization**

- No mechanically cleaned to the apex of the root canal
- Remove necrotic and infected pulp coronally
- Leaving the pulp tissue apically to promote revascularization
- Continued root development and apical closure are predictable
Revascularization

- Pulp revascularization was possible in dog teeth
- **Further root development**
- Reinforcement the canal wall, thus strengthen the root against fracture

Skoglund et al 1978
Revascularization

- Revascularization should occur when
  - Canal is effectively disinfected with 3Mix
  - A scaffold into which new tissue can grow is provided
  - The coronal access effectively sealed

Trope 2007
Revascularization

– 3 months follow up
– No sign of regeneration are presented
– Apexification may be considered
Revascularization VS Regeneration

• Now only “Pulp space has returned to a valid state”  
  Trope M 2008

• Study on infected teeth and avulsed teeth found that the tissue in the pulp space is more similar to PDL than pulp tissue  
  Thibodeau et al 2007
Smear layers delayed the release of dye, even when propylene glycol was used as the carrier

Cruz et al 2002
Revascularization

In the immature teeth
Indication

• Only in teeth with open apex
• and necrosis pulp

Francisco Banchs, DDS, MS, and Martin Trope, DMD
JOURNAL OF ENDODONTICS 2004
The Predictable revascularization of immature teeth with apical periodontitis would be possible if 3 challenges can be met:

1. disinfection of the canal
2. placement of a matrix in the canal for tissue in growth
3. a bacterial tight seal of the access opening

Windley et al 2005
Revascularization of an immature permanent tooth with apical periodontitis and sinus tract

Shin-ichi Iwaya 1, Motohide Ikawa 2, Minoru Kubota 3

Dental Traumatology 2001
Three Mix Antibiotics

- Ciprofloxacin
- Metronidazole
- Minocyclin

Hoshino et al., 1996
Clinical Evaluation of Endodontic Re-treatment Using LSTR 3Mix-MP

- 101 endodontically treated teeth
- Without removal of previous obturation

**Conclusion:**
Radiolucent lesions were efficiently and successfully re-treated using LSTR 3Mix-MP NIET.

TAKUSHIGE et al 2007
Concern

• the more independent clinical trials are required
• the possibility of drug side effects
• the possibility of allergic reactions
• the potential for emergence of antibiotic-resistant bacterial strains

Young et al 2007
• 3 MIX has been demonstrated to be well tolerated by vital pulp tissue

Ayukawa et al 1994
A combination of antibiotics

- 3 MIX would decrease the chance of the development of resistant bacteria strain.

Windley et al 2005
Technical concerns and issues against LSTR use
The American Academy for Pediatric Dentistry as well as the European Association of Pediatric Dentistry recognized the increasing prevalence of microbial resistance and have issued guidelines on antibiotic therapy among pediatric patients. The two dental organizations advocate the prudent and conservative use of antibiotics to minimize the risk of developing resistance to current regimens.
The inappropriate use of antibiotics

Pallasch, T (2000, Journal of the Californian Dental Association) identified 6 things that may happen when antibiotics are employed.

- The antibiotic may aid the immune system to gain control of the infection;
- Toxicity or allergy may occur;
- Already resistant microbes may be selected for and a superinfection may result;

www.docudesk.com
The inappropriate use of antibiotics

- The antimicrobial effects may promote microbial chromosomal mutations;
- Gene transfer may be encouraged from resistant to nonresistant microbes; and
- Latent resistant genes may be expressed.

These are all negative effects and may occur with inappropriate use of antibiotics. Such may occur with the use of the LSTR mix.
"Selective pressure is the phenomenon in which the more susceptible bacteria are destroyed but the more resistant bacteria survives. Dosage regimens that do not destroy the target bacterial population create selective pressure resulting in a population of resistant bacteria. This population may not cause disease in the initial human host but may spread to others."

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Ciprofloxacin

Caution

*G 6 PD*: allergic to quinolone drug group
Tips to Initiate Bleeding

- 3% mepivacaine without vasoconstrictor
- Bend file and extend beyond apex
  - Rotation action
- Dip file in 17% EDTA

Patrino et al., JOE 36:526, 2010
Principle of endodontic treatment in the young permanent teeth is to try to maintain the vitality of the pulp to give the opportunity for further root formation until the primary dentin is fully developed that allowed thickening of the canal wall and resulted in strengthening of the root.
Children management

- Understanding
- Respect
- Honest
- Kindness

Trust
NIET technique In the deciduous teeth

“medication cavity”
(diameter 1mm and depth 2mm)

at the orifice of each root canal as a receptacle for the medication.

cover with GI cement and a coronal restoration
The schema of **LSTR 3Mix-MP NIET** for infected deciduous teeth with physiologic root resorption:

1) Resin inlay
2) GI cement
3) 3Mix-MP in medication cavity

Takehashi et al 2004
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