

COVER STORY

New national guidelines on hypertension

A summary for dentistry

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New guidelines for the evaluation and management of hypertension now are available from the National Heart, Lung, and Blood Institute.¹⁻³ The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure, or JNC 7, substantially revises previous recommendations. These updated guidelines were necessitated by the findings of many recent observational studies and clinical trials dealing with hypertension; the need for useful,

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clear and concise clinical guidelines; the JNC's consensus that a simplified classification of blood pressure, or BP, was necessary; and a realization that practicing physicians were not using previous guidelines to maximum benefit.¹⁻³ The JNC 7 report represents the consensus opinion of a coalition of 39 major professional, public and voluntary organizations and seven federal agencies. Every health care professional, including dentists and members of the dental team, should be aware

of these important changes.

Hypertension is the most common primary diagnosis in the United States, affecting 50 million Americans.⁴ The condition's prevalence is likely to increase with the demographic shift to an older population. Importantly, data from the Framingham Heart Study indicate that people who are normotensive at age 55 years have a 90 percent lifetime risk of developing hypertension.⁵

To appropriately manage their patients' care, dentists and members of the dental team must be knowledgeable about hypertension, particularly its detection and treat-

Background. Periodically, the National Heart, Lung, and Blood Institute publishes recommendations on the prevention, detection, evaluation and treatment of high blood pressure. The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure—known as “JNC 7”—substantially revises previous recommendations.

Methods. This report represents the consensus opinion of a coalition of 39 major professional, public and voluntary organizations and seven federal agencies. All currently available literature on hypertension was reviewed by a select committee of experts on hypertension (including one of the authors [L.M.P.]) and was used to formulate this new report.

Results. The authors present highlights of the JNC 7 report. In addition, they offer the findings of their review of dental literature dealing with patients who have hypertension, into which they integrate information from the JNC 7, and update dental management recommendations. These new guidelines provide key messages to all health care professionals and are designed to improve the diagnosis and treatment of people with hypertension.

Conclusions. Because hypertension affects nearly 50 million people in the United States and underlies most cardiovascular disease, its diagnosis and control should be of concern to all health care providers. Many people have undetected hypertension, and current levels of detection and control need to be improved.

Clinical Implications. All health care providers, including dentists and members of the dental team, need to be involved in detection and management of this important public health problem. The dentist can play an important role in the detection and management of hypertension.



ment. Measurement of BP and review of all medications, including herbal remedies and other over-the-counter medications, should be an integral part of the examination procedure.⁶ Dentists are encouraged to help the medical profession identify people who have elevated BP so that these patients can be treated appropriately.^{1,7,8} The care of a patient with undetected or poorly controlled hypertension requires consultation with the patient's physician. Also, a significant number of antihypertensive medications have undesired oral side effects that require assessment and potential intervention by dentists.

HIGHLIGHTS OF THE JNC 7 REPORT

Increased importance of elevations of systolic blood pressure. For people older than 50 years of age, systolic blood pressure, or SBP, greater than 140 millimeters of mercury is considered a much more important risk factor for cardiovascular disease, or CVD, than is elevated diastolic blood pressure, or DBP. This focus on SBP is a substantial change from recommendations as recent as 15 years ago when, in JNC IV, hypertension was defined solely as a DBP 90 mm Hg or higher.⁹ The recognition of the importance of the SBP gradually has evolved through JNC V¹⁰ and VI,¹¹ and recent clinical trials have convincingly demonstrated the benefits of treating isolated systolic hypertension.^{12,13}

Prehypertension. JNC 7 introduces a category called "prehypertensive" to describe people with SBP of 120 to 139 mm Hg or a DBP of 80 to 89 mm Hg. People with prehypertension are at increased risk of progressing to hypertension and require health-promoting lifestyle modifications to prevent CVD.^{14,15} The term "prehypertension" replaces and expands the previously used terminology of "high normal" (130-139/85-89 mm Hg). People with BP in the range of 130 to 139/85 to 89 mm Hg are twice as

TABLE 1

BLOOD PRESSURE CLASSIFICATION FOR ADULTS.*†		
BLOOD PRESSURE CLASSIFICATION	SBP‡ (mm Hg§)	DBP¶ (mm Hg)
Normal	< 120	and < 80
Prehypertension	120-139	or 80-89
Stage 1 Hypertension	140-159	or 90-99
Stage 2 Hypertension	≥ 160	or ≥ 100

* Adapted from U.S. Department of Health and Human Services; National Institutes of Health; National Heart, Lung, and Blood Institute; National High Blood Pressure Education Program.¹
† Treatment determined by highest blood pressure category.
‡ SBP: Systolic blood pressure.
§ mm Hg: Millimeters of mercury.
¶ DBP: Diastolic blood pressure.

likely to develop hypertension than those with lower values.^{15,16} The risk of a stroke or heart attack doubles for each increase in BP, in 20/10-mm Hg increments, from 115/75 mm Hg.¹⁴

Revised and simplified classification of BP. The JNC 7 report reduces the number of categories of hypertension to only two (Table 1). Stage 1 hypertension is defined as SBP of 140 to 159 mm Hg or DBP of 90 to 99 mm Hg. Stage 2 hypertension is SBP of 160 or higher or DBP of 100 or higher. Further staging was eliminated in JNC 7 to simplify classification and because having a stage higher than Stage 2 would not change the need for treatment.

