



Sherlockian Tale of usage of Antibiotics in Endodontics

Manoj Chandak*, Payal Chaudhari, Pooja Chandak, Kajol Relan, Madhulika Chandak, Chanchal Rathi, Akshay Jaiswal, Rakhi Chandak

Department of Conservative Dentistry and Endodontics, Sharad Pawar Dental College and Hospital, Datta Meghe Institute of Medical Sciences, Sawangi (Meghe), Wardha, Maharashtra, India



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ABSTRACT

Antibiotic resistance is considered a grievous danger to the well-being of common people owing to the growing trend of prescribing antibiotics. In reality, this threat is suitably referred to as a “ticking time bomb” necessitating quick interventions. Antibiotic resistance is not entirely recognized worldwide but is seen to affect poorer countries with inadequate and weaker health-care systems. Regrettably, dentists still continue prescribing antibiotics to patients with an endodontic cause such as periapical abscesses & irreversible pulpitis, which requires only operative procedures. When we talk about the endodontic cause, antibiotics are prescribed widely systemically and locally as well. Intracanal medicaments, irrigant containing antibiotics, medicated sealer & medicated gutta percha comprises of the local mode of taking antibiotics, which enables dentist in aiming microorganisms in every single crook & bend of a root canal, which remains unreachable if done by usual RCT protocols. Instead of using Triple antibiotic paste in patients, to avoid antimicrobial resistance, calcium hydroxide can also be added. The fundamental base for substantial endodontic treatment comprises of complete debridement of the root canals which are infected along with drainage of hard and soft tissues. Even after achieving adequate debridement & drainage, the literature showed that prescribing antibiotics collaterally did not show any added therapeutic effect in preventing or resolving the signs & symptoms occurring during an endodontic infection. The objective of this current article is to comment about the over usage of antibiotics before and during endodontic management, its impact on antibiotic resistance, and crucial methods needed to prevent and manage the antibiotic abuse during endodontic treatment.

*Corresponding Author

Name: Manoj Chandak
Phone: 9822693276
Email: drmanojchandak@yahoo.com

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INTRODUCTION

Antibiotics are conjointly thought of as drugs which have brought about a revolutionary alteration in the healthcare industry by attaining acceptable control of infections. With the advent of penicillin, there has been an equal but a remarkable rise in the usage of antibiotics amongst medical practitioners and dentists (Cohen, 2000). Antibiotic resistance is considered a grievous danger to the well-being of common people owing to the growing trend of prescribing antibiotics. Antibiotics that were previously considered an essential fragment of contemporary medicine have now found to be least effec-

tive or don't work at all. In reality, this threat is suitably referred to as a "ticking time bomb" necessitating quick interventions (Palmer, 2014). This phenomenon, associated with increased consumption of these medicines, has been found to cause mutations in the bacterial strains under selective pressure. Concurrent with antibiotic resistance, there has been documentation of adverse effects and hypersensitivity reactions with added super infections with the increased use of antibiotics (Donnell and Barker, 2016). Antibiotic resistance is not entirely recognized worldwide but is seen to affect poorer countries with inadequate and weaker healthcare systems. (Carlin et al., 2014)

India, which has been named as "the antimicrobial resistance capital of the world" Taneja and Sharma (2019) is being ranked first when compared to other countries, in overall intake of antibiotics for human usage. Pertaining to this universal menace, WHO acquired a "Global Action Plan on Antimicrobial resistance" in May 2015. This seemed to be a challenging task for implementing it, specially in countries with low & middle income where unceasing infectious diseases, simple OTC (Over The Counter) means of approach to antibiotics & shortage of accessibility to a better class of primary health care worsens the issue even more. (Singh, 2017) In April 2017, Action Plan for Antimicrobial resistance was framed by India, but currently, it remains under preliminary stages. (Taneja and Sharma, 2019)

