

Assessing the risk of Hepatitis Transmission in Dental practice

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Abstract

Viral hepatitis is a major global public health concern and remains a leading cause of liver cirrhosis and hepatocellular carcinoma. Research available through PubMed, the National Institutes of Health (NIH), the World Health Organization (WHO), and the American Dental Association (ADA) shows that dental healthcare professionals have an increased occupational risk of exposure to hepatitis viruses. Routine dental procedures frequently involve contact with blood, saliva, and other potentially infectious body fluids. Transmission can occur through direct or indirect contact with contaminated instruments, needle-stick injuries, blood splashes, droplets, and aerosols generated during dental treatment. The effective infection prevention depends on strict adherence to standard infection control practices. These include proper sterilization and disinfection of dental instruments, consistent use of personal protective equipment, safe handling and disposal of sharps, and complete hepatitis B vaccination of all dental personnel. A major part of the universal precautions for reducing the risk of hepatitis transmission is to treat all patients as potential carriers of blood-borne pathogens.

Keywords: Hepatitis, dentists, transmission, prevention

Introduction

Viral hepatitis is one of the world's most important public health challenges. Hepatitis B Virus (HBV) and Hepatitis C Virus (HCV) continue to cause chronic infection in hundreds of millions of people, leading to cirrhosis, liver cancer and over 1 million premature deaths each year, even though both infections are preventable and treatable, globally in 2024, there were an estimated 1.1 million HBV-related deaths and 2,40,000 HCV-related deaths [1, 2]. Together, HBV and HCV account for over 95% of global mortality caused by viral hepatitis, with Hepatitis A Virus (HAV), Hepatitis D Virus (HDV), and Hepatitis E Virus (HEV) accounting for the remainder. Globally, HBV is the major causative agent for hepatocellular carcinoma. An estimated 250 to 300 million individuals are chronic carriers worldwide, with roughly 75% residing in Asia, where regional seroprevalence ranges from 8% to 15% [1, 2].

Viral hepatitis is transmitted through different routes: HBV, HCV, and HDV spread through infected blood and body fluids, whereas HAV and HEV spread via the fecal–oral route through contaminated food or water. Additionally, HBV can be transmitted perinatally from mother to child and horizontally through close contact involving exposure to infected blood or body fluids [1, 2]. HBV is the most efficiently transmissible of bloodborne viruses, thereby posing a substantial occupational risk to healthcare workers [11]. Additionally, it can harbor the Hepatitis D Virus (HDV), which can result in a highly virulent infection [33]. This Delta hepatitis infection is primarily transmitted via blood or blood products. Healthcare workers are frequently exposed by a mucosal-cutaneous or percutaneous route to accidental contact with human blood and other potentially infectious biological materials while carrying out their occupational duties [11, 12, 26]. Approximately 3 million healthcare workers per year suffer an occupational injury. According to a meta-analysis, the yearly incidence of percutaneous injuries is the highest among health care workers in dental settings in Asia at a rate of 54.8% putting dental personnel at a greater risk of acquiring occupational infections in comparison to other health care workers [11]. Injuries in dental offices happen because of confined space, frequent patient movement, and various sharp instruments. HBV infection is a primary occupational hazard in dentistry, as procedures involving blood, saliva, sharps, and aerosols elevate cross-infection risks [3, 4, 12, 26]. This bidirectional transmission hazard affects both patients and dentists [9, 17, 21]. Given the significant occupational risk of hepatitis B virus infection among dental professionals and the critical role of infection control practices in preventing disease transmission, a comprehensive understanding of HBV epidemiology, transmission, prevention, vaccination, and dental management is essential. This review aims to summarize the current evidence regarding hepatitis B infection with special emphasis on its implications for dental practice. [2, 4, 12]