Lifestyle modifications. One of the reasons that the concept of prehypertension was developed is to provide a wake-up call for affected people to encourage them to make appropriate lifestyle choices. A critical aspect in the prevention and management of hypertension is the adoption of healthy lifestyles. Without lifestyle modifications, BP may not be controlled adequately despite sufficient doses of antihypertensive drugs or appropriate combinations of drugs. Recommended modifications are weight reduction for overweight patients,^{17,18} dietary sodium reduction,¹⁹⁻²¹ appropriate physical activity^{22,23} and moderation in consumption of alcohol.²⁴ Also, the consumption of a diet rich in fruits, vegetables and low-fat dairy products—such as recommended in the Dietary Approaches to Stop Hypertension, or DASH, eating plan—is

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TABLE 2

LIFESTYLE MODIFICATIONS TO MANAGE HYPERTENSION.*††		
MODIFICATION	RECOMMENDATION	APPROXIMATE SBP [§] REDUCTION (RANGE)
Weight Reduction	Maintain normal body weight (body mass index 18.5-24.9 kilograms per square meter)	5-20 millimeters of mercury/10 kg weight loss [¶]
Adopt DASH[#] Eating Plan	Consume a diet rich in fruits, vegetables and low-fat dairy products with a reduced content of saturated and total fat	8-14 mm Hg ^{**}
Dietary Sodium Reduction	Reduce dietary sodium intake to no more than 100 millimoles per day (2.4 grams sodium or 6 g sodium chloride)	2-8 mm Hg ^{††}
Physical Activity	Engage in regular aerobic physical activity such as brisk walking (at least 30 minutes per day, most days of the week)	4-9 mm Hg ^{‡‡}
Moderation of Alcohol Consumption	Limit consumption to no more than two drinks (1 ounce or 30 milliliters ethanol; for example, 24 oz beer, 10 oz wine, or 3 oz 80-proof whiskey) per day in most men and to no more than one drink per day in women and lighter-weight people	2-4 mm Hg ^{§§}

* Adapted from U.S. Department of Health and Human Services; National Institutes of Health; National Heart, Lung, and Blood Institute; National High Blood Pressure Education Program.¹
 † Overall cardiovascular risk reduction can be achieved by cessation of smoking.
 ‡ The effects of implementing these modifications are dose- and time-dependent and could be greater for some people.
 § SBP: Systolic blood pressure.
 ¶ The Trials of Hypertension Prevention Collaborative Research Group¹⁷; He and colleagues.¹⁸
 # DASH: Dietary Approaches to Stop Hypertension.
 ** Sacks and colleagues¹⁹; Vollmer and colleagues.²⁰
 †† Sacks and colleagues¹⁹; Vollmer and colleagues²⁰; Chobanian and Hill.²¹
 ‡‡ Kelley and Kelley²²; Whelton and colleagues.²³
 §§ Xin and colleagues.²⁴

advised.²⁵ Table 2 demonstrates that lifestyle changes can have a substantial impact on BP and, in some instances, can produce equivalent effects to use of single-drug therapy and may prevent the development of hypertension in patients who have prehypertension.

Importance of thiazide diuretics. JNC 7 emphasizes that thiazide-type diuretics should be used in the treatment of most patients with uncomplicated hypertension, either alone or combined with other classes of antihypertensive drugs. However, the report recognizes that certain high-risk conditions (heart failure, postmyocardial infarction, high coronary disease risk, diabetes, chronic kidney disease and potential for recurrent stroke) have indications for the initial use of other classes of antihypertensive medications. Importantly, while recent clinical trials demonstrate that effective control of BP is achievable in most patients, the majority of patients will require two

or more antihypertensive agents.²⁶ The figure presents an algorithm for treating hypertension.

Goals of therapy. The primary focus of therapy for those 50 years of age or older has become the reduction of elevated SBP to goal SBP.²⁷ By achieving the SBP goal, most patients will attain the DBP goal. Treatment for people aged 50 years or younger will continue to focus on the DBP. For most people, the current treatment target is a BP of less than 140/90 mm Hg; however, for patients with diabetes mellitus or chronic kidney disease, the goal is a BP of less than 130/80 mm Hg.^{28,29}

Benefits of lowering BP. The benefits of effective treatment of hypertension have been demonstrated convincingly in clinical trials. Effective antihypertensive therapy reduces the incidence of stroke by 35 to 40 percent, myocardial infarction by 20 to 25 percent and heart failure by more than 50 percent.³⁰ A sustained

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reduction of 12 mm Hg in SBP for people with Stage 1 hypertension is estimated to result over a 10-year period in prevention of one death for every 11 patients treated. Even greater benefit is obtainable with the presence of CVD or target-organ damage.³¹

SIGNIFICANCE OF HYPERTENSION IN DENTAL CARE

Dentists can perform a valuable patient service by identifying undetected hypertension or hypertension that is controlled inadequately and by recommending evaluation or treatment by physicians.⁸ Undetected and insufficiently treated hypertension is a problem in a dental environment.⁶ Elevated BP, especially markedly elevated BP, increases a patient's risk of experiencing cardiovascular conditions such as angina, myocardial infarction and cerebrovascular accident while undergoing dental care. The JNC 7 urges all health care professionals, including dentists, to become actively involved in this effort.

