

DRUG EFFECT ON ORTHODONTIC TOOTH MOVEMENT

SEEMA KAPIL LAHOTI¹, KAPIL B LAHOTI², BHUMIKA MUTE³, KALPAK PETER⁴

¹Department of Orthodontics, R.K.D.F Dental College, ²Department of Oral & Maxillofacial Surgery, Bhabha Dental College, Bhopal,

³Department of Orthodontics, V.S.P.M Dental College, ⁴Department of Periodontics, Government Dental College, Nagpur.

Email: sims_kaps_26@yahoo.co.in

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INTRODUCTION

Remodeling changes in paradental tissues are considered to be essential in effecting orthodontic tooth movement which is the base of orthodontic correction. Molecules produced in various diseased tissues or drugs & nutrients consumed regularly by patients, can reach mechanically stressed paradental tissues through the circulation & interact with legal target cell combination of which may be inhibitory, additive or synergize. Therefore it is imperative that being in medical profession, must pay close attention to the drug consumption history of each and every patient before and during the course of treatment.

Drugs for convenience have been divided in to two groups -

- (A) Drug prescribed by orthodontist
- (B) Drug prescribed by medical professionals

Drug prescribed by orthodontist

(a) Pain

NSAID'S:- Most common group of medication given for control of pain following mechanical force application to teeth. First report on the use of analgesics in orthodontics was published by Simmons and Brandt (1992) & by Paganelli (1993). Former group used acetaminophen in their trial, while the latter researcher applied flurbiprofen.[1,2] Ngan et al (1994) did the 1st study to compare various drugs for their effectiveness in managing orthodontic pain and came to conclusion that ibuprofen is more effective than aspirin in controlling pain. Later numerous studies evaluated pain reducing effect of various NSAID'S, prostaglandin analogue and cox-2 inhibitor like rofecoxib.[3]

Studies done by Chumbley and Tuncay 1986 Kehoe et al 1996, Sari et al 2004, Decarlos et al 2007 not only demonstrated the reduction of pain after periodic activation of orthodontic appliance but also showed the side effect of drug by inhibiting or reducing the associated inflammatory & bone resorptive processes required for active orthodontic tooth movement.[4]

Studies demonstrated that NSAID'S inhibiting the tooth movement by inhibition of cyclo-oxygenase activity leading to altered vascular & extracellular matrix remodeling causing a reduction in the pace of tooth movement. Rofecoxib a cox-2 inhibitor was used later as there was no effect on PGE-2 synthesis but study by Carlos et al (2007) showed that ever this drug has effect on tooth movement.[5]

Thus the administration of pre-emptive or post- operative analgesics in order to decrease post operative pain has become a focus of recent research in orthodontics. It is assumed that pre-emptive analgesics will block the afferent nerve impulses before they reach the central nervous system, abolishing the process of initial sensitization. The studies done by Steen law and polat et al shows 2hr, 6hr or overnight relief in pain after separator or arch wire placement with 1 hour before consumption. They have recommended two post operative doses in addition to a pre-operative dose for complete pain control during each orthodontic appointment.[6]

(b) Management of root resorbtion

The unwanted sequel of tooth movement is root resorbtion which can be reduced with use of drugs & hormones. Bisphosphonate was

employed as main drug for it which showed a dose dependent reduction in root resorbtion by altering the cemental surface via inhibiting acellular cementum formation, thereby actually increasing the vulnerability of the dental root to the resorptive process.

Hormone prescribed to reduce root resorbtion is L-thyroxine which increased the resistance of cementum and dentin to clastic activity. Another drug used for combating orthodontic root resorption is echistatine an RGD-containing peptide which specifically targets the *avB3* integrin receptor in odontoclasts.[5] Prescription of this drugs and hormones specially for preventing root resorbtion is rare as it has some effect on osteoclastic activity also which should not be affected for active orthodontic movement to be continued. But definitely when this drugs are prescribed in patient having osteoporosis and hyperthyroidism which are undergoing orthodontic treatment then the effect of these drugs must be kept in mind to avoid any iatrogenic effect.[5]

(c) Management of Temperomandibular disorder (TMD)

Its management includes either splint therapy for centric relation or prescription of muscle relaxants such as cyclobenzapin, tricyclic antidepressants such as amitriptylin benzodiazepines such as diazepam. Side effect associated with all these drugs is xerostomia which can negatively affect maintainance of oral hygiene,

increasing the risk of caries periodontitis and gingival hyperplasia which will finally reduce the movement of teeth.

