

Quality Resource Guide

Screening and Monitoring Blood Pressure in Dental Practice

Author Acknowledgement

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Educational Objectives

Following this unit of instruction, the learner should be able to:

1. Understand the rationale for determining and recording a patient's blood pressure in a dental practice.
2. Understand the proper technique for measuring blood pressure.
3. Recognize patient and technique factors that contribute to inaccurate blood pressure readings.
4. Understand the blood pressure levels that reflect the stages of hypertension.
5. Be aware of the findings from the most recent ACC/AHA Guidelines.
6. Understand the precautions and treatment limitations associated with the various stages of hypertension.

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The following commentary highlights fundamental and commonly accepted practices on the subject matter. The information is intended as a general overview and is for educational purposes only. This information does not constitute legal advice, which can only be provided by an attorney.

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Introduction

The CDC estimates that approximately 108 million Americans (1/2 of all U.S. adults) have high blood pressure. Only about 1/4 of these people with high blood pressure have their condition under control. Consistently elevated high blood pressure is a major risk factor for cardiovascular disease, kidney disease, heart attack, stroke and chronic heart failure. Close to 500,000 American deaths in 2015 included high blood pressure as a primary or contributing cause. High blood pressure costs the nation \$131 billion annually in direct and indirect medical expenses and missed days of work each year.¹⁻²

Blood pressure (BP) is the force exerted by blood against the blood vessel wall. BP is a function of cardiac output and peripheral vascular resistance. Measurements can be made using invasive (usually in a hospital setting) and more commonly, non-invasive techniques. When measuring BP with a non-invasive manometer, the pressure within the compression cuff is reflected by the level of the mercury in millimeters (mm HG) using mercury-gravity manometer or the position of the needle when using aneroid manometer. The systolic pressure is equal to the pressure at which the brachial pulse can first be palpated, or heard by auscultation, as blood flow is restored through the previously compressed vessel. The pressure at the moment the sounds disappear marks the diastolic BP (DBP).

Hypertension (HTN) is an abnormal elevation in arterial pressure that can be asymptomatic. If sustained, it may lead to organ system damage, or be fatal. HTN is a reliable indicator of cardiovascular function and correlates well with a number of other systemic diseases (see Table 1).

In 2017, the American College of Cardiology/ American Heart Association Task Force on Clinical Practice Guidelines changed the definition of HTN to be any systolic BP measurement of 130 mm Hg or higher or any diastolic BP measurement of 80 mm Hg or higher (formerly classified as

greater than 140/90). There are four categories (normal, elevated, HTN Stage 1, and HTN Stage 2 (see Table 2). Elevated blood pressure, a condition where blood pressures are higher than normal, but not yet in the high blood pressure range, raises an individual's risk of developing high blood pressure.

This Guide will review the role of the dentist in monitoring BP in dental practice (reviewing the proper techniques for measuring BP) and will briefly discuss guidelines for providing dental care to patients at different stages of HTN. It will also address the classifications of HTN and briefly summarize the rationale behind the changes as

Table 1 - Hypertension's effects on the body

Organ System	Condition
Cardiovascular	<ul style="list-style-type: none"> • Myocardial infarction • Coronary artery disease • Heart failure • Peripheral vascular disease • Ventricular hypertrophy • Arteriosclerosis • Angina aneurysm
Kidney	<ul style="list-style-type: none"> • Kidney failure • Glomerulosclerosis
Eye	<ul style="list-style-type: none"> • Retinopathy • Optic neuropathy
Neurologic	<ul style="list-style-type: none"> • Transient ischemic attack • Stroke • Dementia • Cognitive impairment
Genitourinary	<ul style="list-style-type: none"> • Sexual dysfunction

Table 2 - Classification of blood pressure

Category	Systolic (mmHg)		Diastolic (mmHg)
Cardiovascular	< 120	and	< 80
Elevated	120-129	and	< 80
Hypertension - Stage 1	130-139	or	80-89
Hypertension - Stage 2	≥ 140	or	≥ 90
Hypertensive Urgency Hypertensive Emergency	> 180 + target organ damage	and/or	> 120 + target organ damage

detailed in the 2017 ACC/AHA/AAPA/ABC/ACPM/AGS/APhA/ASH/ASPC/NMA/PCNA Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults: A Report of the American College of Cardiology/American Heart Association Task Force on Clinical Practice Guidelines.³

The oral healthcare provider’s role in measuring blood pressure

The dentist is responsible for several management considerations associated with patient with HTN. These include: identification of those with undiagnosed disease (screening) with referral for appropriate medical assessment; detection and identification of irregularities and abnormalities associated with control of disease; support of lifestyle and compliance to assist medical management of disease; determination of need for stress/ anxiety reduction; identification of possible drug interactions, and; identification and management of adverse drug effects.