Hypertension underlies most CVD. Hypertension is a substantial risk factor for CVD and resultant organ damage (Box).

Among organ systems associated with hypertensive damage are the vascular system itself, in which hypertension can produce arteriosclerosis and contribute to atherosclerosis; the kidneys, in which hypertensive nephrosclerosis can lead to end-stage renal disease; the heart, in which hypertension can result in myocardial infarction and left ventricular hypertrophy that progress to cardiac failure; and the brain, in which hypertension can lead to all forms of stroke.³²

Undetected or inadequately controlled

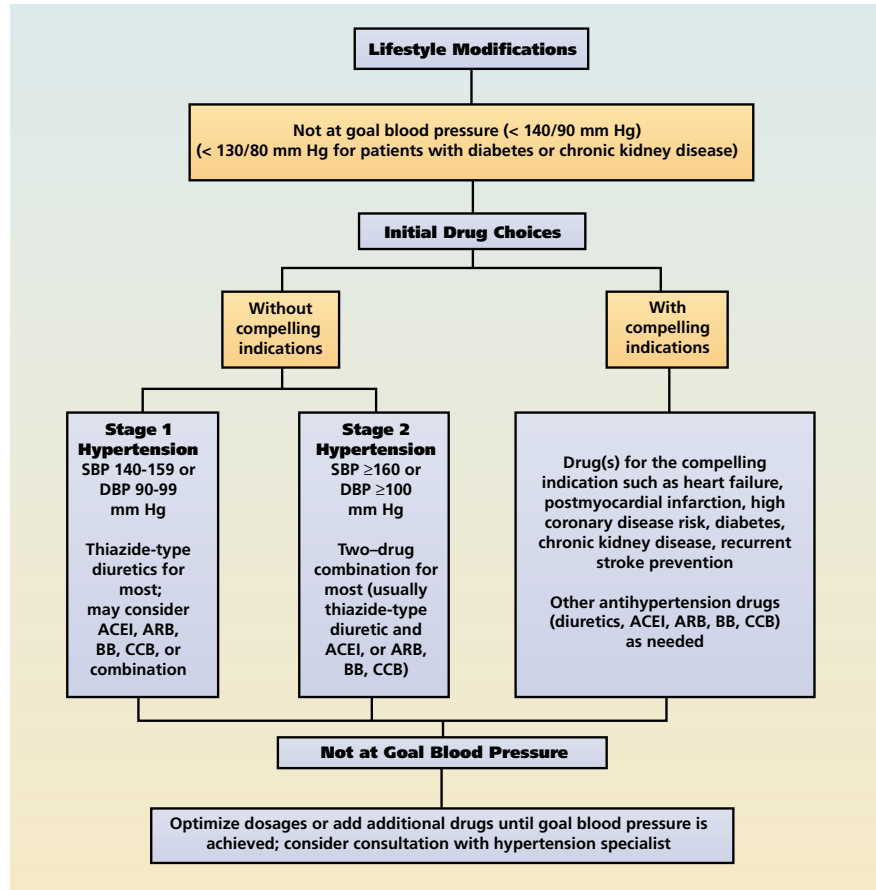


Figure. Algorithm for treatment of hypertension. DBP: Diastolic blood pressure. SBP: Systolic blood pressure. ACEI: Angiotensin-converting enzyme inhibitor. ARB: Angiotensin receptor blocker. BB: Beta blocker. CCB: Calcium channel blocker. Reprinted from U.S. Department of Health and Human Services; National Institutes of Health; National Heart, Lung, and Blood Institute; National High Blood Pressure Education Program.¹

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hypertension. Hypertension is the most common primary diagnosis in the United States, accounting for 35 million health care visits per year.¹⁻³ Additionally, 30 percent of people with hypertension are unaware that they have the condition.¹⁻³ Only 59 percent of patients with hypertension are being treated for their condition, and 34 percent have their BP controlled at levels consistent with JNC 7 guidelines.¹⁻³ This makes it obvious that practicing dentists encounter many patients with undetected or poorly controlled hypertension, requiring medical consultation and intervention. Failure to detect severe elevations of BP can result in stroke or myocardial infarction.

Office monitoring of BP. BP readings should be taken for all new patients and for recall

BOX

TARGET ORGAN DAMAGE THAT CAN RESULT FROM HYPERTENSION.***HEART**

- Left ventricular hypertrophy
- Angina or prior myocardial infarction
- Prior coronary revascularization
- Heart failure

BRAIN

- Stroke or transient ischemic attack

CHRONIC KIDNEY DISEASE**PERIPHERAL ARTERIAL DISEASE****RETINOPATHY**

* Adapted from U.S. Department of Health and Human Services; National Institutes of Health; National Heart, Lung, and Blood Institute; National High Blood Pressure Education Program.¹

patients on at least an annual basis.³¹ People who have hypertension should have BP assessed at each visit in which significant dental procedures are accomplished. The procedure is simple and can be accomplished by office staff. Patients should be allowed to sit quietly in an upright position with the arms supported at the heart level for at least five minutes before BP is taken.³³ JNC 7 recommends averaging two measurements. The mercury sphygmomanometer is the most accurate device for detecting BP. Aneroid sphygmomanometers require calibration every six months. While electronic BP measuring devices are used with increasing frequency because of their ease of use and concerns about the toxic nature of mercury, the American Heart Association Council for High Blood Pressure Research maintains that mercury sphygmomanometers should not be abandoned.^{34,35}

It is important to select a well-fitting cuff.

