ANTIMICROBIAL REVIEW FOR DENTAL HYGIENISTS

BY

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APRIL 22, 2013

Definition of Antimicrobials:

Antibacterial
Antifungal
Antiviral
Antiparasitic

Definition of Antimicrobial

"A chemical substance capable of destroying (biocidal) or inhibiting (biostatic) the growth if disease causing organisms."

History of Antibiotics

- 1928 Discovery of Penicillin
- 1935 Discovery of Sulfonamide
- 1940's Clinical use of Penicillin
- 1940's Emergence of resistant staph aureas
- 1950's Discovery of aminoglycoside, chloramphenicol, tetracycline, macrolide, vancomycin
- 1950's Multi-drug resistant tuberculosis
- 1960 Synthesis of Methicillin
- 1961 Emergence of MRSA
- 1967-80 Development of Cephalosporin's
- 1974 Emergence of Cephalosporin Resistance
- 1984 Development of Carbapenem
- 2000's Emergence of Carbapenem Resistance

Global Antibiotic Resistance: History and Scope

- 1946 Consumers Report Magazine

"The uncritical or promiscuous use of penicillin (may) lead to the persistence of strains of bacteria that will resist its action. Should this happen, it will have serious epidemiological significance."

Global Antibiotic Resistance: History and Scope

- **1967 Surgeon Generals Report**

"The time has come to close the book on infectious disease."

Common "wisdom" of the medical community assumed we could always be able to stay ahead of the microbes with new antibiotics.

Clearly this naiveté that we were smarter and more dedicated than the microbes was a critical error in understanding the grave issue of microbial resistance.

Global Antimicrobial Resistance: History and Scope

- "We must realize that antibiotics are societal drugs as they affect people other than the ones taking the drugs. Every antibiotic given or taken by a single individual can effect other human beings. This may be bad enough when the drugs are used properly, but is intolerable when antibiotics are used improperly."
- Pallasch CDA Feature Article 2000

Global Antibiotic Resistance History and Scope

- 1993 17 million people died of infectious disease worldwide (11.4 million due to bacteria, mostly in children).
- 1993 15.6 million people died worldwide from cardiovascular disease and cancer combined.
- 1993 100,000 people died in the U.S. from nosocomial infections (HAI's)

Global Antimicrobial Resistance: History and Scope

- "The most difficult challenge in the control of microbial resistance is to convince all people(health care practitioners and patients alike) that everyone is responsible for the problem and the solution."
- Pallasch CDA Feature Article 2000

Global Antimicrobial Resistance: History and Scope

- 2013 World Health Organization Definition:
- "AMR is a consequence of the use, particularly the misuse, of antimicrobial medicines and develops when a microorganism mutates or acquires a resistance gene."

Global Antimicrobial Resistance: History and Scope

- 2013 World Health Organization Definition:
- "AMR is resistance of a microorganism to an antimicrobial medicine to which it was previously sensitive. Resistant organisms (bacteria, viruses, fungi, parasites) are able to withstand attack by antimicrobial medicines so that treatments become ineffective and infections persist and may spread to others."

Antibiotic Use in the United States

- 50% of antibiotics used in hospitals are for patients without signs & symptoms of infection.
- 30% have an appropriate culture and sensitivity test prior use.
- Antibiotics are often used as "drugs of fear" to "prevent" claims of negligence.
- Pallasch CDA Journal Feature Article 2000

Antibiotic Use in the United States

- More antibiotics are sold than all over the counter medications
- One prescription for antibiotics is written for every six physician visits
- Antibiotics are often prescribed for infections that are viral in origin.
- Broad spectrum antibiotics are used in lieu of a more appropriate narrow spectrum drug.
- Only 70 years after their introduction, we are facing the possibility of a future without effective antibiotics for multiple infections.

Haas et al cda-adc.ca/jdca/vol-64/issue-7/antimicrobial

2010 CDC Statistics Comparative Mortality Rates

Cancer, all types	500,000
Breast Cancer	40,676
Colorectal Cancer	51,848
Cardiovascular Disease	596,339
Cerebrovascular Disease	128,931
Influenza, Pneumonia	53,667
Septicemia	35,539
HAI's (1.7 million *)	100,000

- *reported infections

Common Resistant Organisms

- MRSA
- VRSA
- S. pneumoniae
- Haemophilus influenzae
- Enterobacteriaceae
- Clostridium Difficile
- Malaria
- Tuberculosis

Cost of HAI's in the United States

2007

- In patient hospital services:
  $35.7-$45 billion dollars
- Estimate of Savings due to effective infection control interventions:
  $5.7-$6.8 billion dollars
- Montefiore Medical Center 2012:
  53% decrease in ICU infections after implementing CDC infection control guidelines

Antibiotic Use in the United States

Pediatricians are currently the most active medical specialty aggressively attempting to reduce unnecessary antibiotic use.

