This article reviews the history of the postoperative nutrition recommendations for today’s common bariatric (weight loss) surgery procedures. Discussion of the evolution of postoperative nutrition guidelines supports the proposal for a standardized postoperative diet for patients who undergo a Roux-en-Y gastric bypass or a laparoscopic adjustable gastric band procedure.

Standardizing the Evolution of the Postoperative Bariatric Diet

Kellene A. Isom, MS, RD, LDN

To comprehensively understand the foundation of the postoperative diet for bariatric surgery patients, we must first understand the evolution of surgical procedures for weight loss. This article reviews that evolution, as well as the history behind current postoperative diet recommendations. It will then build on the understanding of how these surgical procedures work and their nutritional implications to explain the reasons for current postoperative diet recommendations. Finally, it will draw on current literature and the author’s clinical expertise to support a proposal for a standardized diet for the Roux-en-Y gastric bypass (RYGB) and laparoscopic adjustable gastric band (LAGB) procedures.

History of Bariatric Surgery

The history of bariatric surgery started in the 1950s, when the first operation was performed as a jejunoileal bypass (JIB). In this procedure, the stomach was left intact, and weight loss was achieved through severe malabsorption via bypass of the intestines. The JIB resulted in many complications such as malnutrition, osteoporosis, micronutrient deficiencies, and bacterial overgrowth in the bypassed intestines. Most of these procedures were reversed, but they taught important lessons about the impacts of long-term malabsorption and the need for nutritional follow-up.

Then, in the 1960s, Mason and Ito developed the gastric bypass. Some complications were still observed, however, and to reduce these, the vertical banded gastroplasty (VBG) procedure was developed in the 1970s. This procedure used mechanical staplers to create gastric restriction, thus creating a pouch with a mesh band around the outlet of the pouch. VBG complications and micronutrient deficiencies were lower compared to the JIB and gastric bypass. However, this procedure became less utilized because the long-term weight loss associated with it was lower than that of the gastric bypass procedure.

As focus shifted to creating a surgical procedure that would yield greater weight loss, the first biliopancreatic diversion (BPD) surgery was performed by Scopinaro as a safer malabsorptive procedure than the JIB. This procedure resulted in greater weight loss than the VBG or the gastric bypass performed by Mason and Ito.

Next, a procedure called the duodenal switch (DS) was created in 1986 by Hess as a modified BPD to decrease ulcers, increase gastric restriction, and reduce the incidence of malnutrition and dumping syndrome, a complication seen in some bariatric procedures. Dumping syndrome only occurs in RYGB patients and results from the lack of the pyloric sphincter. Dumping syndrome occurs after consumption of foods with a high sugar and carbohydrate content, which create a hypertonic solution in the jejunum. This hypertonic solution leads to sudden distension of the jejunum, resulting in symptoms of early dumping syndrome such as nausea,
As the balloon is inflated through a small, subcutaneous port, the band is tightened, and the volume of food intake decreases. The LAGB has a lower mortality rate than the RYGB, but it results in less weight loss.

The VSG, like the LAGB, does not involve a change to the intestinal anatomy. It involves a subtotal resection of the stomach fundus and body to create a long, tubular, or banana-shaped (sleeve-shaped) conduit along the lesser curve of the stomach. The lack of change to the intestinal anatomy is thought to decrease the potential for nutritional deficiencies. Weight loss is significant, but long-term data are lacking. Resulting weight loss and improvement in comorbidities are likely due to restriction and neurohormonal changes.

Mechanisms of Action
From the history of these bariatric procedures, we can simplify them into two categories: restrictive and malabsorptive. However, this simplification fails to capture the complexity of the surgeries currently performed. As the metabolic mechanisms of these surgeries were discovered, particularly in the case of the RYGB, the categorization of these procedures changed in the literature to reflect the categories of the mechanisms of action: gastric restriction, a combination of gastric restriction and neurohormonal influences, and malabsorption. The VBG and LAGB are gastric restrictive procedures, whereas the BPD and DS are malabsorptive procedures. Finally, the RYGB is a combination procedure, a result of gastric restriction from the small gastric pouch and a modulation of gastrointestinal (GI) hormones from the bypassed remnant stomach, duodenum, and proximal jejunum.

It is also important to understand the expected weight loss for these procedures. Weight loss is calculated in the surgical literature as the percentage of excess body weight loss (EWL). Excess body weight is the difference between an individual’s actual weight and their ideal (healthy) body weight. Thus, the average amount of EWL after having the RYGB is 60–70% of this difference in weight. The average percentage of EWL with the LAGB procedure is 40–45%, and that of the BPD and DS is 70–80%. The percentages of EWL seen in early VSG procedures was ~ 50–60%.

In the 1990s, the mechanism of action for weight loss after RYGB was thought to be gastric restriction and malabsorption of macronutrients (with long limb RYGB procedures) and micronutrients. However, as the improvement in comorbidities such as diabetes became evident within a few hours postoperatively, more research into the mechanism of action showed that something more than gastric restriction was playing a role in weight loss.

More evidence also showed the effects of the RYGB on nutritional deficiencies, and the postoperative diet took the spotlight as case studies were presented regarding micronutrient deficiencies, shortly followed by larger studies presenting long-term data on nutritional deficiencies and weight loss outcomes. Support for behavioral changes, grew, and the RYGB became the preferred procedure.

Later, into the early 2000s, studies looked at the long-term nutritional outcomes of patients. The literature then stressed the importance of nutritional interventions and counseling because pre- and postoperative nutrition interventions were shown to positively affect postoperative weight and health outcomes.