The bladder of the cuff should cover about 80 percent of the upper arm, be centered over the brachial artery and be applied snugly. Some larger patients require a large adult-sized or thigh cuff to obtain a good fit. Inappropriate size of the cuff will give false readings. Gentle placement of the bell of the stethoscope in the antecubital fossa is necessary to auscultate Korotkoff's sounds optimally.

Managing the care of patients with hypertension. As emphasized previously, measurement of BP and review of the health status should be conducted routinely for all patients, but particularly for people with known hypertension. Patients with well-controlled hypertension or

with Stage 1 hypertension are good candidates for all dental procedures.³⁶ Several studies³⁷⁻⁴⁰ have demonstrated that mild-to-moderate hypertension (SBP \geq 140 and \leq 180 mm Hg ; DBP \geq 90 and \leq 110 mm Hg) is not an independent risk factor for perioperative cardiovascular complications. However, risk assessment is essential for all patients, especially those for whom the need of complex or surgical procedures is anticipated.⁴¹ Particular care should be taken to identify risk factors for hypertension and target organ damage and CVDs that indicate increased risk. Sedation with nitrous oxide or an anxiolytic agent may be indicated for anxious patients.³⁶

Limits on epinephrine. Use of a vasoconstrictor in local anesthetic for patients with CVD is a matter of some debate^{36,42-45} and was addressed directly as a dental issue by JNC 7. Among the rationale for limiting epinephrine use with patients with hypertension is that hypertensive disease usually is found in middle-aged and older patients who are more likely to have other CVDs and reduced resiliency of the cardiovascular system.⁴⁶ Bader and colleagues,⁴⁶ in an extensive review of the cardiovascular effects of epinephrine on dental patients with hypertension, concluded that use of epinephrine in local anesthetic solutions resulted in infrequent adverse outcomes. However, it is widely recommended that vasoconstrictor usage should be minimized in patients with increased risk of developing CVD. While there is no official maximum dose for vasoconstrictors when administered with local anesthetic, two to three cartridges of lidocaine with 1:100,000 epinephrine (approximately 0.036-0.054 mg epinephrine) is considered safe in ambulatory patients with all but the most severe CVD.⁴⁷⁻⁴⁹ Dentists' years of experience in dealing with countless patients support this conclusion. There also is general agreement that use of retraction cords containing epinephrine should be avoided. Sufficient alternatives for hemostasis are available that the use of epinephrine-impregnated cords is not warranted.

People with BP consistent with Stage 2 hypertension should have repeat BP determinations to confirm the initial findings. Referral of patients with significantly increased BP to their physicians is appropriate, particularly if the elevation is more than 20 mm Hg higher than the goal BP.

Patients with markedly elevated BP (defined in JNC V¹⁰ as SBP 180-209 mm Hg or DBP 110-119 mm Hg) and acute target-organ damage such as prior myocardial infarction and unstable angina require hospitalization. The condition of patients who have marked BP elevation but not acute target-organ damage usually can be managed by immediate combination oral antihypertensive therapy. Any dental patients whose BP is higher than 210/120 mm Hg should be referred for immediate medical evaluation.

Urgent dental care. It is not uncommon for patients seeking urgent dental care to have elevated BP. The possible causes of this are multiple and include undetected hypertension, inadequate treatment, poor patient compliance with physicians' recommendations, expense of medical care and medications, and avoidance of medication use due to complications such as decreased sexual function. Additionally, people with toothache pain often are poorly rested and experiencing anxiety. Such situational factors can result in increased SBP.

From a dental treatment perspective, there is no simple answer to the problem posed by people with elevated BP needing urgent dental care, such as an extraction. There are no professionally recognized criteria based on BP values to indicate when it is safe to proceed. In JNC VI, Stage 3 hypertension was defined as SBP higher than 180 mm Hg or DBP higher than 110 mm Hg.¹¹ Elevation of SBP higher than 180 mm Hg or DBP higher than 110 mm Hg is used by many dental clinicians as a cutoff point for offering urgent treatment without medical consultation and referral. Pending clear guidelines from research or professional consensus, this appears to be sound advice.

Complications of hypertensive treatment.

Orthostatic hypotension. Any patient, especially an older patient who is taking multiple medications for hypertension, is at risk of developing orthostatic hypotension if he or she attempts to stand upright immediately after being in a reclining or supine position for a prolonged period.³³ Orthostatic hypotension can result in syncope and falling with associated injury. This hazard usually is avoidable by allowing patients to sit upright for a few minutes after completion of the dental procedure. People at most risk are

those who are older, those who are taking multiple cardiovascular medications and those who are undergoing lengthy dental procedures.

