**Table 1** Medications reported to induce xerostomia, salivary gland hypofunction, or sialorrhea with higher and moderate level of evidence, grouped according to their inclusion in first, second, fourth, and fifth ACT levels

| First level, anatomical main group | Second level, therapeutic subgroup | Fourth level, chemical subgroup | Fifth level, chemical substance | ATC code |
|---|---|---|---|---|
| **Alimentary tract and metabolism** | **Drug for functional GI disorder** | **Synthetic anti-cholinergics, quaternary ammonium compounds** | **Propantheline** | **A03AB05** |
| | | **Belladonna alkaloids, tertiary amines** | **Atropine** | **A03BA01** |
| | | | Hyoscyamine | A03BA03 |
| | | **Belladonna alkaloids, semisynthetic, quaternary ammonium compounds** | **Scopolamine/ hyoscine** | **A03BB01** |
| | **Anti-emetics and anti-nauseants** | **Other anti-emetics** | **Scopolamine/ hyoscine** | **A04AD01** |
| | **Anti-obesity preparations, excl. diet products** | **Centrally acting anti-obesity products** | **Phentermine** | **A08AA01** |
| | | | Dexfenfluramine | A08AA04 |
| | | | **Sibutramine** | **A08AA10** |
| | | Peripherally acting anti-obesity products | Orlistat | A08AB01 |
| | | **Serotonin–noradrenaline–dopamine reuptake inhibitor** | Tesofensine | ND |
| **Cardiovascular system** | Cardiac therapy | Anti-arrhythmics, class Ib | Mexiletine | C01BB02 |
| | **Anti-hypertensives** | Methyldopa | Methyldopa | C02AB01 |
| | | **Imidazoline receptor agonists** | **Clonidine** | **C02AC01** |
| | **Diuretics** | **Thiazides, plain** | **Bendroflumethiazide** | **C03AA01** |
| | | Sulfonamides, plain | Furosemide | C03CA01 |
| | | Vasopressin antagonists | Tolvaptan | C03XA01 |
| | **Beta-blocking agents** | **Beta-blocking agents, non-selective** | **Timolol** | **C07AA06** |
| | | Beta-blocking agents, selective | Metoprolol | C07AB02 |
| | | | Atenolol | C07AB03 |
| | **Calcium channel blockers** | Dihydropyridine derivatives | Isradipine | C08CA03 |
| | | **Phenylalkylamine derivatives** | **Verapamil** | **C08DA01** |
| | Agents acting on the renin-angiotensin system | ACE inhibitors, plain | Enalapril | C09AA02 |
| | | | Lisinopril | C09AA03 |
| **Genitourinary system and sex hormones** | **Urologicals** | **Drugs for urinary frequency and incontinence** | **Oxybutynin** | **G04BD04** |
| | | | **Propiverine** | **G04BD06** |
| | | | **Tolterodine** | **G04BD07** |
| | | | **Solifenacin** | **G04BD08** |
| | | | Trospium | G04BD09 |
| | | | Darifenacin | G04BD10 |
| | | | Fesoterodine | G04BD11 |
| | | | **Imidafenacin** | **ND** |
| | | Alpha-adrenoreceptor antagonists | Alfuzosin | G04CA01 |
| | | | Terazosin | G04CA03 |
| Anti-infectives for systemic use | Anti-virals for systemic use | Protease inhibitors | Saquinavir | J05AE01 |
| | | Nucleoside and nucleotide reverse transcriptase inhibitors | Didanosine | J05AF02 |
| | | | Lamivudine | J05AF05 |
| | | Non-nucleoside reverse transcriptase inhibitors | Nevirapine | J05AG01 |
| | | | Etravirine | J05AG04 |
| | | Other anti-virals | Raltegravir | J05AX08 |
| | | | Maraviroc | J05AX09 |
| **Anti-neoplastic and immunomodulating agents** | **Anti-neoplastic agents** | **Monoclonal antibodies** | **Bevacizumab** | **L01XC07** |