Hepatitis and dental professionals

Prolonged exposure during high-risk procedures increases the chances of transmission of blood-borne viral infections [11, 12]. Reusing local anesthetic syringes following recapping, and cleaning instruments were the two most important causes of needlestick injuries in dental students and dental hygienists [6]. In a dental office, infections can be accelerated through three primary routes: direct contact with blood, oral fluids, or other secretions; indirect contact with contaminated instruments, operatory equipment, or environmental surroundings; and contact with airborne contaminants present in either droplet splatter or aerosols of oral and respiratory fluids [11, 12, 26]. HBV infection is the most important infectious occupational hazard in the dental profession. Several reports suggest a significantly higher incidence of HBV infection among dental staff, especially oral surgeons, periodontists, and endodontists [6, 9, 20] highlighting historic risks of provider-to-patient and patient-to-provider transmission during invasive surgical procedures [15, 16, 17]. Exact global estimates of the number of dentists who have contracted or encountered hepatitis are not tracked in a single worldwide census. However, regional studies show that lifetime exposure to the hepatitis B virus among dental workers ranges from 18% to over 20%, and occupational needlestick or sharps injuries occur in roughly 45% of dental staff annually [6, 10, 20].

Intraorally, the greatest concentration of hepatitis B infection is the gingival sulcus and oral fluid exudates [27, 28]. In Egypt, patients with periodontal disease showed a higher detection rate of HBsAg, anti-HBc, anti-HCV or both anti-HCV and/or anti-HBc in whole unstimulated saliva than the controls [23]. Vectors of infection with HBV in

periodontal practice are blood, saliva, and nasopharyngeal secretions. Also, periodontal disease, severity of bleeding, and poor oral hygiene is said to be associated with the risk of HBV [29, 30]. Most HCV patients (77%) had higher HCV RNA levels in their gingival sulcus than in their saliva and on their toothbrush. This fact could be a theoretical risk of infection by sharing these objects with their household members [28]. Most dentists were unwilling to treat virus-infected people [5, 6].

Blood is very often found in the aerosols produced by dental equipment such as an ultrasonic scaler or other high-speed equipment. Ultrasonic scaling is associated with increased air contamination levels, confirming the results reported by several other studies showing that this procedure is the major source of airborne contaminants in dentistry [34]. Previous research demonstrated that rinsing with an antiseptic mouthwash produced a 94.1% reduction in airborne contaminants, compared to non-rinsed controls. Hence, high-volume suction evacuators and pre-procedural oral rinses would prevent air contamination [26, 28].

General surgery, dental procedure, and dilation and curettage are factors most strongly associated with HCV seropositivity, indicating unsafe medical procedures followed in Pakistan. Research conducted in the Kashmir valley demonstrates an elevated Sero-frequency of hepatitis B and C among patients, with a study by Latoo et al. pointing to dental malpractice as a major contributor to cross-infection. For these HBV- and HCV-positive individuals, notable risk factors include a history of dental extractions and blood transfusions, alongside a high prevalence of dental procedures and extensive use of both IV and IM injections. Consequently, adopting proper preventive measures and adhering to strict protocols is imperative to disrupt virus transmission between patients and dental practitioners [14, 22, 24, 25].

Blood exposure accidents (BEAs) are a common occupational hazard among OHCPs, which increases their risk of blood-borne infections with HBV, HCV, and HIV. Needlestick injuries are estimated to be responsible for 39%, 37%, and 4.4% of the infections with HCV, HBV and HIV, respectively, in healthcare workers [11, 12]. Anesthetic needles cause most BEAs during dental treatment. However, incidents with elevators, scalpels, and suture needles cause a higher risk for blood-borne disease transmission, as these instruments are likely to be contaminated with more blood compared with anesthetic needles [12, 19, 26]. In a Japanese university hospital, the average yearly number of needlestick injuries was 6.77 per 100,000 patients between 2002 and 2020. BEAs are most likely under-reported [11, 20]. Therefore, the incidence of BEAs among OHCPs in private dental practices remains unclear. In the general hospital setting, it is still not known exactly how many work-related needlestick injuries occur in India each year; however, estimates indicate that 600,000–800,000 such injuries occur annually in the USA and around half of those go unreported. Data from the EPINet system suggest that in an average hospital, workers incur approximately 30 needlestick injuries per 100 beds per year [5, 7, 12, 21].

Within the local clinical environment, the role of dental surgeons and laboratory technicians in spreading hepatitis warrants significant attention, emphasizing the fundamental duty of clinical teams to strictly follow established sterilization and decontamination protocols to minimize viral transmission [4, 12, 26].