Regardless of all the attempts, growth towards antibiotic resistance is a determined problem & one of the major contributing factor being the dental profession. According to literature, there is absurd usage of antibiotics in dental patients. (Ramachandran et al., 2019) In primary care dentistry, an estimation of up to 10% of antibiotics is prescribed (Chandak et al., 2018) for therapeutic reasons or prophylaxis. Dentists providing primary care are principally autonomous prescribers & their judgements are usually made with no restrictions & supervisions. According to several studies, 30-50% of antibiotics which are prescribed are either needless or are not rightly prescribed & maximum of them are prescribed for those dental diseases which are not indicated. (Demirjian et al., 2015)

Infections related to a root canal are the most common infections which are treated with antibiotics. When we talk about the endodontic cause, antibiotics are prescribed widely systemically and locally as well. Intracanal medicaments, irrigant containing antibiotics, medicated sealer & medicated gutta percha comprises of the local mode of taking antibiotics, which enables dentist in aiming microorgan-

isms in every single crook & bend of a root canal, which remains unreachable if done by usual RCT protocols. (Jain and Bansal, 2014) Instead of using Triple antibiotic paste in patients, to avoid antimicrobial resistance, calcium hydroxide can also be added. (Chandak et al., 2018) The fundamental base for substantial endodontic treatment comprises of complete debridement of the root canals which are infected along with drainage of hard and soft tissues. Even after achieving adequate debridement & drainage, the literature showed that prescribing antibiotics collaterally did not show any added therapeutic effect in preventing or resolving the signs & symptoms occurring during an endodontic infection. (Nagle et al., 2000)

Regrettably, dentists still continue prescribing antibiotics to patients with an endodontic cause such as periapical abscesses & irreversible pulpitis, which requires only operative procedures. The objective of this current article is to comment about the over usage of antibiotics before and during endodontic management, its impact on antibiotic resistance, and crucial methods needed to prevent and manage the antibiotic abuse during endodontic treatment.

Antibacterial Drug Resistance

Antibiotics given systemically have their beneficial effect in battling against the bacteria & infection, but at the same time, it has a disadvantage of carrying risk by transforming the structure of targeted bacteria to 'superbugs' which will counterattack the beneficial effects the drug will have. Alarming increase in the rate of bacteria developing resistance to antibiotics is frightening as they do so soon after the newer drugs are consumed. This has led to hasty development of antibiotic resistance which ominously contributes to the morbidity & death of infectious illnesses. Infections due to antibiotic resistance accounts for thousands of deaths.

The antibiotics themselves aren't the concern of antibiotic resistance as they are the most efficient, reliable and easily accessible over the counter weaponries against diseases. As an alternative, the glitch is in the way these antibiotics are prescribed. The untimely excessive usage of antibiotics has given rise to an emergency owing to transmutations that the bacteria undergo leading to resistant strains. Initial signs of adaptability of the bacteria to antibacterial drugs were seen soon after the institution of the drug "penicillin G". Few strains of "E coli" and "S. Aureus" are shown to produce penicillinase which is a bacterial enzyme having an adaptive mechanism which aims at continuing the exposure towards the bactericidal agent. This adapt-

ability resulted in the acquired resistance to the drug penicillin G. Penicillinase has the capacity to inactivate the beta lactam ring, which is the fundamental structural constituent of the antibiotic. Currently, the most strains of "S. aureus" have found to be unaffected by penicillin G and also resistant to newer generations of "beta-lactamase-resistant penicillins".

What can't kill the moribund organisms, is capable of making them even stronger to destroy later. Since the Penicillinases have been introduced, several investigations have been performed for understanding the cause of acquired resistance. Even with more contemporary techniques to study the genetic modification and adaptability along with the unwavering passage of the segments of nucleic acids amongst the organisms, the already existing scientific literature continues to highlight some elementary trends. Eventually, there is the development of resistance by the bacteria to every upcoming antibiotic. Acquisition, along with the magnitude of resistance to the antibiotic is a matter of concern. Antimicrobials act by exerting selective pressure on the bacteriological populations. When the mutations take place initially, it provides the survivors with the advantage for growth over the vulnerable targeted members of the inhabitants.

