supported bacterial growth well. Blood supported growth of all bacterial isolates except *C. gracilis.* Serum supported the growth of all isolates except *P. urinaeequi and C. gracilis.* Saliva supported the growth of *A. viridans, A. viscosus, R. dentocariosa, C. durum* and *P. urinaeequi.*

Conclusions The differential support of growth by the nutrient sources revealed in the present study support the conclusion that during root canal infection, the causative bacteria may derive nutrition from a variety of locally abundant key tissues, but the principal components of hard and soft tissue present within teeth support bacterial growth only to a limited extent or does not support at all. The principal requirements are body fluids.

S. P. van Zyl, K. Gulabivala & Y.-L. Ng*
Unit of Endodontology, Eastman Dental Institute for Oral Health Care Science, University College London, London

Effect of customization of master gutta-percha cone on apical control of obturation using different techniques: an *in vitro* study

Aims (i) To compare the prevalence of root filling extrusion placed using three different obturation techniques, each with or without customization of the master gutta-percha cone; and (ii) to investigate the effects of various factors on the prevalence of root filling extrusion.

Methodology A total of 180 roots were selected and randomly allocated into three groups. Five general dental practitioners were recruited; each obturated one group of the roots using three techniques, namely cold lateral condensation ($n = 20$), Schilder's warm vertical condensation ($n = 20$) or continuous wave condensation ($n = 20$). Each technique was completed with ($n = 10$) or without ($n = 10$) customization of the master gutta-percha cone using chloroform. Two groups of the roots were recycled to allow all five operators to use them. Two observers examined the preinstrumentation, working length, master apical file and postobturation radiographs, and determined the presence of root filling extrusion and voids independently; they were blinded regarding the obturation technique used. The presence of root filling extrusion was also assessed by inspecting the root apex after obturation. The data were analysed using logistic regression models.

Results A total of 300 root fillings were performed and 291 were included for analysis. Most of the root fillings were placed within 0.5 mm of the working length (80%, $n = 233$); only 20% ($n = 58$) were placed >0.5 mm beyond the working length. The odds of prevalence of extrusion >0.5 mm were significantly reduced by approximately 50% when cold lateral condensation (OR = 0.50; 95% CI = 0.26, 0.99; $P = 0.04$) or customization of master gutta-percha cone (OR = 0.55; 95% CI = 0.30, 0.99; $P = 0.04$) was used. One operator produced 2.5 times more extruded root fillings than the other operators (OR = 2.50; 95% CI = 1.31, 4.78; $P = 0.006$). Other factors, such as root canal curvature and length, apical size of the prepared canal, as well as the operator's preferred obturation technique, were shown to have no significant influence on the prevalence of extrusion.

Conclusions The prevalence of extrusion was significantly lower when cold lateral condensation and customization of the master cone were used. The 'operator' emerged as a significant factor affecting the prevalence of root filling extrusion.

E. T. Pinheiro[1,2,*], B. P. F. A. Gomes[1] & D. B. Drucker[2]
[1]Department of Endodontics, Piracicaba Dental School, State University of Campinas, UNICAMP, Piracicaba, Brazil; and [2]Department of Oral Microbiology, University Dental Hospital of Manchester, Manchester, UK

Identification of *Enterococcci* isolated from canals of root filled teeth with periapical lesions and their antimicrobial susceptibility to different antibiotics

Aim The objective of the present study was to investigate the occurrence of *Enterococcus* spp. in root filled teeth with periapical lesions and the *in vitro* antimicrobial susceptibility of the isolates.

Methodology Sixty teeth with failed root canal treatment were included in the study. During nonsurgical endodontic retreatment, the root filling material was removed and the canals were sampled and microbiologically examined. *Enterococcus* ssp. isolates were tested for their antibiotic susceptibilities using the *E*-test system (AB BIODISK, Solna, Sweden). The following antibiotics were used: benzylpenicillin, amoxicillin, amoxicillin-clavulanic acid, erythromycin, azithromycin, vancomycin, chloramphenicol, tetracycline, doxycycline, ciprofloxacin and moxifloxacin. The strains were also tested for β-lactamase production with nitrocefin (Oxoid, Hampshire, England).

Results Microorganisms were recovered from 51 of 60 teeth. *Enterococcus faecalis* was recovered from 27 of the 51 canals with bacteria, 18 times in pure culture. All strains were susceptible to penicillins; however, the MICs of amoxicillin and amoxicillin-clavulanic acid ($MIC_{90} = 0.75\ \mu g\ mL^{-1}$) were lower than that for

benzylpenicillin ($MIC_{90} = 3.0$ μg mL^{-1}). All strains studied were also susceptible to vancomycin and moxifloxacin, while 95.2% were susceptible to chloramphenicol. Among the isolates, 85.7% were susceptible to tetracycline and doxycycline, and 80.9% to ciprofloxacin. The MIC of erythromycin ranged from 0.38 to >256 μg mL^{-1}; only 28.5% of the strains were susceptible (MIC ≤ 0.5 μg mL^{-1}). Limited susceptibility was also observed with azithromycin, which was active against only 14.2% of isolates. No strains produced β-lactamase.

Conclusion *Enterococcus faecalis* was present in a large number of canals in teeth with failed root fillings and were completely susceptible, *in vitro*, to amoxicillin, amoxicillin-clavulanic acid, vancomycin and moxifloxacin. Most isolates were susceptible to chloramphenicol, tetracycline, doxycycline or ciprofloxacin. Erythromycin and azithromycin were least effective. (Supported by the Brazilian agencies FAPESP 00/13686-8, 00/13689-7; CNPq 520277/99-6 and CAPES BEX2449/02-1).