Studies have shown that of the HCWs who sustained injuries from needles contaminated with blood containing HBV, the risk of developing clinical hepatitis varies as follows: [2, 11, 12]

Serological status of the source	Risk of developing clinical hepatitis (%)	Risk of developing serological evidence of HBV infection (%)
HBsAg positive HBeAg positive	22-31	37-62
HBsAg positive HBeAg negative	1-6	23-37

Figure 1: Risk of Hepatitis B Infection Based on Source Serological Status

Prevention

Prevention of exposure is the primary strategy to reduce the risk of occupational blood-borne pathogen infections in healthcare workers (HCWs) [11, 12]. All measures should be taken to prevent HCWs from acquiring infection [11]. They should also be made aware of the importance of reporting an exposure, and they should have ready access to expert consultants to receive the appropriate counseling, treatment, and follow-up [11, 12]. Vaccination against HBV and proof of immunity prior to employment are strongly recommended [2, 11, 12].

To minimize the impact of hepatitis among dental staff, it is advised that these professionals undergo vaccination against hepatitis viruses and utilize personal protective equipment (PPE), including head caps, masks, and gloves [2, 4, 12].

Despite the availability and recommendations for hepatitis B vaccination, the vaccination rate among dental professionals has remained consistently low in developing countries [5, 6, 20]. A study reported that only 20% of dental surgeons had received three doses of hepatitis B vaccine in Benin City, Nigeria [35]. In another study among Brazilian dentists, 73.8% of them were reported to have three doses of hepatitis B vaccine [36]. It has been found that 5–10% of healthy individuals do not produce the anti-hepatitis B surface antibody (anti-HBs) after receiving a standard course of HBV vaccine [2]. Thus, post-vaccination testing, 1–3 months following the third dose of vaccine, is recommended for HCWs who have contact with blood [2, 11].

Each dental health care facility should develop a comprehensive written program for preventing and managing occupational exposures. This should focus on the following [12]:

- Ensuring that all Dental health care personnel (DHCP) receive three doses of hepatitis B vaccination.
- Defining the type of blood exposures that may place DHCP at risk of infection.
- Outlining the procedures for promptly reporting and evaluating such exposures.
- Identify the qualified health care professional to provide counseling and perform all medical evaluations and procedures in accordance with the most current US Public Health Care Service (CDC) recommendations.

- Providing immediate access to clinical care, serological testing, post-exposure prophylaxis (PEP), and source-patient testing and counseling.

Exposure that might place a dentist at risk of hepatitis infection includes the following [11, 12]:

- Percutaneous injuries (needlestick or cut with a sharp object).
- Mucus membranes of the eye, nose, or mouth or non-intact skin (exposed skin that is chapped, abraded, or afflicted with dermatitis) exposed to contact with potentially infectious blood, tissues, or other body fluids.

Most exposures in dentistry are preventable through the use of standard precautions and engineering controls and modifications of work practice [12, 26]. These approaches might have contributed to the decrease in percutaneous injuries among dentists during recent years. However, needlesticks and other blood contacts continue to occur, which is a concern because percutaneous injuries pose the greatest risk of transmission [11, 12].

When a patient enters a dental clinic, a comprehensive medical history should be recorded. All patients with a history of hepatitis must be managed as they are potentially infectious [3, 4, 13]. Whether an individual becomes a chronic carrier of hepatitis B depends on geographic, socioeconomic, immunological, and genetic factors [1, 33]. A high carrier rate is found among [5, 8, 31]:

- Patients with lepromatous leprosy
- Patients with lymphoma
- Patients on chronic renal dialysis
- Patients with Down Syndrome
- Patients receiving immunosuppressive drugs
- Intravenous Drug Users

The following are the guidelines for treating hepatitis patients [3, 13]:

- Elective dental treatment should be deferred, and only urgent or emergency care should be provided.
- Patients recovering from acute HBV infection carry the virus for up to 3 months after the symptoms have disappeared, so any patient with a recent history of hepatitis B should be treated for dental emergency problems only.
- For patients with a history of hepatitis, consult the physician to determine the type of hepatitis, course and length of the disease, mode of transmission, and any chronic liver disease or viral carrier state.
- Patients fully recovered from HAV or HEV may receive routine dental care without restriction.