Causes for over prescription of antibiotics during endodontic treatment

Placebo effect

Though the literature has comprehensively proven that the antibiotics can neither control nor help in preventing localized endodontic pathology, patients notice a drastic improvement in their dental condition owing to the solid placebo effect of the antibiotics. (Tilburt *et al.*, 2008) Studies have proven that antibiotics are increasingly prescribed for the comfort of the patient and to reduce their apprehension and anxiety. (Fouad, 2002)

For Preventing the spread of infection

Antibiotics are considered to be help in preventing the extent of infection. This is in conviction while prescribing antibiotics in patients with acute localized apical abscesses. The primary accepted management for acute apical abscesses is establishing incision and drainage followed by "root canal treatment or extraction of the tooth" involved if the prognosis is poor to aid in the elimination of the source of infection. As the necrotic pulp lacks an efficient blood circulation, prescribing antibiotic orally as the "first choice of treatment" is extremely doubtful. With the presence of a single exception of cellulitis cases, the patient has to be treated with penicillin.

Nonetheless, literature has proven that the antibiotics are prescribed in the highest proportion before and during endodontic treatment for acute apical abscesses. (Rahabi and Abuong, 2017)

For preventing flare-ups

The cautionary measures taken in preventing root canal flare up include the choice of instrumentation procedure minimizing the periapical extrusion of the debris, single visit completion of biomechanical preparation, access cavity to be sealed in between the consecutive visits along with retaining a sterile surrounding while performing RCT. (Akbar, 2015) Conversely, few studies suggested the usage of systemic antibiotics in the prevention of flare-ups during or after the completion of RCT. (Mata *et al.*, 1985)

Few authors contemplate and justify the use of antibiotics former to the instigation of "Root canal treatment" in teeth having necrosed pulpal tissue as they consider it to be of therapeutic use rather than for a prophylactic purpose. (Sjogren *et al.*, 1997) The reason being that the periapical radiolucencies are seen with necrotic pulps showing that they are perpetually infected and thus prescribing antibiotics becomes therapeutically necessary. However, literature had proven that there has been no effect on the occurrence of flare ups when amoxicillin was prophylactically used in patients with asymptomatic non vital teeth. (Akbar, 2015)

For prophylaxis of patients at high risk

According to AAE recommendations, prophylactic antibiotics are advised for patients with immunocompromised status, or the ones having a history of subacute infective carditis or employment of a prosthetic joint in recent two years, and for patients having congenital heart disease. Antibiotic prophylaxis should not be given to everyone and should only be prescribed when the potential benefits outdo the hazards of taking them. Authors have testified that the prescribing antibiotics for the prophylactic purpose by the dental clinicians are needless 81% of the time. (Suda *et al.*, 2011) The literature illustrates the deficiency of knowledge concerning to the apt prophylactic use of antibiotics. (Rahabi and Abuong, 2017)

For reducing the post endodontic pain

Correlating to the data which is published, Root canal treatment causes more recurrent and implacable pain postoperatively when compared to other dental procedures. This severe pain occurs due to the inflammatory course linked to microbial flora irritation, chemical or mechanical factors recurrence rate up to 40%. (Konagala *et al.*, 2019) Randomized control trials have shown the futile

attempts of antibiotics in curbing the dental pain, still, general dental clinicians and the endodontists keep increasingly and regularly prescribing antibiotics to patients with severe pain of dental origin. (Segura-Egea *et al.*, 2010)

For improving periapical healing and the outcome of the treatment

Literature has shown no correlation between the usage of antibiotics and the outcome of the root canal treatment. Clinical trials have proven that the antibiotics showed no adequate response to the post treatment signs and symptoms and had no impact on postsurgical outcomes. (Henry *et al.*, 2001)

Expectations and demands of antibiotics by the patients

Literature has shown that the patients demand the antibiotic prescription after the completion of root canal treatment due to their misconception that the antibiotics are miracle drugs which would help in resolving all the uncertain adverse pain episodes. Studies show that patients demand antibiotics after RCT due to an ordinarily apprehended belief that antibiotics are “miracle drugs” which would resolve or reduce adverse post endodontic proceedings.

Busy dental clinicians

Patients usually having intolerable tooth pain make unscheduled visits with anxiety to the dentist, who sometimes happens to be overbooked with appointments. So in such instances, irrational prescription of antibiotics is done without having any clinical benefit for the patient to postpone their appointment or to cover the referral period. Nevertheless, there are guidelines which permit the antibiotics to be prescribed if a factual treatment is to be deferred due to referral to professional services, recommending antibiotics this way is unpardonable.