Xerostomia. Many antihypertensive medications—including central α 2-agonists and other centrally acting drugs; α 1-adrenergic-blockers; β -adrenergic blocking agents; diuretics; angiotensin-converting enzyme, or ACE, inhibitors; and calcium channel blockers—are associated with xerostomia.⁵⁰ The likelihood of xerostomia grows as the number of medications with xerostomic potential increases. Xerostomia—with its resultant potential for caries (especially root caries); difficulties with mastication, swallowing and speech; candidiasis; and oral burning—is a frequently underdiagnosed condition.⁵¹ Sometimes the sensation of xerostomia is

transitory, and the patient's salivary function will adjust without any action on the part of the dentist or physician. In other instances, the physician can alter the patient's medications to avoid this potential complication. However, it often is necessary to treat xerostomia directly with parasympathomimetic agents such as pilocarpine (5 mg three or four times a day) or cevimeline (30 mg three times a day). Additional strategies to deal with xerostomia include taking frequent sips of water, using moisturizing gels,

sucking on sugarless hard candy, using sugarless mints or gums, minimizing caffeine intake and avoiding the use of alcohol-containing mouthrinses. Of particular concern to dentists is the increased potential for development of caries, which can be addressed by increased application of fluoride, especially high-potency fluoride delivered either on a toothbrush or in a custom carrier.⁵²

Gingival overgrowth. Calcium channel blockers can cause gingival overgrowth. The incidence of this is not firmly established but ranges from 1.7 to 38 percent.⁵³⁻⁵⁶ Enlargement of the gingiva is possible with most of the calcium channel blockers, but the majority of case reports are associated with use of nifedipine.^{57,58} Gingival overgrowth can result in pain, gingival bleeding and difficulty with mastication. The likelihood of development of gingival overgrowth is reduced by excellent oral hygiene. The process of gingival overgrowth often can be reversed by having the

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physician change the patient's medication to an alternative antihypertensive agent. Extensive overgrowth may require gingivectomy, gingivoplasty or both.

Lichenoid reactions. Several cardiovascular medications (thiazides, methyl dopa,⁵⁹ propranolol, ACE inhibitors,⁶⁰ furosemide, spironolactone and labetalol)^{33,47,61} have the potential to result in lichen planuslike lesions in the mouth termed "lichenoid reactions." The clinical appearance of lichenoid lesions is indistinguishable from oral lichen planus. The best and simplest method of dealing with this complication is to ask the physician to substitute an alternative therapeutic agent. The lichenoid lesions, if associated with the antihypertensive drug, will resolve after the patient ceases taking the medication. When this is not feasible, lichenoid reactions can be treated as necessary with topical corticosteroids.

Other potential adverse reactions. ACE inhibitors are well-recognized for their association with an increased incidence of cough and potential loss of taste. ACE inhibitors also are reported to be associated with a burning sensation described as "scalded mouth" syndrome.⁶²

Potential drug interactions. The interaction of antihypertensive agents with therapeutic agents commonly used in dentistry may result in adverse outcomes. The interaction of nonselective β -blockers with epinephrine in local anesthetics can result in a reduction in cardiac output through an α -receptor-induced increase in BP and a concomitant compensatory vagal reflex-mediated reduction in heart rate.^{46,63,64} However, with careful administration, frequent aspiration and monitoring of vital signs, patients treated with nonselective β -blockers can safely receive two or three cartridges of anesthetic with 1:100,000 epinephrine.^{65,66}

When epinephrine is used in patients receiving non-potassium-sparing diuretics, potassium levels can decrease resulting in dysrhythmias.^{46,67} Clinicians should be aware of this potential adverse reaction and identify patients' use of non-potassium-sparing diuretics.

Prolonged use of nonsteroidal anti-inflammatory agents, or NSAIDs, can lessen the anti-hypertensive effectiveness of diuretics, β -blockers, α -blockers, vasodilators, ACE inhibitors and central agonists.⁶⁸ Clinicians can substitute alternative analgesics to avoid this interaction; however, short-term usage of NSAIDs is unlikely to produce a clinically significant effect.

A NEED FOR PHYSICIAN-DENTIST INTERACTION

Dentists and physicians often consult concerning patient care management. A particularly relevant example is treatment of obstructive sleep apnea, or OSA. Treatment of OSA increasingly involves dentists' fabricating intraoral devices.^{69,70} OSA is associated with a wide variety of CVDs, including dysrhythmias, myocardial infarction and stroke.^{71,72} More than 50 percent of people with OSA have hypertension, and management of OSA often involves weight reduction necessitated by obesity.⁷²⁻⁷⁴ Treatment of OSA illustrates the need for a holistic approach to the practice of dentistry and emphasizes the need for communication between treating physicians and dentists.

SUMMARY AND CONCLUSIONS

This article summarizes the recently released JNC 7 report dealing with the prevention, detection, evaluation and treatment of high BP. Anti-hypertensive therapy has as its ultimate goal reduction of cardiovascular and renal morbidity and mortality. A more aggressive prevention-oriented approach to the treatment of hypertension is currently recommended.

While no major changes in dental patient care management are suggested by JNC 7, it is likely that dentists will encounter more complications of hypertensive therapy among their patients and will require greater interaction and consultation with medical colleagues.

