Blood Products
What Oral and Maxillofacial Surgeons Need to Know

Regina L. Landesberg, DMD, PhD[a],
Elie M. Ferneini, DMD, MD, MHS, MBA[b,c,d,*]

KEYWORDS

• Fibrinogen concentrate • Transfusion complications • Anti-inhibitor coagulant complex
• Prothrombin complex concentrates • Cryoprecipitate • Fresh frozen plasma • Red blood cells
• Platelets

KEY POINTS

- Blood products are routinely used to manage various coagulation and hematological disorders.
- Oral and maxillofacial surgeons must have a basic knowledge and understanding of the various available products.
- A consultation with each patient's hematologist is always advised in order to decrease the risk of adverse events and improve the patient's safety.

INTRODUCTION

Blood products are used in the management of multiple coagulation disorders. However, there is a debate in the medical literature concerning the appropriate use of blood and blood products. Clinical trials investigating their use suggest that waiting to transfuse at lower hemoglobin levels is recommended.[1,2] Different products are available. A proper knowledge and understanding of the different blood products allows clinicians to optimize their patients' clinical outcomes.

RED BLOOD CELLS

Packed red blood cells (RBCs) are prepared from whole blood by removing 250 mL of plasma. One unit of packed RBCs should increase hemoglobin levels by 1 g/dL and hematocrit by 3%. In most areas, packed RBC units are filtered to reduce leukocytes before storage, which limits febrile nonhemolytic transfusion reactions, and are considered cytomegalovirus safe.[3]

RBC transfusions are used to treat hemorrhage as well as improve oxygen delivery to tissues. Transfusion of RBCs should be based on the patient's clinical condition.[4] Indications for RBC transfusion include:

- Restoration of oxygen-carrying capacity in case of acute hemorrhage: acute blood loss (>1500 mL or 30% of blood volume)
- Treatment of symptomatic anemia
- Prophylaxis in life-threatening anemia
- Exchange transfusion in different diseases, including:
  - Acute sickle cell crisis
  - Severe parasitic infection (malaria, babesiosis)
  - Severe methemoglobinemia
  - Severe hyperbilirubinemia of newborn

[a] Private Practice, Greater Waterbury OMS, 1389 West Main Street, Suite 320, Waterbury, CT 06708, USA; [b] Private Practice, Greater Waterbury OMS, 435 Highland Avenue, Suite 100, Cheshire, CT 06410, USA; [c] Beau Visage Med Spa, 435 Highland Avenue, Suite 100, Cheshire, CT 06410, USA; [d] Division of Oral and Maxillofacial Surgery, Department of Craniofacial Sciences, University of Connecticut, 263 Farmington Avenue, Farmington, CT 06030, USA
* Corresponding author. Beau Visage Med Spa, 435 Highland Avenue, Suite 100, Cheshire, CT 06410.
E-mail address: eferneini@yahoo.com

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Recommended dosage and administration include:

- One unit of RBC increases the hemoglobin level of an average-sized adult by ~1 g/dL (or increases hematocrit ~3%)
- The ABO group of RBC products must be compatible with the ABO group of the recipient
- Ideally, the RBC product must be serologically compatible with the recipient
- Rate of transfusion
  - Transfuse slowly for the first 15 minutes
  - Complete transfusion within 4 hours (per US Food and Drug Administration [FDA])

The authors recommend transfusion when the hemoglobin level is less than 7 g/dL, and maintenance of a hemoglobin level between 7 and 9 g/dL.[1] Restrictive transfusion has been used since the late 1990s in most patients who do not have cardiac disease. An updated Cochrane Review supports the use of restrictive transfusion in patients without cardiac disease.[5] A randomized, multicenter, controlled clinical trial evaluated a restrictive transfusion trigger (hemoglobin level of 7–9 g/dL) versus a liberal transfusion trigger (hemoglobin level of 10–12 g/dL) in patients who are critically ill. Restrictive transfusion resulted in a 54% relative decrease in the number of units transfused and a reduction in the 30-day mortality. Another study compared restrictive with liberal transfusion and found similar results. The study showed that patients in the restrictive transfusion group received 44% fewer blood transfusions and there was no difference in rates of multiple organ dysfunction syndrome or death.[2] This type of transfusion is also helpful in stable pediatric patients in the intensive care unit.[2]

PLATELETS

In the United States, platelets are prepared by either apheresis or concentration of a whole-blood donation. Whole blood–derived platelet concentrates are prepared using the platelet-rich plasma method of double centrifugation with a resulting concentration of approximately 5.5×10^{10} platelets in 50 mL of plasma. The usual adult platelet transfusion pools 4 to 6 packs of whole-blood platelet concentrates. Apheresis units are obtained from a single platelet donor using an automated centrifugation unit that processes a high volume of blood. A typical apheresis unit should contain a minimum of 3×10^{11} platelets; the equivalent of 6 packs of pooled platelets. Apheresed platelet preparations are considered a leukoreduced blood product because they contain less than 5×10^6 white blood cells (WBCs) per unit.[6,7]

There are some minor advantages of apheresed platelets compared with whole blood–derived concentrates, most notably a longer survival time in the circulation,[8] which may be caused by gentler handling during preparation. Theoretically, there is less of a risk of viral transmission from apheresed platelets because apheresis units are derived from a single donor, whereas whole-blood platelet concentrates are pooled from 5 random donors. Improvements in screening blood donors have brought the risk of hepatitis B and C, and human immunodeficiency virus (HIV) to a minimum; however, bacterial contamination of platelet preparations has remained constant,[9] most likely because platelets, in contrast with other blood components, must be stored at room temperature because refrigerated platelets are cleared very rapidly from the circulation. However, room temperature storage increases the risk for bacterial growth. Limiting platelet holding time to only 5 days in most facilities is recommended.[10]

Although it was thought that apheresis platelets would elicit less exposure to alloantigens, and hence less alloimmunization, than pooled platelet preparations, clinical data did not support this hypothesis, possibly because platelet surface antigens are poor immunogens and the alloimmune response is caused by contaminating WBCs in the platelet preparation. Therefore, the use of leukoreduced platelets is likely to prevent this complication.[11]

Transfusion-related acute lung injury (TRALI) is associated with blood components that contain higher amounts of plasma, such as fresh frozen plasma (FFP) and platelets. The presence of donor anti–human leukocyte antigen (anti-HLA) (or less commonly antineutrophil) antibodies seems to precipitate this acute respiratory distress syndrome. Because a third of female blood donors have anti-HLA antibodies because of sensitization during pregnancy, it is tempting to limit platelet donations to only male patients in order to decrease the risk of TRALI from platelet transfusions. Although the production of FFP in the United States and several other countries is from male-only donors, assurance of adequate platelet supplies makes it necessary to continue to allow female donors.[9]

Platelet transfusions are currently used for prevention and treatment of bleeding in thrombocytopenic patients or in individuals with various platelet dysfunctions. A recent set of recommendations for platelet transfusions was established by the American Association of Blood Banks Task Force as well as the American Society of Anesthesiologists Task Force on Blood Component Therapy. However, clinical trials supporting these recommendations are lacking. The recommendations are shown in **Table 1**. Although the duration of