Financially instable patient

Commonly, dentists are likely to end up prescribing antibiotics for patients who are financially ridden than allotting more dental office time for surgical treatment. Moreover, patients who are not in the position to afford the dental treatment or are unwilling to undergo extraction request for antibiotic prescription with an assumption that the tooth can be saved by averting the infection. Patients should understand and note that antibiotics are not an substitute to dental intermediation, but are just basic adjuncts. Other reasons that add on to the antibiotic resistance apart from excessive prescription of antibiotics are:

Irregular dosage regimens of antibiotics

“Beta-lactam antibiotics”, namely “Penicillin VK and

amoxicillin” are considered the first line of antibiotics which are selected to be an adjunct to therapeutic mediators in pulpal pathologies. (Fedorowicz *et al.*, 2013) The amoxicillin dosage, which is recommended for adults is 500 mg TID. Antibiotics are prescribed in courses of 3 to 7 days by most clinicians. The studies illustrate that antibiotics if taken for the shorter duration like 2-3 days can also be very effective when used as adjuvant therapies.

Likewise, The British National Formulary promotes the antibiotic course to be taken 2-3 days for treating acute pulpal infections. Several reports have revealed the increased effectiveness of antibiotic therapy taken for 2 -3 days, thus substantiating that extended courses might not give added benefits. (Kuriyama *et al.*, 2005) Furthermore, courses of amoxicillin lasting 7 days have displayed an upsurge in the population of resistant bacterial strains. (Lacey *et al.*, 1983)

Broad spectrum antibiotics

In dentistry, since the samples from the periapical area or the root canal are never routinely analysed, the dentist is often unaware about the particular type of organism that is causing the infection, thereby mandating the prescription of broad spectrum antibiotics. Though AAE guidelines usually recommend that the minimal usage of broad-spectrum antibiotics by the dentists, numerous studies Teoh *et al.* (2018) confirmed that the dental clinicians preferred “moderate to broad-spectrum antibiotics over those with a more appropriate narrow spectrum”. This incongruous usage of antibiotics adds to antibiotic resistance.

Appeal for newer antibiotics

Frequently patients assume that the newer advanced and expensive medicines are better efficient when compared to the older similar formulations. Pharmaceutical company medical representatives work with the healthcare providers to market and sell their antibiotics even in secluded areas. These medical representatives confer to the increase in resistance by PCRs also add on to growing resistance by asking the doctors to prescribe their brand of newer antibiotics. Thereby resulting in the development of resistance to the newer drugs as well as to the original drugs of the same category.

Factors related to the patient

This is because of patients misunderstanding about the use of antibiotics in pupal infections, low compliance, break in the treatment when the patients do not feel the pain, financially ridden patients who are not willing to pay for the entire treatment course and patients self medicating them-

selves. (Suchi and Praveen, 2015) Antibiotics should be used cautiously in pregnant females to avoid complications. (Rathi et al., 2020)

Suboptimal primary health centers (PHCs)

Services for dental care are obtainable and accessible only in some states at the PHC level despite being a major component of primary health care. (Rao et al., 2014) Thus, the general physicians at PHCs play a role by prescribing medications for patients with acute dental pain to provide momentary relief due to unavailability of dental clinicians in remote areas where the patient has no other access to proper dental treatments. In such circumstances, the general physicians only prescribe the antibiotics to patients before referring them to the closest dentist in the vicinity due to patients demands.

Antibiotics for Consideration

Penicillin

This antibiotic has been the first line of defense drug for all most all odontogenic infections. Penicillin VK has proven to be effective, less toxic and economical antibiotic. Penicillins are bactericidal as they obstruct the cross linking of the cell wall in the bacteria. They are known to have an equitably narrow antibacterial spectrum, nonetheless covering the majority of the bacteria linked to dental infections. In a study conducted to test the culture sensitivity for periapical abscesses on 94 patients, it was concluded that penicillin V exerted the least effect in eradicating bacteriological isolates.

