British Journal of Pharmaceutical Research
1(3): 66-87, 2011

SCIENCEDOMAIN *international*
www.sciencedomain.org

Pharmacological Agents in Dentistry: A Review

Mandakini Mohan[1*], Arshiya Gupta[1], Vidya Shenoy[1] and Abhishek Parolia[2]

[1]Department of Prosthodontics, Manipal College of Dental Sciences, Mangalore Manipal University, Karnataka, India.
[2]Department of Conservative Dentistry, Manipal College of Dental Sciences, Mangalore Manipal University, Karnataka, India.

Review Article

Received 3rd May 2011
Accepted 2nd June 2011
Online Ready 5th June 2011

ABSTRACT

All clinicians should be fully aware of the recent trends in their speciality to enable them to provide effective and successful treatment to their patients. One vital aspect of the treatment is that the clinician should constantly update his knowledge on the drugs being administered during the course of treatment and their interactions. The purpose of this article is to review the current pharmacological agents being used in Prosthodontics along with their interactions and indications. The paper mainly focuses on Therapeutic drugs and drugs that aid in prosthodontics treatment. Therapeutic drugs include local anesthetics, antiseptics, steroids, analgesics, antimicrobials, antifungals, antianxity drugs, centrally acting muscle relaxants. Drugs that aid in prosthodontics treatment include astringents, vasoconstrictors, hemostatic agents, sialogogues, anti-sialogogues, denture cleansers, gum paints, denture cleansers, denture adhesives, ORAL protective agents and demulcents. An odontologist should have sound knowledge of the benefits and drawbacks of all these agents. This will enable the clinician to provide a safe and predictable treatment to the patients.

Keywords: Pharmacotherapeutics; Drugs; Dentistry;

**Corresponding author: Email: drmandakini@yahoo.co.in;*

1. INTRODUCTION

Rapid progress in dental pharmacotherapeutics requires that clinicians constantly update their knowledge of new drugs, drug interactions and useful therapeutic trends. The pharmacological agents aid in rapid healing and repair of the damaged tissues, relieve patients of pain and bring back the tissues to the healthy state. These drugs play a useful role in prosthodontics in the treatment of ulcerations, inflammations, xerostomia and bleeding during gingival retraction. They also help in reducing dentinal hypersensitivity during vital tooth preparation and increasing the gingival resistance against infections.

These pharmacological agents can be classified as:-

I. Therapeutic drugs.
II. Drugs that aid in prosthodontics treatment.

2. THERAPEUTIC DRUGS

2.1 Local Anesthetics

Local Anesthetics (LA) are the drugs which upon topical application or local injection cause reversible loss of sensory perception, especially of pain, in a restricted area of the body. These drugs act by excessive stimulation followed by depression (Bennett, 1984a). To work efficiently, the dental local anesthetics should have some requirements (Haas, 2002) such as:

- High intrinsic activity, which ensures complete anesthesia for all dental treatment
- Rapid onset
- Adequate duration of anesthesia (30 to 60 min for standard dental treatment)
- Low systemic toxicity
- High efficacy-toxicity ratio
- Low overall incidence of serious adverse effects

Chemically local anesthetics are classified as either Esters or Amide types. The ester based agents Procaine and Cocaine are no longer widely used as dental anesthetics due to their unwanted side effects. The commonly used injectable dental local anesthetics are explained in table 1. Anesthetic preparations for dental use differ from those for nondental use. The concentration of local anesthetics for dental use is higher, because the volume which can be injected into the oral mucosa is limited. Local anesthetics cause some degree of vasodilation, therefore, vasoconstrictor agents can be added to local anesthetic solutions to antagonize LA action, reduce bleeding at surgical site, diminish toxicity and prolong the duration of anesthesia (Table 1.1). An acidic carrier solution is added to the LA cartridge to maintain the pH of the solution. Apart from this the dental cartridge also contains a reducing agent Metabisulfite that prevents oxidation of the vasoconstrictor and Thymol that acts as a fungicide (Bahl, 2004).

Local anesthetics containing vasoconstrictor agents are to be used with caution in patients with pheochromocytoma, uncontrolled or unstable angina, cardiac arrhythmias, congestive heart failure, hyperthyroidism, or diabetes. Recommended maximum dosage of epinephrine for a healthy individual is 0.2 mg, while 0.04 mg for a patient with clinically significant cardiovascular disease. If 1:100,000 concentration of epinephrine is considered then the

amount of Lignocaine administered is 20 ml in healthy individual (Bennett, 1984b) and 4 ml in patients with cardiovascular diseases (Bennett, 1984c).

For short dental procedures a short or medium acting local anesthetic likes 2% Lidocaine+1:100,000 Epinephrine is used, whereas for long dental procedures such as implants one can use 0.5% Bupivacaine+1:200,000 Epinephrine (Bennett, 1984d). Along with these anesthetic agents, Articaine has also been widely used and it has been seen that, soft tissue anesthesia and pain experience after 4% Articaine with 1:100,000 Adrenaline, and 2% Lignocaine with 1:100,000 Adrenaline are similar (Oliveira et al., 2001). Occasionally, these local anesthetic agents may lead to local and systemic side effects, if not used carefully. The local adverse effects can be in the form of hematoma, spread of infection, temporary/permanent nerve damage (Chen, 1998), while systemic reactions fall into four categories: toxic (drug overdose, rapid absorption, intravascular injection), psychogenic, idiosyncratic, or allergic (Malamed, 1990). Theamide classes of local anesthetics are significantly less allergenic than the ester type. If allergic reactions occur, the immediate treatment is intravenous injection of 0.01 ml per kilogram body weight adrenaline, supplemented by antihistamine agents such as 10 to 20 mg chorpheniramine, or 50 mg hydroxyzine or promethazine hydrochloride (Ball, 1999). Although, allergy to lignocaine is known to be extremely rare, it continues to be suggested as a cause when adverse reactions to dental injections occur. In fact, the overwhelming majority of adverse reactions to local anesthetics is psychogenic in nature and related to fear. A smaller proportion of adverse responses can beattributed to intravascular injections that are avoidable if injections are administered carefullyand with previous suction (Rood, 2000). Apart from these injectable agents, certain topical anesthetics (Table 2) are used in the oral cavity to provide pain relief at needle insertion site and over ulcerations. Topical anesthetic agents can also provide some form of relief in patients exhibiting gagging during the impression procedure. Glycerine, lanolin, petrolatum, mineral oil, sodium carboxymethylcellulose, propylene glycol and polyethylene glycol are used as vehicles for topical anesthetics (Adriani and Zepernick, 1964).

2.2 Antiseptics

Antiseptics are drugs that are applied on the body surfaces to prevent infection by killing or inhibiting the growth of pathogenic bacteria either by oxidation of bacterial protoplasm or denaturation of bacterial proteins including enzymes (Tripathi, 2008a). Amongst the various types of antiseptics available, chlorhexidine a biguanide, is one of the most commonly used. It is found to be more effective against Gram positive micro-organisms, while less effective against Gram-negative micro-organisms, fungi, and ineffective against spores and viruses. Therefore, mouth rinses containing chlorhexidine are widely prescribed in patients with persistent areas of oral inflammation (Newman et al., 2006). Daily oral irrigation with 0.06 to 0.12% chlorhexidine has been shown to be an effective method for the treatment of chronic gingivitis and apthous ulcers (Brownstein et al., 1990). Chlorhexidinedigluconate, at concentrations of 0.12%, binds to hard tissue, soft tissue and salivary protein of oral cavity and then releases slowly, thereby reducing the formation of plaque and inflammation (Yankell et al., 1982). The patient suffering from traumatic ulcer and inflammation after denture insertion is asked to swish 10 ml of chlorhexidine mouthwash for 1 minute that will facilitate healing. Commonly available chlorhexidine containing mouthwashes include Peridex, Periochip, Perichlor, Corsodyl and Periogard oral rinse. Recently, alcohol free dentyl pH mouthwash has been introduced which has a distinctive working action.