Adults are generally more likely to have a dental appointment than they are to go to a physician’s office. This puts the oral health care provider in an ideal position to screen asymptomatic individuals for potential health issues. Screening tests are conducted to assess the risk of developing disease among individuals who present with no clinical signs or symptoms of disease. It is not the role of the dentist to diagnose systemic disease, but oral healthcare providers can screen for those at risk for the disease by putting together data from the screening tests with the medical history, symptoms and family history. If a dental patient is identified as high risk for HTN, he/she should be referred to their physician for follow- up. Early identification of these individuals allows early diagnosis, initiation of intervention and/or treatment, and the potential for reduction in disease-specific morbidity and mortality. Abnormal BP detected in a patient receiving therapy may identify resistance to treatment, or low compliance. They should also be referred to their physician.

Routine BP measurement is the recommendation of the American Dental Association and the National Heart, Blood and Lung Institute (NHLBI). Minimally, blood pressure measurements should be obtained on all new patients and at recall examinations. Individuals with a history of HTN who are either non-compliant with medications or poorly controlled, as well as those with comorbid conditions (for example stroke and/or cardiovascular disease) require more frequent monitoring. Measuring BP helps fosters a better patient-provider relationship in the dental office, with many informed patients now expecting providers to record BP during the course of their dental visit.

How to measure blood pressure

Because the new definition of HTN is lower (130/80), more people will be classified as having HTN. Therefore, it is imperative that measurements be performed properly. When BP is measured in the dental setting it reflects what is happening at one instance in time. There are many factors that may influence the blood pressure measurements.

The dentist and/or any appropriately trained auxiliary in a dental office may measure BP and record this data. Patients should abstain from smoking, exercising and consuming caffeinated beverages for at least 30 minutes prior to taking the reading. Ideally, the BP is measured after the patient has rested comfortably for at least 5 minutes in a seated position with their feet on the floor. If measurements are obtained while a patient is seated in the dental chair, their legs should be uncrossed, and patients should not talk while measuring the BP.

The patient’s arm should be abducted, slightly flexed, and supported by a smooth, firm surface. The brachial artery from which the blood pressure is to be recorded should be at a level with the heart. Arm level and degree of support/lack of support can significantly affect the measurements (see Table 3). For example, if the arm is unsupported, the BP may be elevated by 5-11 mm Hg due to added hydrostatic pressure induced by gravity.

Table 3 - Factors that contribute to errors in blood pressure⁴

Type	Factor	Systolic (mmHg)	Diastolic (mmHg)	Duration
Patient	Heavy physical exertion	↓ 18-20	↓ 7-9	1 hour
	Daily stress	↑ 10	↑ 15	Several minutes
	Distended bladder or bowel	↑	↑	
	Eating a big meal	↓ 20	↓ 20	
	Caffeine	↑ 10-14	↑ 10-14	
	Tobacco/nicotine	↑ 6-20		30 minutes
Technique	Arm height not at heart level	↑ 8	↑ 8	
	Arm not supported	↑ 6-10	↑ 5-11	
	Rapid cuff deflation	↓ 10	↓ 10	
	Cuff size too small	↑ 10	↑ 2-8	
	Cuff size too large		↓ 3	

When measuring BP, the manual method requires auscultation of the blood pressure, whereas an automated system depends on oscillometric devices. Each technique consist of a compressor cuff containing of an inflatable rubber bladder enclosed in an inelastic covering and the pressure source consisting of a rubber hand bulb and pressure control valve. An appropriately sized cuff should cover 2/3 of the biceps; its bladder should be long enough to encircle >80% of the arm and should have a width that equals at least 40% of the arm's circumference. Children require smaller cuffs and obese individuals require larger cuffs. The use of an inappropriately sized cuff may lead to erroneous BP measurements (**Table 3**).