The overall susceptibility test results disclosed that penicillin was least effective drug against *S. aureus* (3.13%), which is in accordance to other studies conducted such as 3.22% in Serbia and 3.5% in China. (Mudey and Munjal, 2018) Regardless, over 95% of patients who underwent incision and drainage in combination with penicillin V showed better and faster recovery. "Orally a loading dose of 1000 mg Penicillin VK should be given superseded by 500mg every four to six hourly for a duration of 3 to 7 days". (Segura-Egea et al., 2017)

Amoxicillin

Amoxicillin has a wide-ranging spectrum of action compared to penicillin V. it is known to have a better effect against gram negative anaerobic bacteria. "It has an oral dosage of 1,000 mg loading dose with 500 mg recommended dosing every eight hours for 3 to 7 days." The schedule of the dose of this drug along with its capacity, which enables it to be taken with food results in its increased acceptance by the patients leading to improved compliance. Amoxicillin is the drug of choice for antibiotic prophylaxis for patients who are compromised medically (Little

et al., 2008). It has a wider and extended range of the spectrum that leads to an increase in resistant strains of microorganisms.

Cephalosporins

Cephalosporins have similar actions as that of penicillins. Comprises of 4 generations; with their range of antibacterial coverage, particularly against gram-negative bacteria is known to increase successively from the first to the fourth generation. Cephalosporins are not used as first line treatment drugs for the treatment of dental infections; though, they can be prescribed in cases of not a real allergy to penicillin. Amongst cephalosporins, Cephalexin is frequently prescribed in cases communication with the sinus and as a prophylactic antibiotic in patients having prosthetic joints.

Metronidazole

Metronidazole is used for its activity against anaerobic bacteria. It acts by disrupting the bacterial DNA which inhibits the synthesis of nucleic acids. It offers outstanding coverage against anaerobes and hence should be prescribed in combination with penicillin. After the preliminary treatment if the symptoms are still not resolving over a period of 2-3 days, then metronidazole can be given as an adjunct to penicillin with the continuance of both the antibiotics until the completion of the full course. "Usual dosage follows a 1,000 mg loading dose and 500 mg every six hours for 5 to 7 days."

Clindamycin

Clindamycin works by inhibition of protein synthesis of the bacteria, which makes it bacteriostatic at initial and bactericidal at higher dosages. Owing to the concern of penicillin resistance, here has been a steep rise in the usage of clindamycin. Its usage has amplified lately due to rising distress over penicillin resistance and was chosen to be the primary alternative in patients allergic to penicillin. (Fouad et al., 2017) Clindamycin markedly leads to increased risk of developing *Clostridioides difficile* infection even after a single dosage, which also carries a warning in a black box for *Clostridioides difficile* infection could be lethal (Fouad, 2017).

If the antibiotic is to be altered, clindamycin can serve as a recommended option as it has the ability to reach a comparable plasma level in the bone as well as it is distributed well through tissues of the body. *Eikenella* inherently is unaffected by clindamycin hence other substitute antibiotics must be prescribed if the causative organism is from this species. "Clindamycin should be prescribed with a 600 mg loading dose followed by 300 mg dosing every six hours for 5 to 7 days."

Macrolides

Erythromycin is a macrolide which is occasionally prescribed for odontogenic infections. This has a similar spectrum and activity as penicillin thereby has an increased risk of developing resistance clinically. Kuriyama et al. stated the ineffectiveness of erythromycin against *Streptococcus viridans* and most *Fusobacterium* species along with the majority of anaerobic bacteria (Kuriyama et al., 2000). Thus, erythromycin is of historic importance in the treatment of dental infections.

Azithromycin

Azithromycin is a contemporary drug which maximum effectiveness against a majority of "aerobic and anaerobic gram-positive and gram-negative bacteria" with enhanced pharmacokinetics (Moore, 1999).

"Patients exhibiting a true allergy to penicillin, the primary antibiotic recommendation has now changed to azithromycin with a loading dose of 500 mg, and then 250 mg for four additional days". Azithromycin may have poor compliance because of its decreased absorption when taken with food and heavy metal consumption; with the highest rate of developing bacterial resistance when compared to other antibiotics. (Lang et al., 2016)

Flouroquinolones

This group includes ciprofloxacin which acts by interfering with the metabolism of bacterial DNA, which is brought about by the inhibition of the enzyme topoisomerase, which is required for replication. This has proven to be least effective against the anaerobic bacteria regularly seen in endodontic infections (Sato et al., 1996).