Table 1. Injectable Local Anaesthetic agents used in Dentistry

Parameters	Anaesthetic agents				
	Lignocaine	**Articaine**	**Bupivacaine**	**Prilocaine**	**Mepivacaine**
Concentration	2-3%	4%	0.25-0.5%	3-4%	2-3%
Vasoconstrictor	Epinephrine 1:50,000-1:100,000	Epinephrine 1:100,000-1:200,000 or without	Without epinephrine	Felypressin 1:1,850,000	Epinephrine 1:66,000 -1:100,000 or without
Chemical class	Amide	Amide with Ester side chain	Amide	Amide	Amide
Onset	Rapid	Rapid	Slow	Slow	Rapid
Duration (with Epinephrine)	120-240 minutes	140-270 minutes	4-8 hours	90-360 minutes	120-180 minutes
Maximum dose	4.5-7 mg/kg	4-7 mg/kg	2.5-3 mg/kg	5-7.5mg/kg	5-7mg/kg
Brand name	Xylocitin/Xylestesin	Ubistesin/Ultracain /Septocaine	Carbostesin/ Marcaine	Xylonest/ Citanest	Scandonest/Mepivastesin /Carbocaine

Table 1.1. Recommended dosage of L.A.

	With vasoconstrictor	Without vasoconstrictor
Recommended dosage of L.A. (Bernett, 1984)	500mg (6.6 mg/kg body weight)	300 mg (4.4 mg/kg body weight)
Maximum syringes* administered in healthy patients	12.5 syringes	7.5 syringes

** One Syringe contains 2 ml of solution.*
(Each 2 ml contains 40 mg of Lignocaine and 0.02 mg of epinephrine)

This advanced formula consists of two phases, a water-based phase incorporating the antibacterial agent Cetylpyridinium Chloride (CPC), and an oil-based with natural essential oils that removes an adherent bacterial layer from a solid surface and exhibits a continuing inhibitory effect on bacterial activity (New addition to alcohol free mouthwash range, 2009).

Table 2. Topical local anesthetic agents

Parameters	Anaesthetic agents			
	Benzocaine	**Dyclonine**	**Lidocaine**	**Tetracaine**
Concentration	6-20%	0.5-1%	2-5%	0.2-2%
Available as	Liquid, Spray, Ointment, gel,	Solution	Gel, ointment Liquid, Solution, 10% spray	Liquid, Spray, Ointment
Chemical class	Ester	Ketone	Amide	Ester
Duration	30-60 minutes	<60 minutes	30-60 minutes	30-60 minutes
Max dose	5000mg	300 mg	200mg	20mg
Brand name	Anbesol Benzodent Gingicaine Topicale	Dyclone	Xylocaine Alphacaine Octocaine Dologel	Pontocaine Supracaine Cetacaine

2.3 Steroids

Steroids play a role in the modulation of the inflammatory reaction by inhibitory activity affecting the production of mRNA and thus protein synthesis. Application of topical steroid preparations provides temporary relief of symptoms associated with inflammation and ulcerated lesions in the oral cavity such as recurrent apthous stomatitis. These topical ointments include Triamcinolone acetonide 0.1%, Kenalog in Orabase; hydrocortisone acetate 1% and Betamethasone dipropionate 0.05%.Topical use of steroids is usually well tolerated but some patients may develop a secondary erythematous candidosis or pseudomembranous candidosis (thrush) if predisposing conditions like xerostomia, systemic and/or topical use of antibiotics, corticosteroid asthma inhalants, prostheses and cigarette smoking are present in them. Even though clinical experience and laboratory studies have shown systemic absorption of steroids to be insignificant through the oral mucosa but caution should be exercised when used in patients with diabetes, hypertension, tuberculosis and those with extensive area of coverage and unmonitored usage (Savage and McCullough, 2005).

2.4 Analgesics

Analgesic agents are used for the management of pain and can be divided into the Nonopioid (non-narcotic), Acetaminophen (Paracetamol) and the Opioid (narcotic). An important difference between the opioids and the nonopioid analgesic agents is their mechanism of action. The action of the nonopioid analgesic agents is related to their ability to inhibit prostaglandin synthesis at the peripheral nerve endings whereas the opioids affect the amount of pain by depressing the central nervous system.

2.4.1 Non steroidal anti-inflammatory Drugs (NSAIDs')

The NSAIDs constitute a heterogeneous group of drugs with clinically important analgesic, antipyretic and anti-inflammatory properties that rank intermediately between corticoids with anti-inflammatory properties on one hand, and major analgesics – opioids on the other (Poveda-Roda et al., 2007).These agents differ from opioid analgesics in the following ways: (1) there is a ceiling effect to the analgesia; (2) they do not product tolerance or physical dependence; (3) they are antipyretic; and (4) they possess both anti-inflammatory as well as analgesic properties (Yagiela et al., 2004a). Nonopioids are most effective in treating postprocedural pain when given before the procedure (or immediately following a short procedure), thus preventing the synthesis of prostaglandins that quickly follow the surgical insult. Table 3 lists the currently available NSAIDs.

Mechanism of action of NSAIDs

Physical, chemical or mechanical stimuli in the form of tissue damage, hypoxia, immune processes, etc. induce arachidonic acid release and metabolization. NSAIDs inhibit cyclooxygenase (COX) – the enzyme responsible for the transformation of arachidonic acid into prostaglandins and thromboxanes, which are substances generically referred to as eicosanoids. These resulting metabolites (prostaglandins and thromboxanes) exert potent vasodilating action, resulting in increased vascular permeability, with the extravasation of fluids and white blood cells therby contributing to inflammation. Consequently, the inhibition of cyclooxygenase synthesis exerts a clear anti-inflammatory effect (Poveda-Roda et al., 2007).Out of the two forms (isoenzymes) of cyclooxygenase namely cyclooxygenase-1 (COX-1) and cyclooxygenase-2 (COX-2) the latter COX-2 appears to be more involved with synthesis of prostaglandins at sites of inflammation, whereas COX-1 is more involved at sites where adverse effects of NSAIDs are expressed, such as the gastrointestinal tract. Therefore NSAIDs that have more selective inhibitory activity on COX-2 as opposed to COX-1 would be expected to have a more favorable therapeutic index (Waldman et al., 1982). Celecoxib, Rofecoxib and Parecoxib are drugs showing selective COX-2 inhibitory action but these should be avoided in patients with moderate to severe hepatic damage. Potential adverse effects of NSAIDs include peptic ulcer disease, gastrointestinal (GI) bleeding, GI perforation, impaired renal function and inhibition of platelet function. These side effects are more pronounced in drugs showing COX-1 inhibitory activity. Salicylates should be avoided in patients suffering from Ulcers, Asthma, Diabetes, Gout, Influenza and hypercoagulation states. Asprin and related salicylates are contraindicated for treatment in children and teenagers with viral infections, as it has been associated with hepatotoxicity and encephalopathy (Reye's syndrome) (Waldman et al., 1982). Ibuprofen, naproxen sodium, ketoprofen and asprin are currently approved by the food and drug administration for over the counter (OTC) use. These OTC drugs should not be used consecutively for over 10 days for pain and 3 days for fever (Yagiela et al., 2004b). A 200 to 800 mg dose of ibuprofen should be considered as the first choice for management of acute inflammatory pain (Hargreaves and Abbott, 2005).