In JNC 7, the medical profession has set high goals for itself to accomplish. Physicians want the help of the entire team of health professions to reach these objectives. Dentists and members of the dental team can and should play an important role through monitoring BP, detecting hyper-

tension, reinforcing compliance with physician-recommended therapies and encouraging patients to adopt healthy lifestyles. ■

1. U.S. Department of Health and Human Services; National Institutes of Health; National Heart, Lung, and Blood Institute, National High Blood Pressure Education Program. The seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (JNC 7). Available at: "www.nhlbi.nih.gov/guidelines/hypertension/index.htm". Accessed July 17, 2003.
2. Chobanian AV, Bakris GL, Black HR, et al.; National Heart, Lung, and Blood Institute Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure; National High Blood Pressure Education Program Coordinating Committee. The Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure: the JNC7 report (published correction appears in JAMA;290[2]:197). JAMA 2003;289:2560-72.
3. Chobanian AV, Bakris GL, Black HR, et al.; National Heart, Lung, and Blood Institute Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. National Heart, Lung, and Blood Institute; National High Blood Pressure Education Program Coordinating Committee. Seventh report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure. Hypertension 2003;42:1206-52.
4. Hajjar I, Kotchen TA. Trends in prevalence, awareness, treatment, and control of hypertension in the United States, 1988-2000. JAMA 2003;290(2):199-206.
5. Vasan RS, Beiser A, Seshadri S, et al. Residual lifetime risk for developing hypertension in middle-aged women and men: The Framingham Heart Study. JAMA 2002;287:1003-10.
6. Gordy FM, Le Jeune RC, Copeland LB. The prevalence of hypertension in a dental school patient population. Quintessence Int 2001;32:691-5.
7. American Dental Association Council on Dental Health. Suggestions for dentists on participating in the National High Blood Pressure Education and Detection Program. JADA 1977;94(6):1190.
8. Hypertension detection and control: importance stressed at Dental Leadership Conference on High Blood Pressure. JADA 1976;93(1):48-50.
9. The 1988 report of the Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure. Arch Intern Med 1988;148(5):1023-38.
10. The fifth report of the Joint National Committee on Detection, Evaluation, and Treatment of High Blood Pressure (JNC V). Arch Intern Med 1993;153(2):154-83.
11. The sixth report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (published correction appears in Arch Intern Med 1998;158:573). Arch Intern Med 1997;157(21):2413-46.
12. Prevention of stroke by antihypertensive drug treatment in older persons with isolated systolic hypertension: final results of the Systolic Hypertension in the Elderly Program (SHEP). SHEP Cooperative Research Group. JAMA 1991;265:3255-64.
13. Kostis JB, Davis BR, Cutler J, et al. Prevention of heart failure by antihypertensive drug treatment in older persons with isolated systolic hypertension. SHEP Cooperative Research Group. JAMA 1997;278:212-6.
14. Lewington S, Clarke R, Qizilbash N, Peto R, Collins R; Prospective Studies Collaboration. Age-specific relevance of usual blood pressure to vascular mortality: a meta-analysis of individual data for one million adults in 61 prospective studies (published correction appears in Lancet 2003;361:1060). Lancet 2002;360(9349):1903-13.
15. Vasan RS, Larson MG, Leip EP, et al. Impact of high-normal blood pressure on the risk of cardiovascular disease. N Engl J Med 2001;345:1291-7.
16. Vasan RS, Larson MG, Leip EP, Kannel WB, Levy D. Assessment of frequency of progression to hypertension in non-hypertensive participants in the Framingham Heart Study: a cohort study. Lancet 2001;358(9294):1682-6.
17. Effects of weight loss and sodium reduction intervention on blood pressure and hypertension incidence in overweight people with high-normal blood pressure. The Trials of Hypertension Prevention, phase II. The Trials of Hypertension Prevention Collaborative Research Group. Arch Intern Med 1997;157:657-67.
18. He J, Whelton PK, Appel LJ, Charleston J, Klag MJ. Long-term effects of weight loss and dietary sodium reduction on incidence of hypertension. Hypertension 2000;35:544-9.