Its usage to be limited as a second line drug to penicillin V, metronidazole and clindamycin in cases of prolonged and persistent infection and when bacterial susceptibility is detected on bacterial culture.

The appropriate Clinical Usage of Antibiotics

In 1997, the ADA Council on Scientific Affairs gave out a position statement on Antibiotic Use in Dentistry gauging the following eight misconceptions or "myths" which may aid in establishing common guidelines to help the dentists make apt clinical decisions concerning the usage of antibiotic therapy, thus paramount to optimal use and therapeutic accomplishment. (Pallasch, 1986)

Myth #1: Antibiotics can cure patients.

This is the case only in patients with compromised immunity. Antibiotics cannot be remedial but rather only help in the restitution of the right balance between the host's immune & inflammatory

defences and the invasive pathogenic bacteria.

Myth #2: Antibiotics are alternates to surgical inter-mediation.

Myth #3: The judgement of supreme importance is about which antibiotic is to be used.

To elude the adverse effects of inessential antibiotics, the most important judgement to be made here is not which antibiotic is to be prescribed but whether to use one at all. Literature has revealed that over 60% of odontogenic infections can be resolved by hosts self-defences single handed with subsequent elimination of the origin of the contagion without actually using the antibiotic.

Myth #4: Antibiotics result in increased defense of the host against the infection.

Myth #5: Numerous antibiotics are superior to the use of a single antibiotic.

Myth #6: Bactericidal agents are more effective when compared to bacteriostatic agents.

Myth #7: Antibiotic dosages, dosing intervals and duration of course therapy are recognized for the majority of the infections.

Myth #8: Bacterial infections necessitate a "complete course" of antibiotic therapy.

Commonly, this misconception exists that proclaims the completion of the course to prevent rebound of the infections that can take place. Studies have proven that there is no rebound of infection which occurs for odontogenic infections provided the infection source is eliminated accurately.

Prevention

Dental clinicians can lessen the excessive needless usage of antibiotics by following the below mentioned pointers:

Conservatively using of antibiotics

When antibiotics are used conservatively, it helps in minimizing the potential risk of developing resistance to the current new antibiotics course regimens. (Costelloe, 2010) They must be recommended only in well-defined indications. Dentists should also consider evidence-based antibiotic references which are freely accessible to patients.

The use of broad-spectrum antibiotics should be minimized and should be used for the shortest duration possible. The shorter regimen of antibiotic greatly increases the compliance of the patient, which is an additional benefit. Empiric regimens of the antibiotics should be revised by the dentist based on the patient's progress and if needed, culture testing should be done.

Dentists should be responsible while prescribing antibiotics

Dentists should avoid prescribing antibiotics based on non-evidence-based historical practices, patient demand, convenience, or pressure from colleagues, to delay the appointment, or to retain the patient.

Educating the patients

An informative discussion with the patient goes a long way to reduce the overprescribing trend. Dentists should play a vital role in educating the patients about how antibiotics are to be taken only for them and not saving antibiotics for future diseases. Patients should be assured and made aware of the fact that an endodontic infection can be successfully managed with a definitive treatment over the over prescription of antibiotics, which is futile.

“Briefing patients about anticipated post endodontic pain and specifying analgesics to manage it will not only increase the faith of patients in their dentists, but also increase patients’ pain threshold, and change their attitude toward placebo role antibiotic plays in managing dental pain”.

Actions needed to curb antibiotic abuse

The clinical concern of antibiotic resistance can’t be reduced without adding significant restrictions to antibiotic use. This can be achieved by

Issuing of antibiotic prescribing guidelines

The government should issue apt guidelines for prescribing antibiotics. Hence, the Government of South Australia has provided regulatory principles for antimicrobial therapy referred to as MINDME ([Antimicrobial Prescribing Clinical Guideline , 2018](#)) an acronym for “antimicrobial creed” which is mentioned in Table 1.