Table 3. Nonsteroidal anti-inflammatory drugs

Group	Generic name	Trade name	Maximum adult dose (mg)	Dosing interval (hours)	Dosing form
Salicylic acid derivatives	Asprin	-	325-650	4	Tablets
Aryl-Acetic acid derivatives	Diclofenac	Voveran/Diclonac/ Movonac	50	8	Tablets/Suppositories/ Injection
	Aceclofenac	Aceclo/Dolokind			
Oxicams	Piroxicam	Dolonex/Pirox Piricam	40 on first day/20 on following days	12-24	Tablets/ Suppositories
	Meloxicam	Meflam Mel-OD	7.5-15		
	Lornoxicam				
Propionic acid derivatives	Ibuprofen/Ketoprofen/Flurbiprofen/ Fenoprofen/Naproxen/Oxaprozin		400/50/50/200/250/ 600-1200	4-6/6/6/4-6/6-8/24	Tablets/ Suppositories
Anthranilicacid (Fenamates)	Mefenamic acid/ Meclofenamate	Medol/Meftal/ Ponstan	250	6	Capsule/ Tablet/ Suspension
Coxibs	Celecoxib	Celact/Revibra	200	12-24	Capsules
	Etoricoxib	Etody/Etoxib	120		Tablets
	Parecoxib	Revaldo/Valto	40		Solution for injection
Pyrazolones	MetamizolPhenylbutazone Oxyphenbutazone	Analgin	500-1500		Capsules/Solution for injection/Suppositorie/ Sachets
Indole	Indomethacin	Indicin/Indoflam/ Indocap/Recticin	200-400	6-8	Capsules/ Suppository
	Etodolac				
Pyrrolo-pyrrole derivative	Ketorolac	Ketorol/Zorovon/ Torolac	10	4-6	Tablets/Solution for injection

2.4.2 Acetaminophen (Paracetamol)

It has analgesic and anti-pyretic effects, and it is a weak inhibitor of the cyclo-oxygenase sub-groups COX-1 and COX-2. At therapeutic doses it does not inhibit prostaglandin in the peripheral tissues so there is very little, if any, anti-inflammatory action. It is therefore not classified as an NSAID (Felpel, 1997).Tolerance and dependence have not been reported, and Paracetamol does not cause the same gastric irritation or the other complications associated with aspirin and other NSAIDs (Seymour et al., 1999).

The usual recommended adult dose of Paracetamol is 500-1000mg every four to six hours (up to a maximum of 4000mg per day) (Therapeutic guidelines, 2002).

2.4.3 Opioid Analgesics

Opioid analgesics used in dentistry for oral administration are Codeine, Hydrocodone, Oxycodone and Pentazocaine whereas Morphine, Meperidine and Fentanyl are used parenterally (Table 4). Opioids are added to nonopioids to manage pain that is moderate to severe or that does not respond to nonopioids alone. Opioids differ from the nonopioids in that they have no ceiling effect. The only dosing limitation is based on side effects (Felpel, 1997).

Mechanism of action of Opioids

Opioid-induced analgesia results from agonist action at one or more of opiate receptors namely mu (μ), kappa (κ), delta (δ), and sigma (σ) at the level of the brain and spinal cord, whereas side effects result from their activation at both central and peripheral sites. Morphine and Codeine, produce analgesia and euphoria by an agonist action at μ_1-receptors and side effects of respiratory depression and constipation by an agonist action at μ_2-receptors. Opioids, which are agonists at some receptors and antagonists at others, are called "mixed" agents or partial agonists. Pentazocine, for example, causes analgesia by an agonist action at κ-receptors and dysphoria by an agonist action at σ receptors. The third class of opioids is antagonists at opioid receptors and is therefore primarily used to treatopioid overdose (Felpel, 1997). Repeated use of opioids for control of pain can lead to analgesic tolerance (loss of analgesic effect), as well as physical and sometimes psychologic dependence. Their undesirable effects, include respiratory depression, urinary retention, sedation, nausea and vomiting, and constipation. Coadministration of Opioids with Tricyclic antidepressants and Phenothiazines is known to produce additive CNS depression and orthostatic hypotension (Yagiela et al., 2004c). Meperidine a synthetic opioid, can cause a life-threatening drug interaction with Monoamine oxidase inhibitors and in contrast to other opioids, its overdose of causes CNS stimulation.

2.4.4 Combination drug therapy

The goal of combining analgesics with different mechanisms of action is to use lower doses of the component drugs, thereby improving analgesia without increasing adverse effects (Mehlisch, 2002). Patients with acute dental pain are best treated with NSAIDs or acetaminophen as the primary analgesic and the addition of a narcotic should be reserved for situations when additional analgesia is required. Opioid and acetaminophen combination studies show that a combination is better than opioids or acetaminophen alone (Moore et al., 1997). Opioids such as codeine, hydrocodone and oxycodone combined with ibuprofen are superior to manage acute dental pain than ibuprofen alone (Po and Zhang, 1998). The

analgesic properties of aspirin, acetaminophen and ibuprofen have been seen to increase when combined with 65 to 100 mg caffeine. Table 5 lists the drugs available as a combination therapy for use in Dentistry.

Table 4. Opioid analgesics

Group	Generic name	Trade name	Therapeutic dose (mg)	Duration of action (hr)	Route of administration
Agonist analgesics	Alfentanil	Alfenta	0.5-2	0.5	Intravenous
	Codeine	-	30-60	4-6	Oral
	Fentanyl	Sublimaze	0.05-0.1	1-1.5	Intramuscular
			0.05-0.1	0.5-1	Intravenous
	Hydrocodone	Dicodid	5-10	4-6	Oral
	Levorphanol	Levodromoron	2-3	4-5	Subcutaneous Oral
	Meperidine	Demerol	50-100	2-4	Intramuscular Oral
	Methadone	Dolophine	2.5-10	3-5	Intramuscular Subcutaneous
			5-15	4-6	Oral
	Morphine	-	10-15	4-5	Intramuscular Subcutaneous
			20-60	3-5	Oral
	Oxycodone	In percodan	5-10	4-5	Oral
	Oxymorphone	Numorphan	1-1.5	4-6	Intramuscular
	Propoxyphene	Darvon	32-65	4-6	Oral
Agonist-Antagonist	Buprenorphine	Buprenex	0.4-0.8	6-8	Intramuscular Sublingual
	Butorphanol	Stadol	1-4/0.5-2	3-4/2-4	Intramuscular
			1-2	3-4	Intravenous Nasal
	Dezocine	Delgan	5-20	3-6	Intramuscular
			2.5-10	2-4	Intravenous
	Nalbuphine	Nubain	10	3-6	Intravenous Intramuscular Subcutaneous
	Pentazocine	Talwin	30	3-4	Intramuscular
		Talwin NX	50	3-4	Oral
Antagonist	Naloxone	Narcan	0.4-2	1-2	Intravenous
	Naltr	Trexan	25	1-4	Oral
Others	Tramadol	Ultram	50	5-6	Oral