The deflated compression cuff is applied snugly around the arm. The lower edge of the cuff should be 2-3 cm above the ante-cubital fossa. The radial pulse is palpated while the compression cuff is inflated to about 30 mm Hg above the pressure at which the radial pulse is no longer palpated. The cuff is then deflated at a rate of 2-3 mm Hg per heartbeat. The level of pressure at which the pulse in the radial artery returns is noted and recorded as the SBP. The DBP is the pressure recorded when the sounds disappear.

Abnormal blood pressure reading may be attributed to several patient factors; technique errors as well as the type of device being used (**see Table 3**). One should avoid measuring BP in an arm if it has an arteriovenous fistula for hemodialysis or if lymphedema is present following a mastectomy. The clinician must be aware that BP may vary between a patient's dominant and non-dominant arms. If you need to re-measure the BP, you should wait for 1 minute before taking the next reading.

Devices

A mercury-gravity manometer consists of a uniform diameter straight glass tube with a reservoir containing mercury. The pressure chamber of the reservoir communicates with the compression cuff through a rubber tube. When pressure is exerted on the mercury in the reservoir, it falls, and the mercury in the glass tube rises. Since the weight of the mercury is dependent on gravity,

which is constant, a specific amount of pressure will always support a column of mercury of the same height. The mercury-gravity manometer is the most accurate of all BP devices, does not require recalibration, and is the standard for measuring BP.

An aneroid manometer consists of a metal bellows, which is connected to the compression cuff. Variations of pressure within the system cause the bellows to expand and collapse. The movement of the bellows rotates a gear that turns a needle, pivoted on bearings, across a calibrated dial. Since the blood pressure recorded with the aneroid manometer depends upon the elasticity of the metal bellows, it is subject to errors inherent in the elastic properties of metals. For this reason the aneroid manometer must be calibrated against a mercury manometer at regular intervals (yearly).

Automated devices are fine for use by an individual at home to monitor their BP. In the dental office however, they are often too inaccurate to be consistent. Results obtained from these devices have important clinical implications. For example, use of an inaccurate device may falsely indicate that a patient treated for hypertension is now normotensive and requires no further medication adjustment. The dental professional must understand that automated devices placed on the upper arm are less accurate than mercury-gravity and aneroid manometers. Automated devices used on wrists or fingers are even less accurate compared with those used on the upper arm. Devices for the wrists and fingers should be avoided all together in a healthcare setting. Regardless of which device is used, all must be appropriately calibrated and checked regularly for accuracy.⁵

Classification and guidelines for management of high blood pressure

Since 1980, the American College of Cardiology (ACC) and American Heart Association (AHA) have translated scientific evidence into clinical practice guidelines with recommendations to improve cardiovascular health. In December 2017, the ACA