For patients with a history of HBV/HDV, it is necessary to conduct thorough HBsAg and anti-HBs serological profiles [2, 3, 13, 33]:

- **Presence of anti-HBs:** This result signifies protective immunity; routine dental care must be provided.
- **Presence of HBsAg:** This identifies a chronic viral carrier state. It is essential to assess the potential for transmission through **HBeAg screening and the measurement of quantitative HBV DNA viral loads.**

- **Negative for both markers (where infection is suspected):** One should re-examine the HBsAg status or request a total anti-HBc test to rule out potential occult HBV infections.

If a patient with active hepatitis, positive-HBsAg (HBV carrier) status, or positive HCV status requires emergency treatment, use the following precautions:

- Consult the patient's physician regarding systemic stability and liver function [3, 13].
- If bleeding is likely during or after treatment, measure the PT/ INR ratio and bleeding time. Hepatitis may alter coagulation; change treatment accordingly [3, 31, 32].
- All personnel in clinical contact with the patient should use full barrier techniques, including masks, gloves, glasses or eye shields, and disposable gowns [4, 12, 26].
- Use as many disposable covers as possible, covering light handles, drawer handles, and bracket trays. Headrest covers should also be used [4, 12].
- All disposable items (e.g., gauze, floss, saliva ejectors, masks, gowns, gloves) should be placed in a lined wastebasket. After treatment, these items and all disposable covers should be bagged, labeled, and disposed of, following proper guidelines for bio-hazardous waste.
- Aseptic techniques should be followed at all times. Minimize aerosol production by not using ultrasonic instrumentation, air syringe, or high-speed handpieces. Remember that saliva contains a transudate of the virus. Pre-rinsing with chlorhexidine gluconate (0.12%) for 30 seconds is highly recommended [26, 28].
- When the procedure is complete, all equipment should be scrubbed and sterilized. If an item cannot be sterilized or disposed of, it should not be used [4, 12, 16].
- All clinical contact surfaces must be disinfected using EPA-registered intermediate-level hospital disinfectants (e.g., sodium hypochlorite). High-level disinfectants such as glutaraldehyde should never be used as surface wipes [12, 26].

Work practice controls are an important adjunct for preventing blood exposure. They are as follows [12, 26]:

- Recap needles using a one-handed scoop technique, a mechanical device designed for holding the needle cap, or an engineered sharp injury protection device.
- Do not bend or break needles before disposal.
- Avoid passing a syringe with an unsheathed needle and provide a verbal warning.
- Remove burs before disassembling the handpiece from the dental unit.
- Use instruments (tissue retractors or forceps) rather than fingers to grasp needles, retract tissue, and load/unload needles and scalpels.
- Place used disposable syringes and needles, scalpel blades, and other sharp items in appropriate puncture-resistant containers located as close as feasible to where the items were used.

The risk of hepatitis in dental practice can be decreased by wearing good quality gloves. Moreover, the use of double gloves can decrease the risk of needle pricks by up to 70%. A review of surgical glove perforations showed outer-glove punctures in 25.6% of cases and inner-glove punctures in 10%. Inner-glove perforations occurred only during

surgeries exceeding two hours, always accompanied by an outer-glove puncture, and were mostly located on the non-dominant hand index finger and thumb [18, 19].

Moreover, endoscopic procedures and no-touch techniques reduce the chance of blood contact during operations. Similarly, frequently replacing gloves during exposure to prolonged procedures can provide further protection [18, 19]. The employment of protective eyewear, specialized goggles, or surgical helmets is essential to prevent the mucosal contact of blood splashes with the eyes. The meticulous management and safe disposal of contaminated equipment are equally important [4, 12].

Ultimately, risk assessment, comprehensive serological screening, and adherence to infection control protocols are essential to mitigate occupational cross-infection in dental practice [2, 3, 4].

Post-Exposure Prophylaxis (Pep)

PEP is the guideline given by the World Health Organization for prevention of infection if there was risk of contact with potentially hazardous materials. Mandatory protocol PEP is implemented in six steps discussed below [11, 12].