Drug Prescribed by Medical Professionals

20-30 % of all orthodontic patient belongs to adult group amongst whom many consume prescribed drugs to address various systemic & local condition. All these medication can potentially affect target cells throughout the body including paradental tissues. Drug which may reach the mechanically stressed PDL interact with local target cell & modify there reactions to the applied forces. To avoid there undesirable influences on tooth movement, the orthodontists should be aware of any drug taken by each patient.

The diseases which may an orthodontist deals with are as follow:-

- (a) Osteoporosis
- (b) Rheumatoid arthritis
- (c) Seizure disorder
- (d) Asthma
- (e) Cancer \
- (f) Psychiatric problems
- (g) Immunosuppressant drug
- (h) Alcohol abuse
- (i) Corticosteroid therapy

(a) Osteoporosis

Prevalent disease affects women in adult age group where density of bone is 2.5 SD below & presence of fragility fracture. It results in loss of bone mass and strength and decrease in bone turnover with increased resorptive activity. Most of the osteoporotic drugs are anti resorptive, slowing down the destructive phase of bone turnovers.

Drug used for treating it are bisphosphonates, estrogen, selective estrogen receptor modulation & calcitonin.

Action of drug increases the mineralization of bone & decreases the sub-cellular localization & expression of both vacuolar types H (-) Atpase, cathysinase which are enzymes essential for bone resorption. Because of this mechanism of action interferes with tooth movement, impair bone healing and induces osteonecrosis of maxilla & mandible. A report by Liu et al (2004) showed a 40% decrease in tooth movement after administration of bisphosphonates. Thus the orthodontic treatment in case of osteoporotic patient should be done cautiously under the medical supervision, accepting that the result will be very slow as compare to other patient.[8]

(b) Rheumatoid Arthritis (RA)

It is characterized by the presence of immune mediated inflammatory sinusitis that exhibits the capacity to invade and destroy the extracellular matrices of joint cartilage and bone. Drugs used for treatment of RA include immunomodulatory agents, TNF antagonists or Interlukin antagonists. All these drug influences the inflammatory response following force application reducing the pace of bone remodeling & thereby slowing tooth movement. Orthodontist treating patient with RA should be aware of these effect of the drugs & should expect a slow response to tooth moving forces.[5]

(c) Seizure disorder

Most common serious chronic neurological condition are characterized by sudden involuntary time limited alteration in neurologic function resulting from abnormal electrical discharge by cerebral neurons. Treatment is directed towards eliminating or reducing the frequency of seizures.

Drug important to orthodontic clinicians are valproic acid, phenytoin and gabapentin. Valproic acid has the potential to induce gingival bleeding even with minor trauma making orthodontic management difficult. Studies by Brodie 2003, Sheller 2004 states phenytoin induces gingival hyperplasia with involvement of interdental papilla, making application of orthodontic mechanics as well as maintainance of oral hygiene difficult. Gabapentin produces xerostomia making oral hygiene maintainance difficult.[9]

Orthodontic treatment is not contraindicated in seizure disorder but orthodontist should be aware of possible difficulties that might encounters during treatment period & discuss it with the patient and parents regarding the same.

(d) Asthma

Episodic narrowing of the airway that results in breathing difficulties and wheezing characterizes asthma. Orthodontic treatment should not be performed in patient who have frequent flare up elicits adequately medicated. Patient with low to moderate risk can be treated with short waiting time in morning appointment. Patient should take adequate medication and get inhaler during the treatment for managing the sudden attack.

These patient are sensitive to certain medication such as erythromycin, aspirin, antihistamines and L.A. with epinephrine (Son's 2004). So prescription of all these drugs should be done with precaution. Chronic use of inhalers with steroids often results in oral candidiasis & xerostomia which should be managed properly with antifungal agents and salivary substitute. It involves periodic production of large amount of pro-inflammatory eytotens in the airway mucosa & skin. Leukocytes derived from this tissue may travel through circulation into the extra vascular space of the tissue surrounding orthodontically treated teeth. Thus these patients seem to be at high risks for developing excessive root resorption during orthodontic treatment. To prevent all these, light orthodontic forces should be applied to reduce the risk of root resorption.[1,5]

(e) Cancer

One in every 900 young adult between the ages of 16 to 44 is a survivor of childhood cancer (Dahl of & hugger 2004). Increased

number of these patients are now altering orthodontic clinic for treatment. Disturbance occurs in their dental as well as general body growth and development as result of chemotherapeutic agent and radio therapy.[5]