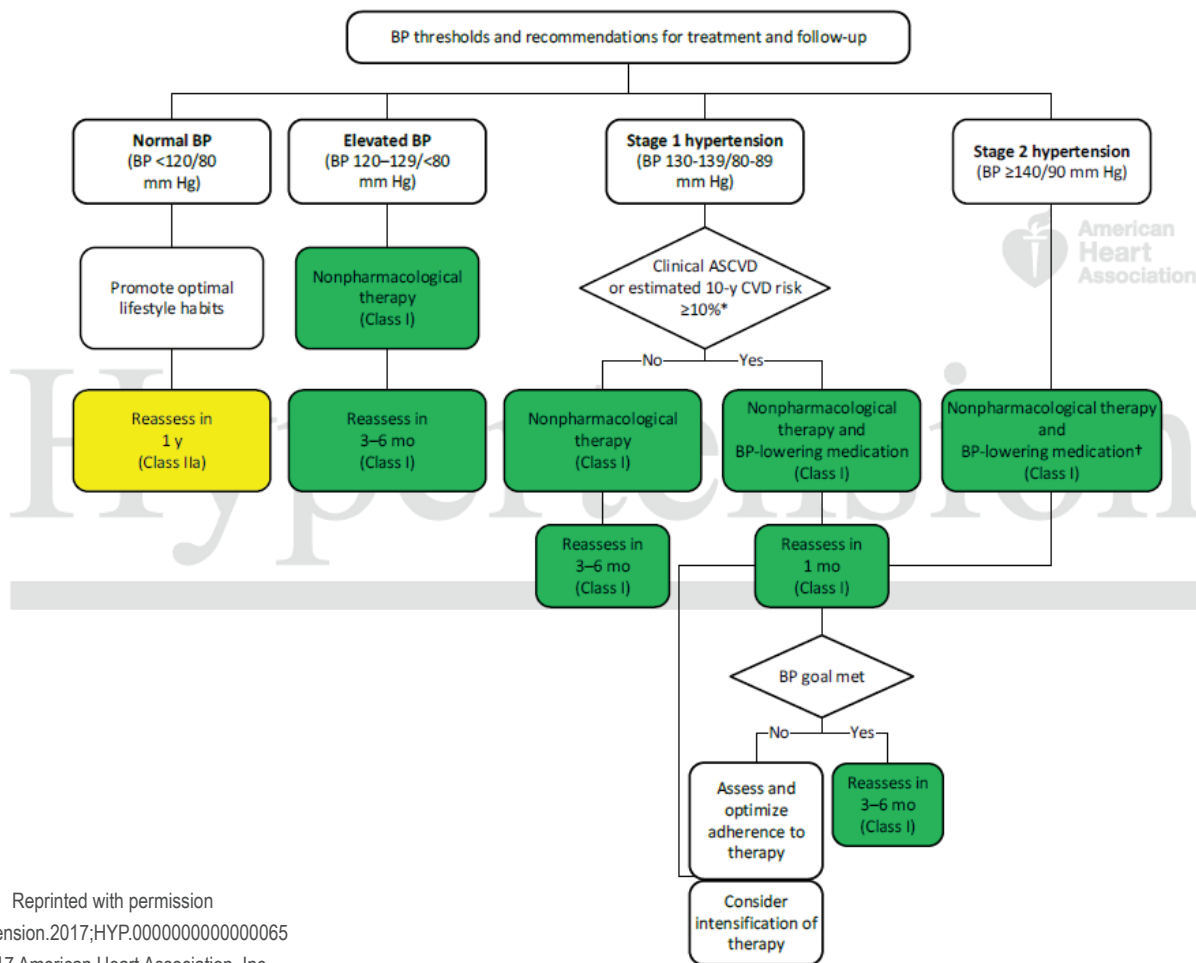
and AHA published Guideline for the Prevention, Detection, Evaluation, and Management of High Blood Pressure in Adults. This guideline is an update of the NHLBI publication, "The Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation and Treatment of High Blood Pressure" (JNC 7) and the 2013, in which the NHLBI Advisory Council recommended that the NHLBI focus specifically on reviewing the highest-quality evidence and partner with other organizations to develop recommendations and is a comprehensive resource for the clinical and public health practice communities.

The main findings of the 2017 guidelines now defines high blood pressure to be anyone with a systolic blood pressure (SBP) \geq 130 mm Hg or diastolic blood pressure (DBP) \geq 80 mm Hg. This means that more patients will be diagnosed with hypertension but by doing so, it may lead to improved blood pressure control and reduce cardiovascular disease (CVD) risk in these patients. There is the understanding that a small percentage of them will be asked to take medications but the majority will be recommended for nonpharmacological interventions with healthy lifestyle changes including use of the Dietary Approaches to Stop Hypertension (DASH) dietary program, weight loss, sodium reductions, increased physical activity and reduction in the consumption of alcohol. Blood pressure thresholds and recommendations are illustrated in **Figure 1**.

Dental treatment for patients with high blood pressure

Although acute adverse events associated with elevated BP are rare in the dental setting, some degree of treatment modifications may be needed for the patient with a history of HTN. These considerations include stress and anxiety reduction, determining possible drug interactions with anesthesia or medications the dentist may use and having an awareness of drug adverse effects and knowledge on how to manage them (**Tables 4 and 5**).

Figure 1 - BP thresholds and recommendations for treatment and follow-up³



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Table 4 - General recommendations based on blood pressure⁶

Blood Pressure	Dental Treatment Alterations	Physician Referral
≤ 120/80	None	None
120-139 / 80-89	None	Encourage MD visit
140-159 / 90-99	None	Encourage MD visit
160-179 / 100-110	Consider intraoperative BP monitoring	Within 1 month
≥ 180/110	Defer elective treatment	As soon as possible, immediately if patient is symptomatic

The American Heart Association and American College of Cardiology assessed cardiac risk during non-cardiac surgical interventions.⁷ They categorized surgical procedures into high (>5%), intermediate (<5%) and low (<1%) risk. General dental procedures would logically be placed within the low risk category using the medical procedures (endoscopic intervention, cataract removal, etc.) in that category as a proxy.