2.5 Antimicrobials

Antibiotics are chemicals virtually always derived naturally with the exception of ulfonamides, fluoroquinolones and oxazolidinones. These drugs act on the microorganisms to effect their viability hence they can be either bactericidal (inducing cell death) or bacteriostatic (preventing cell growth or replication) (Yagiela et al., 2004d). Antibiotics with activity against a wide range of disease-causing bacteria are termed as broad-spectrum antibiotics. It also means that it acts against both Gram-positive and Gram-negative bacteria. This is in contrast to a narrow-spectrum antibiotic which is effective against only specific families of bacteria (Figure 1). Table 6 lists the various antimicrobial agents available for use. Of these,

tetracyclines and clindamycin are accepted by the Council on Dental therapeutics, American Dental Association. Other antibiotics appropriate for use in Dentistry include penicillin, erythromycin, cephalosporins and bacitracin (Felpel, 1997). Oral infections are usually caused by aerobic gram-positive cocci (*Staphylococcus aureus*) and anaerobic microorganisms (Peptostreptococcus) and the use of antibiotics in dentistry is to either treat these or as a prophylaxis to prevent bacterial endocarditis that is caused by α hemolytic streptococci.

Most acute oral infections respond well to one of the oral penicillin preparations. However Penicillin can cause few adverse side effects, and allergic reactions. A true allergic reaction usually manifests as an irritating rash. Anaphylactoid reactions though rare, occur in susceptible patients within 30 seconds of an intramuscular injection. Signs and symptoms of anaphylaxis include oral paresthesia, cold hands and feet, bronchospasm and wheezing, circulatory collapse, and unconsciousness.

Table 5. Combination analgesics used in dentistry

Trade name	Contents	Amount (mg)
Anacin	Asprin	400
	Caffeine	32
Empirin	Asprin	325
	Codeine	15/30/60
Tylenol	Acetaminophen	300
	Codeine	15/30/60
Vicodin	Acetaminophen	660/750
	Hydrocodone	10/7.5
Percodan	Asprin	325
	Oxycodone	2.44/4.88
Percocet	Acetaminophen	325/500/650
	Oxycodone	5/7.5/10
Talwin	Asprin	325
	Pentazocaine	12.5
Talacen	Acetaminophen	650
	Pentazocaine	25
Ultracet	Acetaminophen	325
	Tramadol	37.5
Synalgos	Asprin	356.4
	Caffeine	30
	Dihydrocodeine	16
Vicoprofin	Ibuprofen	200
	Hydrocodone	7.5
Combiflam/Renofen Answell	Acetaminophen	325
	Ibuprofen	400

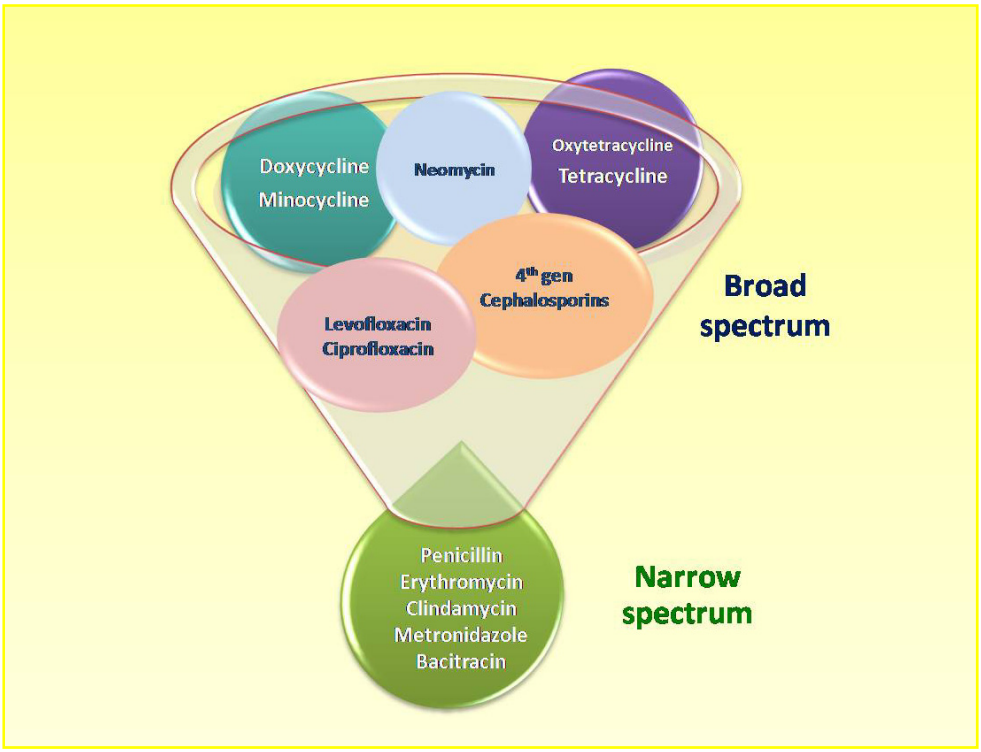

Fig. 1. Spectrum of activity of antibiotics

Alternatives to penicillin include Erythromycin, Cephalosporins, Clindamycin, and Tetracycline but Cephalosporins should not be used in a person with a history of anaphylaxis, angioedema or urticaria with penicillins or ampicillin. Erythromycin estolate and Erythromycin ethylsuccinate are contraindicated in the presence of liver dysfunction as they can cause cholestatic hepatitis. The use of Tetracyclines should be avoided during pregnancy and in children below 8 years because permanent staining of deciduous and permanent teeth and retardation of bone growth may occur. Other adverse effects include gastrointestinal upset, hepatotoxicity, nephrotoxicity, photosensitivity and impaired calcium absorption. Similarly, quinolones should be avoided in children, pregnant or nursing women, and in epileptics (Felpel, 1997). Antibiotic prophylaxis is recommended for dental procedure in patients with prosthetic cardiac valve, previous infective endocarditis, cardiac transplantation recipients who develop cardiac valvulopathyand during the first six months following any procedure to treat congenital heart disease (Prevention of infectiveendocarditis, 2007). Antibiotic coverage for invasive dental procedures is recommended in patients with poorly controlled or uncontrolled diabetes, infective endocarditis, 2007) but not in those having orthopedic prosthesis placed over 2 years prior to the dental procedure. Advisory statement, (2003) lists the dental procedures requiring antibiotic prophylaxiswhile. Figure 2 shows the current regimen of prophylactic antibiotics to be administered (Prevention of infective endocarditis, 2007; Tong and Rothwell, 2000). Prophylactic use of antibiotics in conjunction with dental treatment should be avoided unless there is a clearindication since unwarranted overuse of antibiotics can lead to development of resistant strains of microorganisms (Barker, 1999).