Step one: Treatment of the site of exposure

The site of exposure to potentially infectious fluids should be washed as soon as possible using soap and water only, while the exposed mucous membranes should be washed with water only. Eyes should be flushed with water and saline solutions (if there is contact with potentially infectious fluids). Do not use caustics and do not rinse the wound with antiseptics and disinfectants [11, 12].

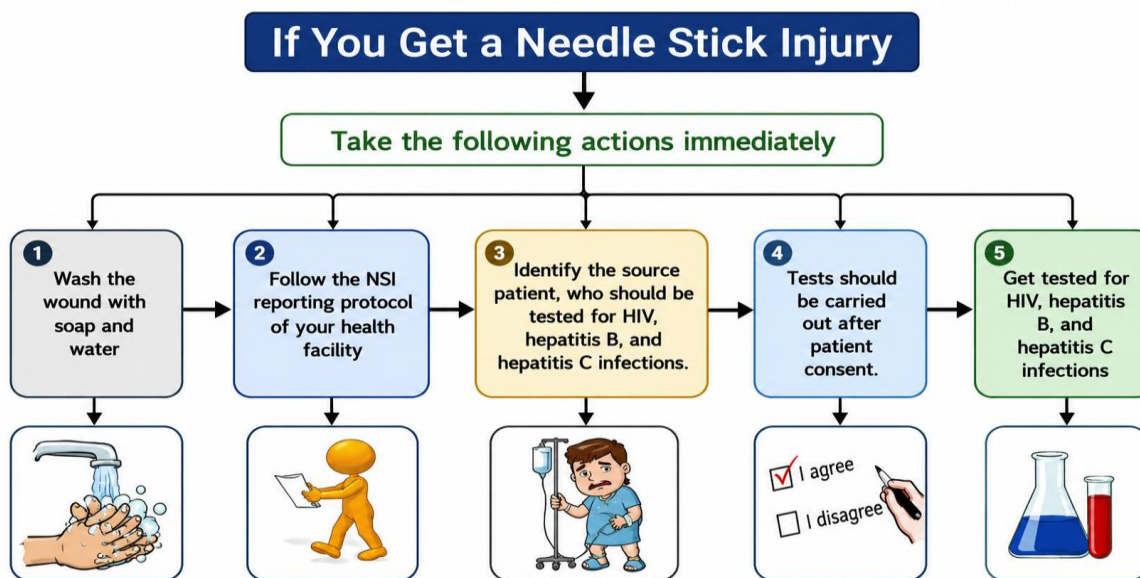


Figure 2: Recommended Steps Following Occupational Needle stick Injury

Step two: Report and documentation

Occupational exposure should be reported immediately. Details regarding the circumstances under which the exposure happened and any prophylaxis administered to the employee should be recorded in the employee's medical record. The documentation should include: Date and time of exposure, details of the accident (where and how the exposure happened, what was the site or sites of exposure on the body, if the exposure was associated with a sharps – type and brand of sharp), details of exposure accident (type and amount of fluid or material a person was exposed to), severity of injury (or different kind of exposure), and details about the source of infectious material. The following should be checked [11, 12]:

- Does the source of potentially infectious material have HBV, HCV, or HIV infection?
- If the source patient is a known positive, the stage of disease or the level of infectious particles in the blood should be determined.
- It is important to note the history of taking antiretroviral therapy, or antiretroviral resistance (if known).
- It is necessary to record the details of the exposed person (HBV vaccination, the response to vaccination, other medical conditions and medications used, existence of pregnancy or lactation).

Step three: Evaluation of exposure

The potential for spreading the infection of HBV, HCV, or HIV should be evaluated based on the type of infective material, the site of entry of material into the body of the exposed person, and the severity of exposure. Significant exposure may be a risk for further transmission of pathogens by blood and requires further evaluation of body fluids: Blood, semen, vaginal secretions, cerebrospinal, synovial, pleural, peritoneal, pericardial, and amniotic fluid. Body fluids that do not present the risk of transmitting infectious agents of this type, unless they clearly contain blood, are urine, sputum, saliva, stool, vomit, nasal secretions, tears, and sweat [11, 12].