Reasons for Inappropriate Use of Antibiotics

Insufficient training in infectious diseases and proper antibiotic therapy, and failure to follow infection prevention guidelines

Empirical use

Lack of culture and sensitivity tests

Inadequate diagnostics

Inappropriate choice of drug, dose, and duration

Need of self assurance

Patient Demands

Fear of Litigation

Control of Antibiotic Misuse

- Reduction in antibiotic use leads to altered resistance patterns
- Hospital changes in antibiotic use leads to altered antibiotic resistance patterns
- HAI rates are far greater than those in the community due to more intensive antibiotic use
- Areas of the hospital with the greatest antibiotic use have the highest resistance rates
- The longer the duration of antibiotic use, the more likely resistant organisms will occur

What is Being Done?

- **CDC**
  World Health Day 2011
- **NHSN**
  National Health Surveillance Network
- **WHO**
  Monthly Fact Sheets
- **TATFAR**
  Transatlantic Taskforce on Antimicrobial Resistance

Common Goals of CDC, WHO, TATFAR

Appropriate use of antimicrobials in medical, veterinary, and agricultural communities.

Prevention of healthcare and community associated drug resistant infections.

Develop strategies to improve development of new antimicrobial drugs.

International Success Stories

- Finland:

Appropriate dosing of erythromycin for group A Strep. for 4 years.

Result: 8% decrease in resistance.

- Iceland:

Appropriate use of penicillin in pediatrics decreased resistant pneumococci 5% in one year.

- Hungary:

Appropriate use of upper respiratory antibiotics decreased S. pneumoniae 16% in one year.

Responsible Use of Antimicrobials in Dentistry

Dentistry prescribes 10% of all common antibiotics, therefore our contributions to the problem of microbial resistance can be substantial.

Antimicrobials in Periodontal Treatment

- Periodontitis is a polymicrobial infectious disease associated with specific bacterial species and herpes viruses.
- The primary goal of periodontal therapy is too achieve a periodontal environment free of infectious pathogens and consequent periodontal health.
- Slots, J.medscape.com/viewarticle/749509

Topical Antimicrobials in Periodontal Treatment

- Increase in antibiotic resistant bacteria has created interest in non systemic therapies
- Inexpensive, safe, and highly bactericidal/viricidal
- No interaction with prescription medications
- Valuable in treatment of biofilm infections, which may be unresponsive to even high concentrations of antibiotics
- Risk of systemic adverse effect virtually non-existent

Slots.medscape.com/viewarticle/749509

Topical Antibiotics in Periodontal Treatment

- Local antibiotic delivery systems placed directly in the pocket
- Tetracycline HCL, Doxycycline HCL, Minocycline HCL
- FDA studies 6 months, long term efficacy?
- Statistical vs. Clinical Significance
- Potential problems:
  - Insufficient range of antimicrobial activity
  - Modest and transient long term effect
  - Possible development of resistant bacteria
  - High cost, delivery time to place in pocket

Chlorhexidine

- Used as an oral antiseptic for more than 40 years
- Ability to adhere to dental pellicle and oral mucosa (substantivity) prolongs antiplaque effect
- Chlorhexidine gluconate 0.12% (Oral rinse ex. Peridex)-0.2%(Topical scrub ex. Hibiclens)
- Inactivated by organic serum compounds in crevicular fluid, therefore of limited to no use subgingivally
- Adverse reactions include staining (tooth structure and anterior fillings), increase in supragingival calculus, alteration in taste
- FDA approved for gingivitis (not NUG, precaution for periodontitis), 6 month clinical studies.

Povidone Iodine

- Iodine solutions used as dental antiseptics for more than 150 years
- Most common commercial form is Betadine or generic equivalent, 10% solution in water
- In vitro kills periodontopathic bacteria within 15-30 seconds, in addition to being viricidal
- Subgingival delivery with 3 ml endo syringe, 23 gauge blunt end side port cannula. Entire dentition requires~ 5 minutes for application
- Contraindications: Thyroid dysfunction, pregnancy, infants, known allergy, routine patient self care
- Effective for caries control

Sodium Hypochlorite (NaOCl)

- Used for over 100 years an oral antiseptic and disinfectant against bacteria, fungi, and viruses.
- Occurs naturally in neutrophils, monocytes & macrophages. Does not evoke allergic reactions.
- Used as endodontic irrigant 1.0%-5.25% solution for years.
- NaOCl rinse may reduce biofilm up to 80%. ADA designated as "mild antiseptic mouthwash."
- Oral rinse: 2 tsp. 6% household bleach/ 8 oz. water (.2% solution), rinse 30 seconds 2-3 times per week.
- Pt. administered oral irrigation, 0.5% 2 tsp./ 4 oz. water in reservoir of oral irrigation device. Always rinse device with 100% water after use.
- Has mild positive effect on dentinal sensitivity.