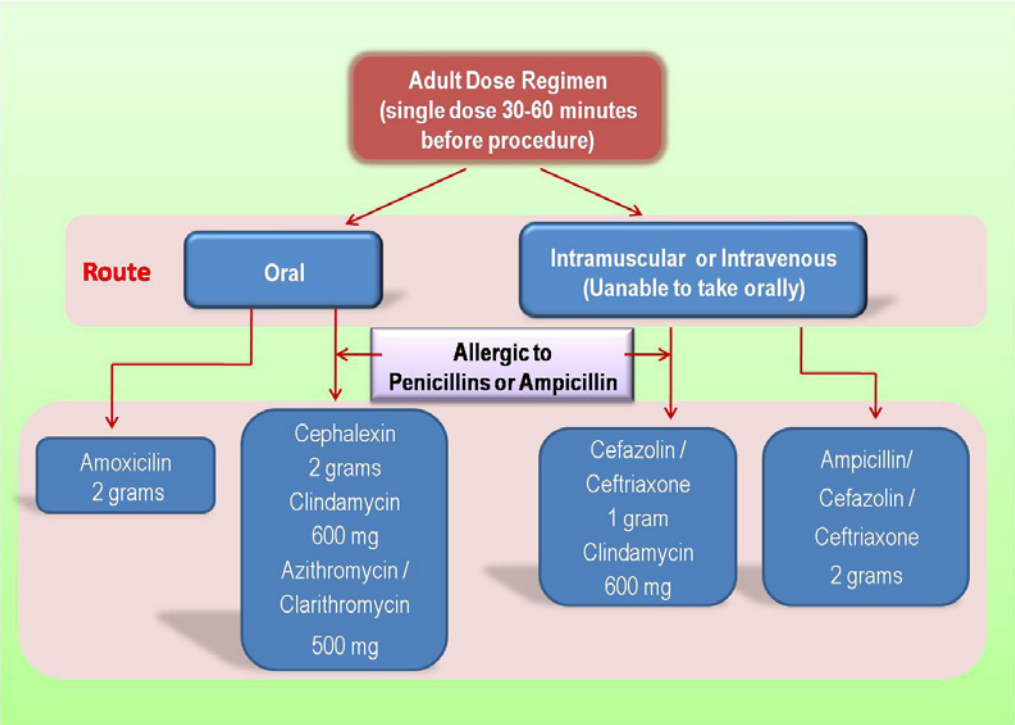

Fig. 2. Antibiotic prophylactic regimen for dental procedures in high risk patients

2.6 Antifungals

Oral moniliasis (thrush) is a fungal infection of the oral cavity caused by Candida albicans. C albicans can also colonize prosthetic devices like dentures. Atleast 2 weeks of therapy are required for treating oral candidiasis. Nystatin (Mycostatin) is the most common drug used in dentistry and it can have a fungistatic or fungicidal effect depending on its dose. A 2-3 ml (100,000 units/ ml) suspension or 1-2 lozenges (200,000 units each) may be used four to five times per day. Colonized dentures can be treated by soaking them in a nystatin solution or applying an ointment (100,000/g) of nystatin to the tissue surface. Clotrimazole (Mycelex), a fungistatic can be used in a dose of 10 mg troches dissolved in the mouth five times a day. Since Nystatin and Clotrimazole are not appreciably absorbed from the gastrointestinal tract, the topical route is preferred for their administration. Oral Fluconazole (Diflucan) in a dose of 50 to 100 mg/day and Itraconazole (Sporanox) 200mg/day are broad-spectrum antifungal agents that are effective in treating oropharyngeal and esophageal candidiasis (Yagiela et al., 2004e).

Table 6. List of Antimicrobial drugs

Mechanism of action	Class	Generic name	Trade name	Dose(mg)/ Interval (hours)	Effect
Inhibition of cell wall synthesis	Penicillin	Ampicillin	Penicillin	250-500/6	Bacteriocidal
		Amoxicillin	Amoxylin	250-500/8	Bacteriocidal
	Beta-lactamase inhibitors	Clavulanic acid	Augmentin	Amoxicillin 250+ Clavulanic acid 125/8	Bacteriocidal
	Cephalo-sporins	Cefadroxil	Duricef	500/12	Bacteriocidal
		Cephelexin	Keflex	250-500/6	Bacteriocidal
		Cephradine	Velosef	250-500/6	Bacteriostatic
		Cefaclor	Keflor	250-1000/8	Bacteriocidal
		Cefixime	Topcef	200/12	Bacteriocidal
Alteration of cell membrane integrity	Polypeptide	Polymyxin B	Aerosporin	Topical	Bacteriostatic
		Neomycin	Mycifradin	Topical	Bacteriostatic
		Bacitracin	Baciguent	Topical	Bacteriostatic
Inhibition of ribosomal protein synthesis	Macrolide	Erythromycin stearate	Erythrocin	250-500/ 6	Bacteriostatic
		Erythromycin estolate	Althrocin	250-500/6	Bacteriostatic
		Erythromycin ethylsuccinate	Erynate	400/6	Bacteriostatic
		Azithromycin	Azithral	500/24	Bacteriostatic
		Roxithromycin	Roxid	150-300/12	Bacteriostatic
	Tetracycline	Oxytetra-cycline	Terramycin	250-500/6-12	Bacteriostatic
		Minocycline	Minocin	100/12	Bacteriocidal
		Doxycycline	Vibramycin	100/12-24	Bacteriocidal
		Tetracycline	Achromycin	250-500/12	Bacteriocidal
	Lincosamide	Clindamycin	Cleocin	150-450/6	Bacteriostatic
Inhibition of nucleic acid synthesis	Nitroimidazole	Metronidazole	Flagyl	400/8	Bacteriocidal
	Fluoro-quinolones	Ciprofloxacin	Ciplox	250-500/12	Bacteriocidal
		Norfloxacin	Norflox	400/12	Bacteriocidal
		Levofloxacin	Tavanic	500/24	Bacteriocidal
Inhibition of folic acid synthesis	Sulphonamides	Sulfadizine	Sulfadizine	500/6	Bacteriostatic
	Cotrimoxazole	Trimethoprim+ sulfa-methoxazole	Septran	80-160+400-800/12	Bacteriocidal

2.7 Antianxiety Drugs

Antianxiety agents are used in clinical dentistry for premedication in an apprehensive patients pending operative procedure like Implant surgery. Antianxiety agents are known to summate with anesthetics, opioid analgesics, antidepressants, sedative-hypnotics and alcohol to cause excessive CNS depression (Yagiela et al, 2004f), hence should be prescribed with caution. Benzodiazepines such as Diazepam (Valium), Lorazepam (Ativan) and Alprazolam (Xanax) and Antihistamines such as Hydroxyzine (Vistaril) and Promethazine (Phenergan) are the preferred anxiolytics for use in dentistry. They should preferably have a rapid onset and a short duration of action. Diazepam (2-10mg), Lorazepam (2-6 mg) and Alprazolam (0.25-1.5mg) have a 12-24 hour duration of action whereas antihistamines in a dose of 25-100mg have a 4-6 hour duration of action. The use of Benzodiazepines is contraindicated in patients with psychosis, acute narrow-angle glaucoma, or liver disease.

2.8 Centrally Acting Muscle Relaxants

These are drugs that reduce skeletal muscle tone without altering consciousness. They are used in chronic spastic conditions and acute muscle spasms of the temporomandibular joint. Table 8 lists the various drugs used alone or in combination with analgesics as muscle relaxants in Dentistry. These drugs usually cause slight sedation hence caution is to be exercised regarding operation of motor vehicles. These drugs have a potential for abuse and dependence hence prolonged administration and abrupt stoppage is to be avoided (Stanko, 1990).