Step four: Evaluation of sources

When the patient source of infectious material is known, it is necessary to follow these:

- Test the patient for HBsAg, HCV, and HIV antibodies.
- Evaluation of “viral load” (the level of infectious particles in the blood) for routine control of a patient source is NOT recommended.

If the patient is NOT infected with either of these viruses, after primary testing of the exposed person, further control monitoring is not required.

When the patient's source is not known, it is necessary to evaluate the risk of exposure. When assessing the likelihood of source-patient infection, factors related to the exposure setting should be considered, such as: What is the prevalence rate in the community? Does the clinic, where the exposure happened, treat a great number of infected or high-risk patients? Do not test the wasted needles for these pathogens because the reliability of obtained results is not known [11, 12].

Step five: Specific prophylaxis

Primary testing of all exposed persons to HBV, HCV, and HIV should be done after each exposure to potentially infectious fluids. If the exposed person had a previous infection caused by any of those viruses and did not know about it, he/she should receive the antiviral treatment rather than prophylaxis [2, 11, 12].

Step six: Control monitoring

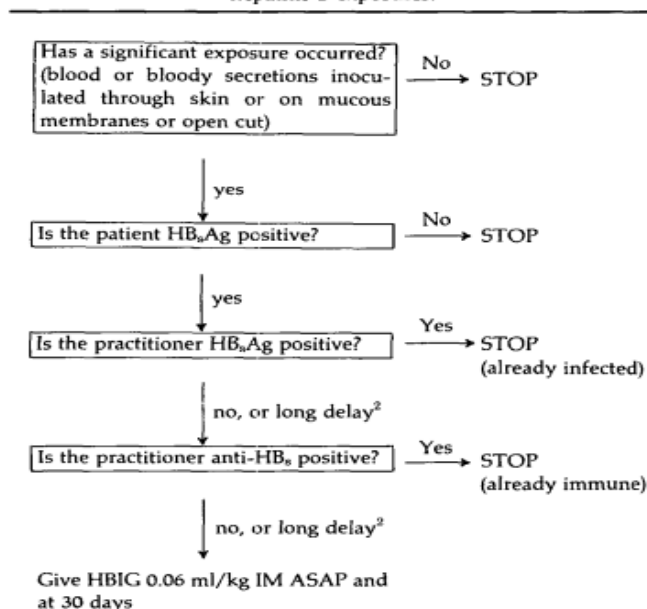
If any medical staff were exposed to hepatitis, it would be necessary to initiate post-exposure evaluation, serological monitoring, and clinical follow-up in accordance with the standard management guidelines [11, 12].

HBV management:

- HCWs previously immunized need not undergo PEP.
- Unvaccinated personnel should receive Hepatitis B Immune Globulin (HBIG) as soon as possible, along with initiating the hepatitis B vaccine series [2, 11, 12].
- Testing for anti-HBs antibodies should be performed 1 to 2 months after the final dose of the vaccine series [2, 11].
- Anti-HBs antibodies cannot be tested 6–8 weeks after the administration of anti-HBs immunoglobulin (HBIG) because of the possibility for false-positive results [2, 11, 12].
- exposed personnel should be advised to abstain from donating blood, plasma, organs, tissue, or semen [11, 12].

HCV management:

- Baseline testing for anti-HCV antibodies and alanine aminotransferase (ALT) activity should be performed immediately following exposure [11, 12].
- Follow-up testing for anti-HCV antibodies and ALT should be repeated at 4 to 6 months post-exposure [11, 12].
- For early detection, quantitative testing for HCV RNA should be performed at 4 to 6 weeks post-exposure [11, 12].
- During the testing period, the exposed person must not donate blood, plasma, organs, tissue, or sperm [11, 12].
- Exposed people should abstain from changes in sexual activity, pregnancy, breastfeeding, or professional activities [11, 12].