Systemic Antibiotic Indications

Acute dento-alveolar abscess:
swelling, fever, cervical lymphadenopathy, malaise , prevention or treatment of cellulitis.
* Must be accompanied by I & D, appropriate endodontic therapy.

Acute or chronic pulpitis without above symptoms cannot be successfully treated with antimicrobials as the pulp is an "enclosed box" in which antimicrobials cannot penetrate.

Martin, Michael V., FACULTY DENTAL JOURNAL March 2010 Somerset,UK.

Systemic Antibiotics

- Post- operative infections after dental surgery <1% without prophylactic antimicrobials (non medically compromised patients).
- Consistent high rates of postoperative infection following dental surgery are usually due to poor aseptic technique.
- Prophylactic antibiotics should not be routine, but rather decided on a patients overall medical history.

Antibiotics in Periodontal Treatment

- Systemic therapy reduces or eradicates specific bacteria not reached by topical therapy such as pathogens in gingival tissue, furcations, and the base of periodontal pockets.
- Challenging to choose appropriate antibiotic due to multiple organisms that have diverse susceptibility profiles.
- Tradition to treat empirically, or treat "best estimate" of most probable pathogen(s).
- Wrong choice of antibiotics may contribute to microbial resistance or overgrowth of resistant strains.
- Microbiologic testing offers a more predictable, targeted therapy than the empiric trial and error approach.

Periodontal Microbial Analysis

- Patient non-responsive to traditional therapy: definitive scaling/root planing, antimicrobial therapy, surgical intervention.
- Aggressive periodontitis
- Severe chronic or refractory periodontitis

Microbial Analysis Procedure

Figure 32-1 Supragingival plaque should be removed by means of periodontal scalers or cotton pellets. During sampling, sample sites should be isolated by cotton rolls.

Figure 32-4 An identification label for each transfer vial is completed by printing the dental office account number, the patient's name, and the date the sample was taken.

Microbial Analysis Procedure

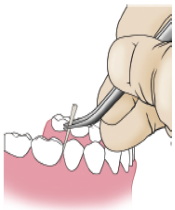


Figure 32-2 For single-pocket samples, two paper points should be inserted to the depth of the periodontal pocket and kept there for 10 seconds. For pooled samples, one paper point should be inserted for 10 seconds into each of the periodontal pockets.

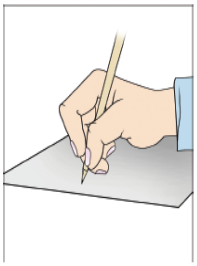


Figure 32-5 A laboratory request form is completed for each patient before sending the samples.

Microbial Analysis Procedure

Figure 32-3 The paper points should be transferred immediately to the anaerobic medium and the vial cap should be quickly replaced. The vial cap should only be removed for inserting the paper points. The anaerobic medium should not be exposed to air for more than 15 to 20 seconds.

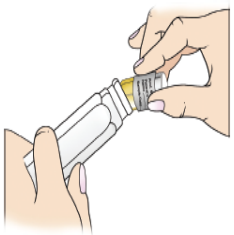


Figure 32-6 The container and the laboratory request form are inserted into a mailing container and envelope.

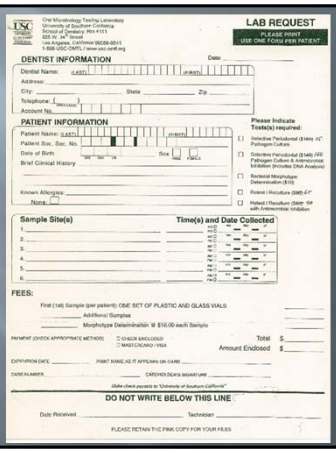
Microbial Analysis Procedure

Send the sample using an overnight service as this is a live culture and time sensitive!

Oral Microbiology Testing Lab

University of Southern California
School of Dentistry, Room 411
925 West 34th Street
Los Angeles, CA 90089-0641

(213) 740-3163



LAB REQUEST

PLEASE PRINT
USE ONE FORM PER PATIENT

DENTIST INFORMATION

Date:

Dentist Name: (LAST) (FIRST)

Address:

City: State Zip

Telephone: ( )

Account No.:

PATIENT INFORMATION

Please Indicate Tests(s) required:

Patient Name: (LAST) (FIRST)

Patient Soc. Sec. No.