19. Sacks FM, Svetkey LP, Vollmer WM, et al.; DASH-Sodium Collaborative Research Group. Effects on blood pressure of reduced dietary sodium and the Dietary Approaches to Stop Hypertension (DASH) diet. DASH-Sodium Collaborative Research Group. N Engl J Med 2001;344:3-10.
20. Vollmer WM, Sacks FM, Ard J, et al.; DASH-Sodium Trial Collaborative Research Group. Effects of diet and sodium intake on blood pressure: subgroup analysis of the DASH-sodium trial. Ann Intern Med 2001;135:1019-28.
21. Chobanian AV, Hill M. National Heart, Lung, and Blood Institute Workshop on Sodium and Blood Pressure: a critical review of current scientific evidence. Hypertension 2000;35:858-63.
22. Kelley GA, Kelley KS. Progressive resistance exercise and resting blood pressure: a meta-analysis of randomized controlled trials. Hypertension 2000;35:838-43.
23. Whelton SP, Chin A, Xin X, He J. Effect of aerobic exercise on blood pressure: a meta-analysis of randomized, controlled trials. Ann Intern Med 2002;136:493-503.
24. Xin X, He J, Frontini MG, Ogden LG, Motsamai OI, Whelton PK. Effects of alcohol reduction on blood pressure: a meta-analysis of randomized controlled trials. Hypertension 2001;38:1112-7.
25. Appel LJ, Moore TJ, Obarzanek E, et al. A clinical trial of the effects of dietary patterns on blood pressure. DASH Collaborative Research Group. N Engl J Med 1997;336:1117-24.
26. Cushman WC, Ford CE, Cutler JA, et al.; ALLHAT Collaborative Research Group. Success and predictors of blood pressure control in diverse North American settings: the antihypertensive and lipid-lowering treatment to prevent heart attack trial (ALLHAT). J Clin Hypertens 2002;4:393-404.
27. Mitka M. Hypertension experts recommend new focus on the systolic reading. JAMA 2000;284:1638-9.
28. Arauz-Pacheco C, Parrott MA, Raskin P; American Diabetes Association. Treatment of hypertension in adults with diabetes. Diabetes Care 2003;26(supplement 1):S80-2.
29. National Kidney Foundation, Kidney Disease Outcome Quality Initiative Advisory Board. K/DOQI clinical practice guidelines for chronic kidney disease: evaluation, classification, and stratification. Kidney Disease Outcome Quality Initiative. Am J Kidney Dis 2002;39(2)(supplement 1):S1-246.
30. Neal B, MacMahon S, Chapman N; Blood Pressure Lowering Treatment Trialists' Collaboration. Effects of ACE inhibitors, calcium antagonists, and other blood-pressure-lowering drugs: results of prospectively designed overviews of randomised trials. Blood Pressure Lowering Treatment Trialists' Collaboration. Lancet 2000;356(9246):1955-64.
31. Ogden LG, He J, Lydick E, Whelton PK. Long-term absolute benefit of lowering blood pressure in hypertensive patients according to the JNC VI risk stratification. Hypertension 2000;35:539-43.
32. Cowper TR, Terezhalmay GT. Pharmacotherapy for hypertension. Dent Clin North Am 1996;40:585-610.
33. Little JW. The impact on dentistry of recent advances in the management of hypertension. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2000;90:591-9.
34. Jones DW, Frohlich ED, Grim CM, Grim CE, Taubert KA. Mercury sphygmomanometers should not be abandoned: an advisory statement from the Council for High Blood Pressure Research, American Heart Association. Hypertension 2001;37(2):185-6.
35. Jones DW, Appel LJ, Sheps SG, Roccella EJ, Lefant C. Measuring blood pressure accurately: new and persistent challenges. JAMA 2003;289:1027-30.
36. Muzyka BC, Glick M. The hypertensive dental patient. JADA 1997;128:1109-20.
37. Goldman L, Caldera DL, Nussbaum SR, et al. Multifactorial index of cardiac risk in noncardiac surgical procedures. N Engl J Med 1977;297:845-50.
38. Ashton CM, Petersen NJ, Wray NP, et al. The incidence of perioperative myocardial infarction in men undergoing noncardiac surgery. Ann Intern Med 1993;118:504-10.
39. Lette J, Waters D, Bernier H, et al. Preoperative and long-term cardiac risk assessment: predictive value of 23 clinical descriptors, 7 multivariate scoring systems, and quantitative dipyridamole imaging in 360 patients. Ann Surg 1992;216:192-204.
40. Eagle KA, Berger PB, Calkins H, et al.; American College of Cardiology/American Heart Association Task Force on Practice Guidelines Committee to Update the 1996 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery. ACC/AHA guideline update for perioperative cardiovascular evaluation for noncardiac surgery. Executive summary: a report of the American College of Car-