**Table 1** continued

| First level, anatomical main group | Second level, therapeutic subgroup | Fourth level, chemical subgroup | Fifth level, chemical substance | ATC code |
|---|---|---|---|---|
| **Musculoskeletal system** | **Muscle relaxants** | **Other centrally acting agents** | **Baclofen** | **M03BX01** |
| | | | **Tizanidine** | **M03BX02** |
| | | | **Cyclobenzaprine** | **M03BX08** |
| | **Drugs for treatment of bone diseases** | **Bisphosphonates** | **Alendronate** | **M05BA04** |
| **Nervous system** | Anesthetics | Opioid anesthetics | Fentanyl | N01AH01 |
| | **Analgesics** | Natural opium alkaloids | Morphine | N02AA01 |
| | | | Dihydrocodeine | N02AA08 |
| | | Phenylpiperidine derivatives | Fentanyl | N02AB03 |
| | | **Oripavine derivatives** | **Buprenorphine** | **N02AE01** |
| | | **Morphinan derivatives** | **Butorphanol** | **N02AF01** |
| | | Other opioids | Tramadol | N02AX02 |
| | | | Tapentadol | N02AX06 |
| | | **Other anti-migraine preparations** | **Clonidine** | **N02CX02** |
| | **Anti-epileptics** | Fatty acid derivatives | Sodium valproate/valproic acid | N03AG01 |
| | | **Other anti-epileptics** | **Gabapentin** | **N03AX12** |
| | | | Pregabalin | N03AX16 |
| | **Anti-Parkinson drugs** | **Dopamine agonists** | **Rotigotine** | **N04BC09** |
| | **Psycholeptics** | **Phenothiazines with aliphatic side-chain** | **Chlorpromazine** | **N05AA01** |
| | | **Phenothiazines with piperazine structure** | **Perphenazine** | **N05AB03** |
| | | Butyrophenone derivatives | Haloperidol | N05AD01 |
| | | **Indole derivatives** | Sertindole | N05AE03 |
| | | | **Ziprasidone** | **N05AE04** |
| | | | Lurasidone | N05AE05 |
| | | **Diazepines, oxazepines, thiazepines, and oxepines** | **Loxapine** | **N05AH01** |
| | | | **Clozapine** | **N05AH02** |
| | | | **Olanzapine** | **N05AH03** |
| | | | **Quetiapine** | **N05AH04** |
| | | | Asenapine | N05AH05 |
| | | Benzamides | Amisulpride | N05AL05 |
| | | **Lithium** | **Lithium** | **N05AN01** |
| | | **Other anti-psychotics** | **Risperidone** | **N05AX08** |
| | | | **Aripiprazole** | **N05AX12** |
| | | | **Paliperidone** | **N05AX13** |
| | | Benzodiazepine derivatives (anxiolytics) | Clobazam | N05BA09 |
| | | **Benzodiazepine-related drugs** | **Zolpidem** | **N05CF02** |
| | | | Eszopiclone | N05CF04 |
| | | | Zopiclone | N05CF01 |
| | | **Other hypnotics and sedatives** | **Scopolamine/hyoscine** | **N05CM05** |
| | | | Dexmedetomidine | N05CM18 |

**Table 1** continued

| First level, anatomical main group | Second level, therapeutic subgroup | Fourth level, chemical subgroup | Fifth level, chemical substance | ATC code |
|---|---|---|---|---|
| | **Psychoanaleptics** | **Non-selective monoamine reuptake inhibitors** | Desipramine | N06AA01 |
| | | | **Imipramine** | **N06AA02** |
| | | | **Amitriptyline** | **N06AA09** |
| | | | **Nortriptyline** | **N06AA10** |
| | | | Doxepin | N06AA12 |
| | | | Dosulepin | N06AA16 |
| | | **Selective serotonin reuptake inhibitors** | **Fluoxetine** | **N06AB03** |
| | | | **Citalopram** | **N06AB04** |
| | | | **Paroxetine** | **N06AB05** |
| | | | **Sertraline** | **N06AB06** |
| | | | **Escitalopram** | **N06AB10** |
| | | **Other anti-depressants** | **Bupropion** | **N06AX12** |
| | | | **Venlafaxine** | **N06AX16** |
| | | | **Reboxetine** | **N06AX18** |
| | | | **Duloxetine** | **N06AX21** |
| | | | Desvenlafaxine | N06AX23 |
| | | | **Vortioxetine** | **N06AX26** |
| | | **Centrally acting sympathomimetics** | **Methylphenidate** | **N06BA04** |
| | | | **Dexmethylphenidate** | **N06BA11** |
| | | | **Lisdexamfetamine** | **N06BA12** |
| | **Other nervous system drugs** | Drugs used in nicotine dependence | Nicotine | N07BA01 |
| | | Drugs used in alcohol dependence | Naltrexone | N07BB04 |
| | | **Drugs used in opioid dependence** | **Buprenorphine** | **N07BC01** |
| | **ND** | **ND** | **Dimebon** | **ND** |
| | | | Tesofensine | ND |
| **Respiratory system** | Nasal preparations | Anti-allergic agents, excl. corticosteroids | Azelastine | R01AC03 |
| | **Drugs for obstructive airway diseases** | **Anti-cholinergics** | **Tiotropium** | **R03BB04** |
| | **Anti-histamines for systemic use** | **Aminoalkyl ethers** | **Doxylamine** | **R06AA09** |
| | | Piperazine derivatives | Cetirizine | R06AE07 |
| | | | Levocetirizine | R06AE09 |
| | | Other anti-histamines for systemic use | Ebastine | R06AX22 |
| | | | Desloratadine | R06AX27 |
| **Sensory organs** | **Ophthalmologicals** | **Sympathomimetics in glaucoma therapy** | **Brimonidine** | **S01EA05** |
| | | **Anti-cholinergics** | **Atropine** | **S01FA01** |
| | | Other anti-allergics | Azelastine | S01GX07 |

*ACE* angiotensin-converting enzyme, *ATC* Anatomical Therapeutic Chemical, *GI* gastrointestinal, *ND* not determined

[a] Bold type indicates higher level of evidence

The number of patients adversely affected by a specific drug, as well as the severity of the effect of this drug, are usually dose dependent. Figures for these parameters are not presented in the current study. Lack of saliva is often manifested as the sensation of dry mouth (xerostomia). A number of studies have suggested an association between the incidence of xerostomia and the number and dose of medications [274]. That study also discussed secondary effects of MISGD in promoting caries or oral mucosal alterations.

Management of MISGD has mainly been based on a trial-and-error approach. Use of intraoral topical agents, such as a spray containing malic acid, sugar-free chewing gums or candy, saliva substitutes, or non-alcoholic mouthwashes to moisten or lubricate the mouth have served as the mainstay of treatment for patients with a dry