Date of Birth: Sex

Brief Clinical History

Known Allergies:
None

Sample Site(s) Time(s) and Date Collected

1.
2.
3.
4.
5.
6.

FEES:

First (1st) Sample (per patient): ONE SET OF PLASTIC AND GLASS VIALS

Additional Samples

Morphotype Determination @ $10.00 each Sample

PAYMENT (CHECK APPROPRIATE METHOD): ☐ CHECK ENCLOSED ☐ MASTERCARD / VISA

Total $

Amount Enclosed $

EXPIRATION DATE: PRINT NAME AS IT APPEARS ON CARD:

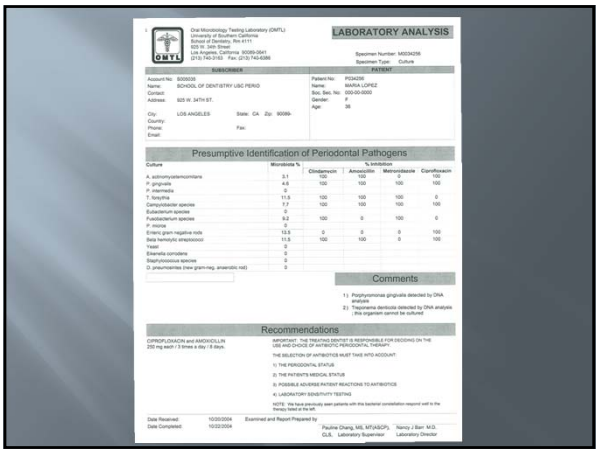
CARD NUMBER: CARDHOLDER'S SIGNATURE:

Make check payable to "University of Southern California"

DO NOT WRITE BELOW THIS LINE

Date Received: Technician:

PLEASE RETAIN THE PINK COPY FOR YOUR FILES



LABORATORY ANALYSIS

Presumptive Identification of Periodontal Pathogens

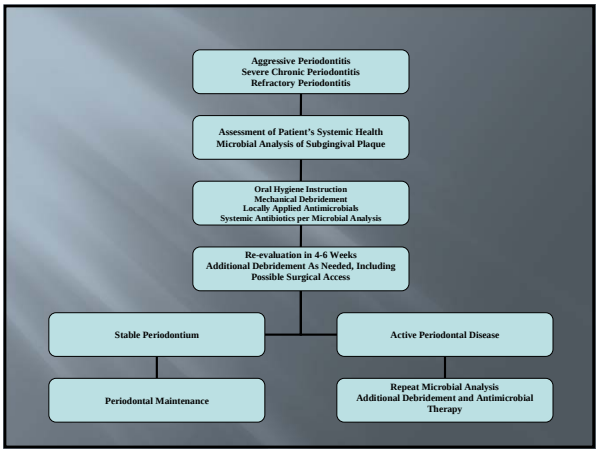
Comments

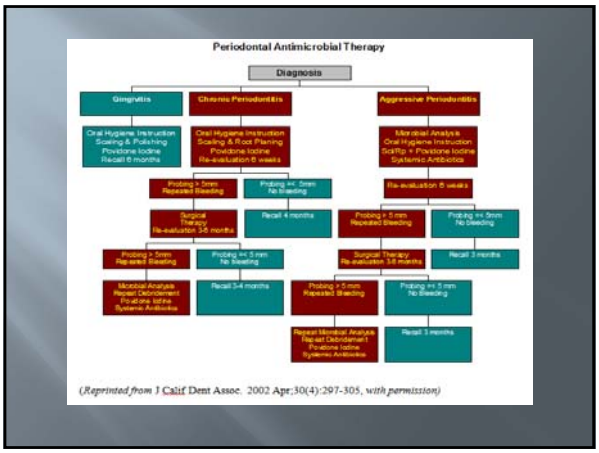
Recommendations

Table 1. Common systemic antibiotic regimens in periodontal treatment.

Metronidazole	500 mg/TID/8 days
Clindamycin	300 mg/TID/8 days
Doxycycline	100-200 mg/QD/21 days
Ciprofloxacin	500 mg/BID/8 days
Azithromycin	250-500 mg/QD/4-7 days
Metronidazole + amoxicillin	250 mg/TID/8 days of each drug
Metronidazole + ciprofloxacin	500 mg/BID/8 days of each drug
Fluconazole (yeasts)	100 mg/QD/14 days
Valacyclovir (herpesviruses)	500 mg/BID/10days

QD=once daily; BID=twice daily; TID=three times daily





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Questions and Answers