Table 7. Dental procedures requiring antibiotic prophylaxis

Prophylaxis recommended	Prophylaxis not recommended
Dental extractions	Postoperative suture removal
Subgingival placement of antibiotic fibers or strips	Making impressions or Taking radiographs
Intraligamentary local anesthetic injection	Local anesthetic injections
Initial placement of orthodontic bands	Placement and adjustment of removable Prosthesis and Orthodontic appliance
Prophylactic cleaning of teeth or implants with anticipated bleeding	Restorative procedures (with/without retraction cord)
Endodontic instrumentation or surgery beyond the tooth apex	Endodontic procedures, post placement and buildup
Dental implant placement, reimplantation of teeth	Placement of rubber dams
Periodontal procedures including surgery, scaling, root planing and probing	Bleeding from trauma to lips or mucosa
	Shedding of deciduous teeth

Table 8. Centrally acting muscle relaxants

Generic name	Trade name	Content	Dose (mg)	Dosing interval (hours)
Casiprodol	Carisoma	Casiprodol	350	6-8
	Somaflam	Casiprodol	175	6-8
		Ibuprofen	400	
Chlorzoxazone	Mobizox	Chlorzoxazone	500	
		Diclofenac	50	8
		Paracetamol	500	
	Parafon	Chlorzoxazone	250	8
		Paracetamol	300	
Methocarbamol	Flexinol	Methocarbamol	400	6
		Paracetamol	325	
	Robiflam	Methocarbamol	750	8
		Ibuprofen	200	
Baclofen	Lioresal	Baclofen	10-25	8-12
Dantrolene	Dantrium	Dantrolene	25	4-6
Diazepam	Valium	Diazepam	2-10	12

3. DRUGS THAT AID IN PROSTHODONTIC TREATMENT

3.1 Astringents

Astringents are the substances that precipitate proteins, but do not penetrate cells, thus affecting the superficial layer of mucosa only. They toughen the surface by making it mechanically stronger and decrease exudation. Astringents may be administered by retraction cords already impregnated with the agent or by applying them to cotton pellets. Some of the examples are alum, aluminum chloride, zinc chloride (8-20%) and tannic acid (Table 9). Styptics are the concentrated form of astringents. They cause superficial and local coagulation. Some of the examples are ferric chloride and ferric sulfate. Aluminum chloride and Ferrous sulfate are preferred astringents amongst prosthodontists because they cause minimum tissue damage (Rosenstiel, 2006a).

3.2 Vasoconstrictors

Vasoconstrictors are used in dentistry either as components of the local anesthetic syringe or for application with gingival retraction cords. These agents do not produce coagulation of blood but act by constricting blood vessels. Examples of vasoconstrictors accepted by the Council on Dental Therapeutics include Epinephrine (1:200,000/1:100,000/1:50,000), Levonordefrine (1:20,000) and Norepinephrine (1:30,000). Epinephrine is the vasoconstrictor of choice for use in dentistry (Felpel, 1999). It restricts the blood supply to the area by decreasing the size of blood capillaries thereby decreasing hemorrhage and fluid seepage. It is advisable to use low concentration epinephrine (0.01%) for gingival retraction due to its superior effect in keeping the gingival sulcus relatively dry during the impression procedure (Csillag et al., 2007).

Table 9. List of Hemostatic agents

Brand name	Constituent	Action	Available as
Gel Cord/ Gel cord clear (Pascal)	25% Aluminum sulfate Gel	Biologic fluid coagulant	Cartridge-0.32g Syringe-0.75g Jar- 30g
Stat Gel FS (Pascal)	15.5% Ferric sulfate	Styptics	
Racelletcotton Pellets (Pascal)	Epinephrine	Vasoconstrictor	1.15mg and 0.55 mg pellets
Rastringent/ Retraxcotton Pellets (Pascal)	25 % Aluminum sulfate	Biologic fluid coagulant	Solution in bottle
Epidri pellet (Pascal)	Racemic epinephrine HCl	Vasoconstrictor	1.9mg pellet
Hemostatic gel (Pro-option)	20% Ferric sulfate	Styptics	Syringe
Hemostatic solution (Pro-option)	15.5% Ferric sulfate	Styptics	Syringe
Traxodent/ Hemodent (Premier dental products)	15% Aluminum chloride	Biologic fluid coagulant	Syringe
Hemostasyl gel (Kerr)	15% Aluminum chloride	Biologic fluid coagulant	Syringe
ViscoStat clear (Ultradent)	Aluminum chloride gel	Biologic fluid coagulant	1.2 ml syringe
Gingiaid (GingiPak)	8% dl epinephrine HCl	Vasoconstrictor	Syringe
Racestyptine (Septodent)	25 % aluminum chloride, oxyquinol, hydroalcoholic excipients.	Biologic fluid coagulant	Solution in bottle
Astringedent (Ultradent)	15.5% Ferric sulfate solution	Styptics	Bottle/ syringe
Astringedent X (Ultradent)	12.7% Iron Solution Containing Equivalent Ferric sulfate and Ferric Subsulfate	Styptics	Bottle/ syringe
ViscoStatWintermint (Ultradent)	20% Ferric sulfate gel	Styptics	Syringe
ViscoStat Clear (Ultradent)	20% Aluminum chloride gel	Biologic fluid coagulant	Syringe
QuickStat FS (Vista)	15.5% Ferric sulfate gel	Styptics	Syringe

3.3 Hemostatic Agents

Hemostatic agents are used in dentistry for hemorrhage control and wound protection (Mc Bee and Koerner, 2005). These are drugs which arrest more serious bleeding from cut or lacerated capillaries and arterioles.

Some of the examples are:

I. Thrombin- It is prepared from mammalian pro-thrombin, acts by accelerating the clotting of blood. It is available in powder form and mixed with saline. It should be applied locally and never injected.

II. Gel Foam- It is also known as gelatin sponge and is available as a powder or porous sheet. The hemostatic properties of absorbable gelatin sponge can be improved by soaking it in a thrombin solution before application (Felpel, 1999).

Table 10. Salivary stimulants

Stimulants	Type	Example	Key ingredients
Mechanical (Masticatory) Stimulants	Sugarless gums	Biotene Eclipse Orbit Airwaves Trident, Xylifresh	Xylitol, Sorbitol, Mannnitol, Aspartame, Acesulfame K
	Sugarless tablets	Salix	Carboxymethylcellulose/ hydroxypropylmethylcellulose
Chemical Stimulants	Solutions	Mouth-Kote	Alcohol free Mucopolysaccaharide Sol with citric acid
		Optimoist	Citric acid
Electrical Stimulation		Salitron	Intra-oral electronic stimulator of saliva
Pharmacologic Stimulant	Drugs	Salagen (PilocarpineHCl)	Cholinergic agonist
		Evoxac (CevimelineHCl)	Cholinergic agonist
Oral moisturizers		Water	
	Solutions	Salivart Oralube Xero-Lube Moi stir Glandosane Aqwet	Carboxymethyl cellulose and hydroxyethyl cellulose
		Orex	Carboxymethylcellulose with flouride
	Gel	Plax	Water-glycerin agent
		Oral Balance	Glycerate polymer

3.4 Sialogogues

Xerostomia may result from disease states (Sjogren's syndrome, rheumatoid arthritis, diabetes insipidus, pernicious anemia), from radiation, as a side effect of a wide variety of drugs, or from natural aging. Edentulous patients suffering from xerostomia may experience

difficulty in using dentures and an increased incidence of intraoral candidal infection (Felpel, 1999). Sialogogues are the agents which activate muscarinic cholinergic receptors of the parasympathetic nervous system to increase salivary flow in patients with xerostomia (Tripathi, 2008b).Various agents can be used as salivary stimulants (Table 10). All commercially available preparations have a limited duration of action, making frequent application necessary. Agents such as sugar free gum or candies and lozenges containing citric acid sorbitol, mannitol or xylitol may be recommended. According to Boucher, making a conscious effort of consuming at least eight glasses of water, juice or milk daily is the most important measure to relieve dry mouth (Zarb and Bolender, 2004a). Pilocarpine and Bethanechol have been reported as potentially effective sialogogues for xerostomic patients in a study on patients with dry mouth following cancer therapy (Gorsky et al., 2004). Carboxy methyl cellulose based artificial saliva demonstrated moderate effects in reducing dry mouth-related symptoms with more significant effects appearing in patients whose residual secretory potency was severely compromised (Oh et al., 2008).