Table 1. Algorithm for immunoglobulin prophylaxis in dental hepatitis B exposures.¹**Figure 3: Algorithm for Hepatitis B Immunoglobulin Prophylaxis Following Occupational Exposure**

While PEP protocols effectively reduce the risk of viral seroconversion following an accidental exposure, they cannot replace primary prevention. Given that many occupational sharp injuries remain unnoticed or unrecorded in daily clinical practice, comprehensive pre-exposure vaccination and rigid compliance with engineering and work-practice controls remain the foundation of occupational safety in dental practice [2, 11, 12].

Hepatitis Vaccine

To decrease the burden of hepatitis in dental health care workers, it is recommended that the dental professionals receive immunization against hepatitis B virus and should use personal protective equipment (PPE) such as gloves, head caps, masks, etc. [2, 4, 12]. Despite the availability and recommendations on hepatitis B vaccination, the vaccination rate among dental professionals has remained consistently low in developing countries. Only 50-60% of dentists are immunized against HBV [5, 6, 20]. India continues to have a substantial burden of chronic hepatitis B and remains among the countries contributing significantly to the global HBV disease burden [1,8]. National reports indicate that only 16-60% of healthcare workers have received complete HBV immunization. Such reports are hampered by inconsistent data coverage and workplace immunization programmes. There are certain population groups like recipients of multiple blood / blood products transfusion, patients on hemodialysis, people who inject drugs (PWID), men who have sex with men (MSM), sex workers, sexual partners of infected people, etc. who are at a higher vulnerability to acquiring hepatitis infection [5, 8].

Vaccines are available to prevent Hepatitis A and Hepatitis B. There are currently no vaccines for Hepatitis C.

Table 1: Vaccination Schedule and Protection Against Hepatitis A and B

Vaccine	Type of Vaccine	Dosage/Schedule	Protection
Hepatitis A	Inactivated (killed virus) vaccine	2 doses , given 6–12 months apart	Prevents Hepatitis A infection and is highly effective.
Hepatitis B	Recombinant (protein-based) vaccine	3 doses at 0, 1, and 6 months. In India, newborns should receive the first dose within 24 hours of birth.	Prevents Hepatitis B infection and reduces the risk of liver cirrhosis and liver cancer.

How Many Cases Can Be Prevented?

- *Hepatitis B vaccination is highly effective, providing protective immunity in more than 95% of immunocompetent individuals who complete the recommended vaccination schedule.* [1,2]
- Hepatitis A vaccine is also highly effective and provides long-term protection against hepatitis A infection.

The Hepatitis B vaccine is included in India's Universal Immunization Programme (UIP) for infants.

National guidelines also recommend that all healthcare workers, including doctors, nurses, laboratory staff, dental professionals, students, housekeeping staff, and others with occupational exposure, should receive the complete Hepatitis B vaccination series if they are not already immune.

Hospitals are encouraged to have vaccination and post-exposure management policies to protect healthcare workers [1, 2, 12].

Dental Public Health Significance

Beyond chairside safety at individual dental clinics, HBV and HCV pose a dental public health challenge. From a community point of view, clinician compliance is insufficient to prevent the risk of cross infection. It requires a population level surveillance, national policies, and structural infection control [35, 36]. Healthcare systems must employ immunization programmes, transparent post exposure reporting protocols, and routine institutional infection control inspections, both across public and private dental units [35, 36]. Moreover, oral HCWs mostly treat undetected viral carriers; oral mucosal examinations and viral screenings must be integrated into dental community health programmes [35, 36]. This will not only prevent the risk of transmission but also provide a strategic command over early case identification. Positioning dental personnel as active participants in public health surveillance bridges the gap between chairside hepatitis prevention and global viral elimination.

Conclusion

World Hepatitis Day, observed on 28th of July, provides a global platform for healthcare leaders and the public to raise awareness and find advance strategies to eliminate Hepatitis infection; however, annual observances alone are not enough. The media plays a prominent role by collaborating with worldwide experienced gastroenterologists, hepatologists, general surgeons, dental surgeons, and infectious disease specialists; to develop Public Health Education materials.

Dental professionals who face an elevated risk of transmission must treat every patient as potentially infectious by strictly abiding the standard infection control protocols and rigorous instrument sterilization. Ultimately, vigilance, complete occupational immunization, and universal barrier precautions remain vital to controlling viral hepatitis transmission in dental settings.

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