- diology/American Heart Association Task Force on Practice Guidelines (Committee to Update the 1996 Guidelines on Perioperative Cardiovascular Evaluation for Noncardiac Surgery). *Circulation* 2002;105:1257-67.
41. Fleisher LA. Preoperative evaluation of the patient with hypertension. *JAMA* 2002;287:2043-6.
42. Dionne RA, Goldstein DS, Wirdzek PR. Effects of diazepam premedication and epinephrine-containing local anesthetic on cardiovascular and plasma catecholamine responses to oral surgery. *Anesth Analg* 1984;63:640-6.
43. Goulet JP, Perusse R, Turcotte JY. Contraindications to vasoconstrictors in dentistry, part III: pharmacologic interactions. *Oral Surg Oral Med Oral Pathol* 1992;74:692-7.
44. Perusse R, Goulet JP, Turcotte JY. Contraindications to vasoconstrictors in dentistry, part I: cardiovascular diseases. *Oral Surg Oral Med Oral Pathol* 1992;74:679-86.
45. Glick M. New guidelines for prevention, detection, evaluation and treatment of high blood pressure. *JADA* 1998;129:1588-94.
46. Bader JD, Bonito AJ, Shugars DA. A systematic review of cardiovascular effects of epinephrine on hypertensive dental patients. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2002;93:647-53.
47. Riley CK, Terezhalmay GT. The patient with hypertension. *Quintessence Int* 2001;32:671-90.
48. Yagiela JA. Injectable and topical local anesthetics. In: Ciancio SG, ed. *ADA Guide to dental therapeutics*. 2nd ed. Chicago: ADA Publishing; 2000:1-16.
49. Knoll-Kohler E, Frie A, Becker J, Ohlendorf D. Changes in plasma epinephrine concentration after dental infiltration anesthesia with different doses of epinephrine. *J Dent Res* 1989;68:1098-101.
50. Navazesh M. How can oral health care providers determine if patients have dry mouth? *JADA* 2003;134:613-20.
51. Ship JA, Pillemer SR, Baum BJ. Xerostomia and the geriatric patient. *J Am Geriatr Soc* 2002;50:535-43.
52. Guggenheimer J, Moore PA. Xerostomia: etiology, recognition and treatment. *JADA* 2003;134:61-9.
53. Ellis JS, Seymour RA, Steele JG, Robertson P, Butler TJ, Thomason JM. Prevalence of gingival overgrowth induced by calcium channel blockers: a community-based study. *J Periodontol* 1999;70(1):63-7.
54. Prisant LM, Herman W. Calcium channel blocker induced gingival overgrowth. *J Clin Hypertens* 2002;4(4):310-1.
55. Miranda J, Brunet L, Roset P, Berini L, Farre M, Mendieta C. Prevalence and risk of gingival enlargement in patients treated with nifedipine. *J Periodontol* 2001;72:605-11.
56. Tavassoli S, Yamalik N, Caglayan F, Caglayan G, Eratalay K. The clinical effects of nifedipine on periodontal status. *J Periodontol* 1998;69(2):108-12.
57. Thomason JM, Seymour RA, Ellis JS, et al. Determinants of gingival overgrowth severity in organ transplant patients: an examination of the role of HLA phenotype. *J Clin Periodontol* 1996;23:628-34.
58. Kunimatsu K, Ozaki Y, Aoki Y, Kato I. Possible roles of medullasin in nifedipine-induced human gingival overgrowth. *Arch Oral Biol* 1996;41(1):111-5.
59. Williams BG. Oral drug reaction to methyldopa: report of a case. *Oral Surg Oral Med Oral Pathol* 1983;56:375-7.
60. Firth NA, Reade PC. Angiotensin-converting enzyme inhibitors implicated in oral mucosal lichenoid reactions. *Oral Surg Oral Med Oral Pathol* 1989;67:41-4.
61. Robertson WD, Wray D. Ingestion of medication among patients with oral keratoses including lichen planus. *Oral Surg Oral Med Oral Pathol* 1992;74:183-5.
62. Brown RS, Krakow AM, Douglas T, Choksi SK. 'Scalded mouth syndrome' caused by angiotensin converting enzyme inhibitors: two case reports. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 1997;83:665-7.
63. Becker DE. The autonomic nervous system and related drugs in dental practice, part II: adrenergic agonists and antagonists. *Compendium* 1988;9:772-4,776,778-80.
64. Sugimura M, Hirota Y, Shibutani T, et al. An echocardiographic study of interactions between pindolol and epinephrine contained in a local anesthetic solution. *Anesth Prog* 1995;42(2):29-35.
65. Replogle K, Reader A, Nist R, Beck M, Weaver J, Meyers WJ. Cardiovascular effects of intraosseous injections of 2 percent lidocaine with 1:100,000 epinephrine and 3 percent mepivacaine. *JADA* 1999;130:649-57.
66. Yagiela JA. Adverse drug interactions in dental practice: interactions associated with vasoconstrictors. *JADA* 1999;130:701-9.
67. Meechan JG. Plasma potassium changes in hypertensive patients undergoing oral surgery with local anesthetics containing epinephrine. *Anesth Prog* 1997;44(3):106-9.
68. de Leeuw PW. Nonsteroidal anti-inflammatory drugs and hypertension. The risks in perspective. *Drugs* 1996;51(2):179-87.
69. Ivanhoe JR, Cibirka RM, Lefebvre CA, Parr GR. Dental considerations in upper airway sleep disorders: a review of the literature. *J Prosthet Dent* 1999;82:685-98.
70. Schmidt-Nowara W, Lowe A, Wiegand L, Cartwright R, Perez-Guerra F, Menn S. Oral appliances for the treatment of snoring and obstructive sleep apnea: a review. *Sleep* 1995;18:501-10.
71. Leung RS, Bradley TD. Sleep apnea and cardiovascular disease. *Am J Respir Crit Care Med* 2001;164:2147-65.
72. Dart RA, Gregoire JR, Gutterman DD, Wolf SH. The association of hypertension and secondary cardiovascular disease with sleep-disordered breathing. *Chest* 2003;123(1):244-60.
73. Nieto FJ, Young TB, Lind BK, et al. Association of sleep-disordered breathing, sleep apnea, and hypertension in a large community-based study. *Sleep Heart Health Study* (published correction appears in *JAMA* 2002;288:1985). *JAMA* 2000;283:1829-36.
74. Peppard PE, Young T, Palta M, Skatrud J. Prospective study of the association between sleep-disordered breathing and hypertension. *N Engl J Med* 2000;342:1378-84.