3.5 Anti-sialogogues

These agents are used to decrease salivary secretion by cholinergic antagonist action. They decrease salivary secretion by inhibiting the action of myo-epithelial cells in the salivary glands thus producing a dry field. Methantheline and Propantheline (synthetic atropine derivatives) are few examples of anti-sialogouges, with Propantheline being 5 times more potent. Clonidine (0.2mg) an antihypertensive drug has been found to be as effective as methantheline (50 mg) in reducing salivary flow (Wilson et al., 1984). For thedesired reduction in salivary flow, the oral administration of atropine, scopolamine, or methantheline and propantheline should precede the clinical procedure by 1to 2 h, half to 1 h, or one-half an hour, respectively. Medications with anti sialogogic effect include (Rosenstiel et al., 2006b); probanthine (7.5 to 15 mg), robinul (1 to 2 mg), saltropine (0.4 mg) and antipasbentyl (10 to 20 mg). Anticholinergic drugs are contraindicated in patients with glaucoma, prostatic hypertrophy, severe gastrointestinal disorders (ulcerative colitis, obstructive disease, intestinal atony), and myasthenia gravis (Felpel, 1999).

3.6 Gum Paints

Gum paints are the combination of antiseptics and tanning agents which precipitate proteins but do not penetrate cells thereby affecting only the superficial layer making it mechanically stronger and decreases exudation. They have germicidal, fungicidal, anesthetic and healing properties. When applied, they provide a soothing, cooling and an astringent effect. All these preparations contain Choline salicylate, Tannic acid, Cetrimide, Thymol, Camphor, Cinnamon oil, Iodine and Alum (hydrated potassium aluminumsulfate). ‘Zingisol’ containing 2% Zinc Sulfate is used to control bleeding gums. The patient is advised to apply 3-4 drops on finger and massage 3-4 times a day. ‘Sensoform’ gum paint (Warren) contains tannic acid, glycerine and potassium iodide and is applied on affected area several times with the cotton applicator for the treatment of stomatitis, inflammation and bleeding gums. It also decreases sensitivity and increases gingival resistance against infections. ‘Stolin’ gum paint (dr. reddy’s)15ml contains cetrimide 0.1 % w/v, tannic acid 2 % w/v, zinc chloride 1 % w/v. ‘Sensorok’ gum astringent with zinc sulfate is used for gum massage 2-3 times daily. Other commonly available brands include Gumex and Pyastringent, Payogum and Pyosan.

3.7 Denture Cleansers

It must be emphasized that improper care of dentures can have detrimental effects on the health of the denture supporting tissues. Maintenance of adequate denture hygiene is essential to minimize and eliminate adverse tissue reactions. It must be an integral component of post insertion patient care (Zarb and Bolender, 2004b). Following are the requirements of an ideal denture cleanser:

- Should be non toxic
- Easy to remove and harmless to the patient
- Be able to dissolve the denture deposits such as calculus
- Exhibit bacteriocidal and fungicidal effect
- Should have long shelf life and inexpensive
- Harmless to the denture base materials, denture teeth as well as soft liners

Commonly available denture cleansers are available in powder and tablet form and include:

a) Oxygenating cleansers- overnight immersion of dentures in alkaline peroxide solution is a safe and effective method.
b) Hypochlorite cleansers- immersion of the dentures in a solution of one part of 5% sodium hypochlorite in three parts of water followed by light brushing is advisable.
c) Dilute mineral acids.
d) Abrasive powders and pastes.
e) Enzyme containing minerals (proteases).

Commercially available denture cleansers include Kleenex, Stain Away, Polident, Triclean, Efferdent.

3.8 Denture Adhesives

Denture adhesives augment the same retentive mechanisms already operating when a denture is worn. They consist of keraya gum, tragacanth, sodium carboxyl methyl cellulose, polyethylene oxide, flavouring agents, antimicrobial agents and plasticizers. They enhance retention through optimizing interfacial forces by increasing the adhesive and cohesive properties and viscosity of the medium lying between the denture and the basal seat and eliminating voids between the denture base and the basal seat (Zarb and Bolender, 2004c).

They are supplied in powder and paste form. Method of application is as follows:

(1) The powder is sprinkled on the wetted denture base and after the excess powder is shaken off; the prosthesis is inserted and seated firmly.
(2) Placement of thin beads of adhesive is recommended in the incisor and molar regions in case of cream type. An anteroposterior bead should be placed along the midpalate in the maxillary unit.

Commercially available denture adhesives are Fixodent, Poligrip, Cushion grip, Rigident, SeaBond wafers, Secure, Effergrip and Staydent.

3.9 Oral Protective Agents

These agents are finely powdered, inert and insoluble. They afford physical protection to the mucous membrane thus are used for apthous ulcers and gingival inflammation. All these gel preparations should be applied 2-3 times daily. The Lignocaine based preparations contain Lignocaine hydrochloride, Benzalkonium and Choline salicylate. Examples are Dentogel, Dologel and Emergel. Dentasep, Dentonex-M, Maghex-M and Metrogyl DG gel are examples of metronidazole and chlorhexidine preparations. Oraguard B and Mucopain are gels containing Benzocaine as the active ingredient. Petroleum jelly is also used successfully as an oral protective agent.

3.10 Demulcents

These are inert substances which sooth the inflamed and denuded mucosa by preventing contact with air or irritants in the surrounding. They can be applied as thick colloidal and viscid solutions in water. Commonly used agents are Gum Acacia and Gum Tragacanth. These are used as suspending agents for indiffusible powders, emulsifying agents for oils and in lozenges. Glycerin (50-75%) in water acts as a popular vehicle for gum paint(Tripathi, 2008c).

4. CONCLUSION

All the pharmacological agents mentioned are used either before commencement of the treatment, during the treatment or at the post treatment duration. Judicious use of these agents yield good results and have a positive effect in the success of any prosthesis. Therefore, a prosthodontist should have sound knowledge of the benefits and drawbacks of these agents in achieving the desired results.

REFERENCES

Adriani, J., Zepernick, R. (1964). Clinical effectiveness of drugs used for topical anesthesia. J. Am. Med. Assoc., 188, 711-716.

Advisory statement (2003): Antibiotic prophylaxis for dental patients with total joint replacement. J. Am. Dent. Assoc., 134, 895-898.

Bahl, R. (2004). Local anesthesiain Dentistry. Anesth.Prog., 51, 138-42.

Ball, A. (1999). Allergic reactions to Lignocaine. Br Dent J., 186, 224-226.

Barker, K.F. (1999). Antibiotic resistance: a current perspective. Br J ClinPharmacol., 48, 109-124.

Bennett, C.R. (1984a). Monheim's local anesthesia and pain control in dental practice 7th ed. St. Louis, Mosby, pp.129.