The concept of functional capacity (the ability of the patient to meet the oxygen demands of the tissues when carrying out common daily activities in the presence of disease) is related to surgical stress. This is a valuable concept for the dentist to understand when managing patients with cardiac pathology. Functional stress is based upon the physiology of maximum oxygen uptake and uses treadmill exercise as the benchmarking standard. It is expressed in metabolic equivalents (METs), with one MET equating to meeting the oxygen demand of a 70 Kg, 40 y/o male in the resting state with the absence of symptomology (shortness of breath, pallor, sweating, or chest pain). When daily activities become compromised due to disease, and oxygen demands of the tissues are not being met, the individual is more sensitive to the stress of surgical care and must be managed accordingly.

Combining these concepts (cardiac risk and functional stress), the treated hypertensive patient, with a blood pressure in the normal range, is essentially functioning normally when undergoing routine dental care. As their pharmacologic management becomes more complex and/or end organ sequelae are present, the need to understand the interplay of surgical stress with patient related factors (including functional capacity) becomes greater for the dentist when deciding whether or not to modify their treatment approaches.

Table 5 - General dental management considerations

- ✓ Stress/anxiety reduction - consider need for sedatives or anxiolytics or nitrous oxide
- ✓ Obtain profound local anesthesia, use of moderate amounts of epinephrine is fine
- ✓ Use caution with epinephrine (local anesthesia, retraction cord) if patient uses non-selective β -blockers
- ✓ Slow chair position changes to prevent orthostatic hypotension
- ✓ Be aware of interactions between NSAIDs and ACE inhibitors, diuretics and β -blockers
- ✓ Be aware of gingival overgrowth with calcium channel blocker (nifedipine) therapy; consider improved oral hygiene or consult with MD for possible change of medications
- ✓ Consider periodic intraoperative BP monitoring in patients with Stage 2 hypertension; terminate appointment if >180/110

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POST-TEST

Internet Users: This page is intended to assist you in fast and accurate testing when completing the “Online Exam.” We suggest reviewing the questions and then circling your answers on this page prior to completing the online exam.

(1.0 CE Credit Contact Hour) Please circle the correct answer. 70% equals passing grade.

1. Which of the following statements is **FALSE**?
 - a. Diastolic BP is the force caused by the contraction of the heart.
 - b. Systolic BP is the force caused by the contraction of the heart.
 - c. BP can be measured with both invasive and non-invasive methods.
 - d. BP is an important risk factor for cardiovascular disease.
2. Which of the following blood pressure devices is the **MOST** accurate?
 - a. Mercury gravity
 - b. Aneroid manometer
 - c. Automated readers using the arm
 - d. Automated readers using the wrist
 - e. Automated readers using the finger
3. Operator techniques as well as patient factors can affect BP. Which of the following situations most commonly result in elevated BP?
 - a. Heavy physical exertion
 - b. Rapid cuff deflation
 - c. Cuff size too large
 - d. Daily stress
4. When taking a blood pressure, if the arm is unsupported, the blood pressure:
 - a. Is unaffected compared to if the arm is supported at heart level
 - b. May be decreased by 10-12 mm Hg
 - c. May be decreased by 13-20 mm Hg
 - d. May be increased by 5-11 mm Hg
 - e. May be increased by 13-20 mm Hg
5. Your patient has a BP of 120/80. What is her classification?
 - a. Normal
 - b. Elevated
 - c. Stage 1 Hypertension
 - d. Stage 2 Hypertension
6. Sustained, uncontrolled high blood pressure can cause damage to all of the following organ systems **EXCEPT**:
 - a. Cardiovascular
 - b. Kidney
 - c. Eye
 - d. Brain
 - e. Musculoskeletal
7. What is the most appropriate management recommendation if your patient's BP is 175/105?
 - a. No alterations needed
 - b. Consider intraoperative BP monitoring
 - c. Defer elective treatment
 - d. No restriction other than using retraction cord without epinephrine
8. There are potential drug/drug interactions associated with the concomitant use of NSAIDs and ACE inhibitors.
 - a. True
 - b. False
9. Incorrect assessments of BP is associated with all of the following **EXCEPT**:
 - a. Wrist monitor
 - b. Caffeine intake within 30 minutes of the measurement
 - c. Talking while measurement is being obtained
 - d. Sitting upright with feet flat on the floor
10. Blood pressure should be obtained for all of the following **EXCEPT**:
 - a. All new patients
 - b. All recall patients
 - c. At every dental visit
 - d. All patients prior to surgical procedures