Table 1: Antimicrobial principle given by the Government of South Australia

Principles of Antimicrobial	
M	Microbiology steers the treatment plan wherever possible.
I	Indications are evidence based.
N	Narrowest spectrum to be used
D	Dosage which is appropriate according to the site and type of infection
M	Minimize time period of therapy
E	Ensure therapy with a single drug in most cases

Comparable guidelines have been introduced in India to curb the development of antibiotic resistance which will ensure the optimal and apt prescription of antibiotics by the dental clinicians. In

April 2017, the government of India had implemented the National Action Plan (NAP) for containment of antimicrobial resistance. ([Ranjalkar and Chandy, 2019](#))

This 5 year NAP (2017–2021) sketches the priorities and execution schemes for reduction of Antimicrobial resistance in India. ([Ranjalkar and Chandy, 2019](#)) Execution of this system resulted in a decrease in the use of broad spectrum antibiotics, enhanced antibiotic choice and dosing, scarcer prescribing errors, antibiotic cost, and decreased antibiotic resistance.

Antimicrobial Stewardship Program

These Programs are formulated to augment the appropriate usage of antimicrobials by reassuring the choice of the ideal antimicrobial drug regimen, duration of therapy, dose and route of administration. ([Dellit et al., 2007](#))

1. Strategic methodologies to antimicrobial stewardship
2. Appropriate antimicrobial therapy.
3. Augmenting antimicrobial prophylaxis for operative procedures.
4. Developing and employing antibiotic guidelines and standard policies for treatment.
5. Prospective assessing and giving feedback and well-timed intermediation in rationalizing the antibiotic prescriptions.
6. Formulary constraint/pre authorisation.
7. Improving antimicrobial prescribing skills by means of education and administration facilities.

Addressing “over the counter” sale of antibiotics

There is a lack of regulation on the merchandising of pharmaceuticals in many countries which are still developing. Antibiotics are usually readily available without a doctor’s prescription and this trend of non prescription antibiotic usage has led to the crisis of developing resistance. It varies from 19% to 90% in countries outside U.S. and Europe. ([Morgan et al., 2011](#))

There should be a reinforcement of international guidelines pertaining to the “prescription only medicines” strictly followed. By creating a centralized computer software application which can monitor the manufacturing of the antibiotic with supply record throughout India can go a long way in tacking this antibiotic crisis. ([Bansal et al., 2019](#))

Education Plans

Passive instructive conducts like lectures or informative brochures must be implemented to balance stewardship activities. Dental hospitals with an academic purpose must include education on basic antibiotic stewardship ethics into their core curriculum. The dental syllabus needs to have an unambiguous protocol of treating patients with endodontic problems.

Numerous other measures which can help spread the awareness on the danger of antibiotic resistance comprises of “presentations, posters, flyers, newsletter, or electronic communication to dental professionals along with a range of web based educational resources.”

The part played by primary health care in cutting off of antimicrobial resistance

In developing countries such as India, where there is a lack of accessible and rational dental treatment to patients in rural areas, there is a vital need for developing primary oral health care programs. (Pallavi et al., 2012) There should be the employment of doctors with apt skills of prescribing the right antibiotics to provide primary dental care. Shortages of drugs result in doctors prescribing incorrect antibiotics in primary care set up. (Årdal et al., 2016)

This can be undone by improving the supply chain, particularly in the peripheral facilities. (Kotwani et al., 2007) Technologies aiding rapid diagnosis for primary care can help in improving both the precision of diagnosis and its management. “WHO approach Aware Access, Watch, Reserve for tackling antibiotic resistance should be properly implemented to primary care”.

CONCLUSIONS

Dental practitioners lacking the knowledge of rationally prescribing the antibiotics is one amongst the many causative factors leading to antibiotic resistance. Antibiotic resistance has now become a multifaceted crisis which needs to be curbed with a holistic approach. Endodontists should think before injudiciously prescribing antibiotics. Health professionals, government as well as the general public need to come together and take a stand to decrease the inapt usage of antibiotics. Countries also need to take an initiative of developing various Primary dental health care programs to tackle this crisis worldwide and having these health programs reflected promptly in national plans.

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Conflict of Interest

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