Bennett, C.R. (1984b). Monheim's local anesthesia and pain control in dental practice 7th ed. St. Louis, Mosby, pp.175.

Bennett, C.R. (1984c). Monheim's local anesthesia and pain control in dental practice 7th ed. St. Louis: Mosby, pp.176.

Bennett, C.R. (1984d). Monheim's local anesthesia and pain control in dental practice 7th ed. St. Louis: Mosby, pp.160.

Brownstein, C.N. et al. (1990). Irrigation with chlorhexidine to resolve naturally occurring gingivitis. A methodologic study. J Clin. Periodontol., 17, 588-593.

Chen, A.H. (1998). Toxicity and allergy to local anesthesia. J. Calif. Dent. Assoc., 28, 683-692.

Csillag, M. et al. (2007). Dose related effect of epinephrine on human gingival blood flow and crevicular fluid production used as a soaking solution for chemo-mechanical tissue retraction. J. Prosthet. Dent., 97, 6-11.

Felpel, L.P. (1997). A review of pharmacotherapeutics for prosthetic Dentistry: Part II. J Prosthet Dent., 77, 293-305.

Felpel, L.P. (1999). A review of pharmacotherapeutics for prosthetic Dentistry-part 1. J. Prosthet Dent., 77, 285-292.

Gorsky, M. et al. (2004).The efficacy of pilocarpine and bethanechol upon saliva production in cancer patients with hyposalivation following radiation therapy. Oral Surg. Oral Med Oral pathol Oral RadiolEndod., 97,190-195.

Haas, D.A. (2002). An update on Local anesthetics in Dentistry. J Can Dent Assoc., 68, 546-51.

Hargreaves, K., Abbott, P.V. (2005).Drugs for pain management in Dentistry. Aust Dent J., 50, 4.S14-S22.

Malamed, S.F. (1990). Handbook of local anesthesia 3rd ed. St Louis, Mosby.

Mc Bee, W.L., Koerner, K.R. (2005). Review of Hemostatic agents used in Dentistry. Dent Today, 24, 62-65.

Mehlisch, D.R. (2002). The efficacy of combination analgesic therapy in relieving dental pain. J. Am. Dent. Assoc., 133, 861-871.

Moore, A. et al. (1997). Paracetamol with and without codeine in acute pain: a quantitative systematic review. Pain, 70,193-201.

New addition to alcohol free mouthwash range (2009). Br. Dent. J., 206: 437.

Newman, M.G. et al. (2006). Carranza's Clinical Periodontology 10thed.St Louis, WB Saunders Company, pp.741.

Oh, D.J. et al. (2008). Effects of carboxymethylcellulose (CMC)-based artificial saliva in patients with xerostomia. IntJ Oral Maxillofac Surg., 37, 1027-1031.

Oliveira, P.C., et al. (2001). Articaine and lignocaine efficiency in infiltration anaesthesia: a pilot study. Br Dent J., 197, 45-46.

Po, A.L., Zhang, W.Y. (1998). Analgesic efficacy of ibuprofen alone and in combination with codeine or caffeine in post-surgical pain: a metaanalysis. Eur. J. Clin. Pharmacol., 53, 303-11.

Poveda-Roda, R., Bagán, J.V., Jiménez-Soriano, Y., Gallud-Romero, L. (2007). Use of nonsteroidalantiinflammatory drugs in dental practice - A review. Med. Oral Patol. Oral Cir. Bucal., 12, E10-18.

Prevention of infective endocarditis. (2007). Guidelines from the American Heart Association. J. Am. Dent. Assoc., 138, 739-760.

Rood, J.P. (2000). Adverse reaction to dental local anaesthetic injection. Br. Dent. J., 189, 380–384.

Rosenstiel, S.F., Land, M.F., Fujimoto, J. (2006a). Contemporary fixed prosthodontics 4th Edn. St Louis: Mosby, pp. 435.

Rosenstiel, S.F., Land, M.F., Fujimoto, J. (2006b). Contemporary fixed prosthodontics 4th ed. St Louis, Mosby, pp.434.

Savage, N.W., McCullough, M.J. (2005). Topical corticosteroids in dental practice. Aust Dent J., 50 Suppl. 2: S40-S44.

Seymour, R. A. et al. (1999). Pharmacology and dental therapeutics 3rd ed. Oxford, Oxford University Press, pp.92-93.

Stanko, J.R. (1990). Review of oral skeletal muscle relaxants for the carniomandibular disorder (CMD) practitioner. Cranio, 8, 234-243.

Therapeutic Guidelines. (2002). Analgesics Version 4. Melbourne: Therapeutic Guidelines Ltd. 30-32.
Tong, D.C., Rothwell, B.R. (2000). Antibiotic prophylaxis in Dentistry: a review and practice recommendations. J. Am. Dent. Assoc., 131, 366-374.
Tripathi, K.D. (2008a). Essentials of pharmacology 6th ed. New Delhi:Jaypee, pp.857.
Tripathi, K.D. (2008b). Essentials of pharmacology 6th ed. New Delhi: Jaypee, pp. 97.
Tripathi, K.D. (2008c). Essentials of pharmacology 6th ed.New Delhi: Jaypee, pp.845.
Verrill, P.J. (1975). Adverse reactions to local anaesthetics and vasoconstrictor drugs.Practit, 214, 380-385.
Waldman, R.J., Hall, W.N., Mc Gee, H. (1982). Asprin as a risk factor in reye's syndrome. J. Am. Med. Assoc., 247, 3089-3094.
Wilson, E.L. Jr. et al. (1984). Effect of methantheline bromide and Clonidine hydrochloride on salivary secretion. J. Prosthet Dent., 52, 663.
Yagiela, J.A., Dowd, F.J., Neidle, E.A. (2004a). Pharmacology and therapeutics for Dentistry 5th ed. St Louis, Mosby, pp.328.
Yagiela, J.A., Dowd, F.J., Neidle, E.A. (2004b). Pharmacology and therapeutics for Dentistry 5th ed. St Louis, Mosby, pp.337.
Yagiela, J.A., Dowd, F.J., Neidle, E.A. (2004c). Pharmacology and therapeutics for Dentistry 5th ed. St Louis, Mosby, pp. 329.
Yagiela, J.A., Dowd, F.J., Neidle, E.A. (2004d). Pharmacology and therapeutics for Dentistry 5thedn. St Louis: Mosby, pp.597.
Yagiela, J.A., Dowd, F.J., Neidle, E.A. (2004e). Pharmacology and therapeutics for Dentistry 5thedn. St Louis: Mosby, pp. 665.
Yagiela, J.A., Dowd, F.J., Neidle, E.A. (2004f). Pharmacology and therapeutics for Dentistry 5thedn. St Louis: Mosby, pp. 214.
Yankell, S. et al. (1982). Effects of chlorhexidine and four antimicrobial compounds on plaque, gingivitis, and staining on beagle dogs. J Dent Res., 61, 1089-1093.
Zarb, G.A., Bolender, C.L. (2004a). Boucher's Prosthodontic treatment for edentulous patients. 12th ed. St Louis, Mosby, pp. 58.
Zarb, G.A., Bolender, C.L. (2004b). Boucher's Prosthodontic treatment for edentulous patients. 12th ed. St Louis, Mosby, pp.203.
Zarb, G.A., Bolender, C.L. (2004c). Boucher's Prosthodontic treatment for edentulous patients. 12th ed. St Louis, Mosby, pp.445.