Dahllof 2001 has suggested that patient who has been on chemotherapy with busul fan /aplophosphamide & who have had less than two years of disease free life belong to the high risk group. For orthodontic treatment as it affects the bone remodeling process, Daley 1991 suggest that patient who is on immunosuppressant therapy with cyclosporine A belong to the high risk group. Most of the pharmaceutical agents used to treat cancer are a potent inhibitor of osteoclasts which succeeds in blocking cancer from metastazing in bone but also completely stops tooth movement (Schwartz 2005).[5]

(f) Psychiatric problems

Early adolescent is the time of rapid changes as adolescent are challenged with a multitude of tasks in their lives. They can be extremely sensitive to social successes and failures. The later can often lead to psychiatric problem which require medication for their management. These medication have definite influences on dental as well as orthodontic care. The attention deficit hyperactivity disorder is mainly treated with central nervous system stimulantns such as methylphenidate, dextroamphetamine, atomoxetine, bupropriolone and guanfacine.

Depressed patient are managed with antidepressants and mood stabilizers. Orthodontists can expect these patient to be only concerned about their appearance while at the same time they may be non compliant. Anxiety disorder or psychological stress is usually managed with benzodiazepines which can raise undue concern in patient mind. They will be more concerned about side effect and outcomes but may disrupt appointment frequently. Psychiatric disorder of development origin are treated with second generation neurolytics which often lead to challenging unreasonable worries, inflexibility, odd behavior & misbehavior with office staff.[5]

Orthodontist should keep in mind increased behavior changes in patient on drug for proper management in orthodontic offices. Goldman (2004) suggests that staff member should be informed and educated about the behavioral changes and its management. Psychological stress affects the hypothalamic pituitary adrenal axis and immune system which leads to affected osteoclastic activity. Study done by Davidovitch in 2000 reports these patients with excessive root resorption.

(g) Immunosuppressant drug

Chronic renal failure or kidney transplant patients are on immunosuppressant drugs encounter some difficulty during orthodontic tooth movement. Drug consumed for graft rejection like cyclosporine- A produces severe gingival hyperplasia making orthodontic treatment as well as maintenances of oral hygiene difficult. Darcy et al 1991 advised not to start the treatment for first 6 month in this patient as gingival hyperplasia is at its peak. Treatment should be started only when good hygiene maintenance is their or after excessive removal of gingival tissue. Removable appliances should not be given as fitting gets changed regularly. Band cementation should be avoided as it leads to injury & inflammation of gingival and may its enlargement later. So bondable tubes are advised.

(h) Alcohol abuse

Moderate to low consumption of alcohol may have beneficial effects on cardiovascular system but large amount for longer duration on daily basis may have devastating effect on a number of tissue system including skeletal system. It may lead to severe complication like liver cirrhosis, neuropathies, osteoporosis and spontaneous bone fracture. Circulating ethanol inhibits the hydroxylation of vitamin D₃ in the liver, thus impeding calcium homeostasis in such situation the synthesis of parathyroid hormone is increased, tipping the balance of cellular functions towards enhanced resorption of mineralized tissues including dental roots in order to maintain normal level of calcium (10 mg%) in blood. Davidovitch et al (1996) found that

chronic alcoholics receiving orthodontic treatment are at high risk of developing severe root resorption during the course of treatment.[5]

(i) Corticosteroid therapy

Corticosteroids are used for its anti inflammatory and immunosuppressive effects. Side effect of long-term steroid therapy includes disturbances in mineralized tissue metabolism, wound healing discrepancies in chondrogenesis & osteogenesis, bone loss and osteoporosis. Short term course of corticosteroids decreases bone remodeling while long term administration produces an increase in tooth movement.

Orthodontic treatment in a patient who is on short term drug therapy should be advice to post- pone the treatment. Patient who are on long term drug therapy has accelerated tooth movement so appliance should be adjusted as usual or even frequently (gamelro et al 2007).[12]

CONCLUSION

Orthodontic is a specialty of dentistry which deals will tooth movement but it does not mean that we don't prescribe them the drug or the patient who comes for the treatment may be are already under some drug therapy which has single or multiple effect on the body in general and jaws, tooth particularly. Thus its must for us being in to medical profession to know the effect and side effect of drug so that we can manage the patient properly and reduce the iatrogenic causes to them.

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