To further evaluate the mechanism of weight loss after RYGB, Bobbioni-Harsch et al. suggested that weight loss after RYGB was induced by calorie restriction and not by the macronutrient composition of the postoperative diet. However, caloric restriction was challenged as a mechanism of weight loss because of the variable caloric intake in bariatric surgery patients. In addition, further studies suggested the influence of preoperative weight on postoperative weight loss outcomes.

As changes in appetitive behavior became evident with the RYGB, procedures that were strictly restrictive such as the LAGB were proven to be less effective for appetite and weight control. One theory about the decrease in appetite after RYGB, which was not seen with restrictive procedures, was that the rapid transit of food to the hindgut was thought to decrease appetite. Finally, the effects of ghrelin on appetite were shown to effect appetite and research into gut hormones began to dominate the literature along with more research into the altered absorption of nutrients.

Dizziness, weakness, rapid pulse, cold sweats, fatigue, cramps, and diarrhea 10–30 minutes after eating. Some RYGB patients experience late dumping, which occurs 1–3 hours after a meal as a result of an exaggerated insulin release and reactive hypoglycemia. The BPD and DS worked by causing severe malabsorption of calories and micronutrients but allowed patients to consume a greater volume of food than gastric bypass patients. The BPD and DS required the most intensive forms of nutritional monitoring because they had the highest rates of malabsorption and complications, including fat-soluble vitamin malabsorption, iron deficiency, malnutrition, frequent and foul-smelling bowel movements and gas, and ulcers and dumping syndrome. Because of the intensive nutritional maintenance required for the BPD and DS procedures, surgeons spent much of the 1980s and 1990s improving the gastric bypass, which evolved into the RYGB procedure we know today.

Surgical Procedures
The RYGB involves a subtotal gastrectomy in which the upper part of the stomach is separated from the majority of the stomach to create a small gastric pouch. The lack of the stomach fundus in the gastric pouch prevents the production of hormones that affect neural signals and dumping syndrome. This is connected to the proximal jejunum, creating gastric restriction from the small gastric pouch. The lack of the stomach is separated from the majority of the stomach and proximal jejunum. The jejunum, duodenum, and proximal stomach, duodenum, and proximal jejunal anastomosis. The pouch may remain connected to the remnant stomach, or it may be separated to prevent formation of gastrogastric fistula. This is the procedure involved in the modern laparoscopic RYGB.

Overall, the RYGB results in the complete bypass of the remnant stomach, duodenum, and proximal jejunum, creating gastric restriction and malabsorption of micronutrients. The potential weight loss and improvement in comorbidities are the result of gastric restriction and neurohormonal changes associated with gut hormones that affect neural signals after surgery. Other modern procedures include the laparoscopic adjustable gastric band (LAGB) and the vertical sleeve gastrectomy (VSG). Because the LAGB is a restrictive procedure, weight loss is induced strictly via a decrease in food intake. In this procedure, a silicone band with a balloon inside is placed around the upper part of the stomach.
Table 1 summarizes the various bariatric procedures, their nutritional implications, and their mechanisms of action.

Postoperative Diet
Despite the fact that bariatric surgery has been performed since the 1950s, limited evidence exists regarding postoperative diet recommendations. Current postoperative diet guidelines are based on both the food texture and nutrient needs of patients with the goals of providing adequate energy and nutrients while minimizing symptoms such as dumping syndrome and early satiety. It is important for clinicians working with bariatric surgery patients, and especially registered dietitians (RDs), to help patients transition through these texture-based diet stages, because this progression is necessary during GI tract healing after bariatric surgery.

The most generally accepted postoperative diet for all bariatric procedures is composed of four diet stages, each providing a more advanced form of food texture than the last. The first stage is a clear-liquid diet composed of low-calorie, low-sugar beverages. Patients are started on clear liquids immediately after surgery. These beverages are free of caffeine, carbonation, and alcohol. Once patients are able to consume an adequate volume of clear liquids to stay hydrated (typically 1–2 days), they are advanced to a diet of clear and full liquids composed of high-protein, low-calorie beverages. These full-liquid drinks are also low in sugar to prevent dumping syndrome in RYGB patients.

To prevent dumping syndrome, foods and beverages containing a hypotonic solution should be consumed. For example, clinical experience suggests that sugar consumed in amounts of < 25 g per serving may prevent dumping syndrome. Therefore, foods containing natural sugars, such as dairy and whole fruit, should not be avoided, whereas foods with added sugar (e.g., soda, juice, and frost- ing) will more likely cause dumping syndrome. In addition, separating drinking such hypertonic solutions and consuming food by 30 minutes can help prevent dumping syndrome. Patients are encouraged to consume five 8-oz servings of full-liquid protein drinks, in addition to 48–64 oz of clear liquids to remain hydrated.

Patients will remain on the clear-liquid diet for a minimum of 2 weeks and then slowly transition to a soft-food diet. The texture of the foods in this stage is not only soft, but also includes foods that are moist, minced, diced, ground, or pureed. There is great individuality in tolerance, and patients may remain on soft foods for a few weeks to a few months. They will eventually transition to a solid-food diet, for which the RD will focus on monitoring eating speeds and amounts and encouraging healthy eating for life. In addition, patients must separate solid foods from liquids by waiting at least 30 minutes after consuming solid foods to consume liquids. This is because the heaviness of fluids on top of solid foods in the small gastric pouch can lead to abdominal discomfort and potential stretching of the anastomosis.

In addition to the diet stages above, LAGB patients follow a post-fill protocol, usually starting 6 weeks postoperatively. This involves going back on protein drinks for a few days, then soft foods, before slowly implementing solid foods again after each adjustment to their band. Patients will have consecutive adjustments to the band every 6 weeks until an optimal volume in the band is achieved. This not only prevents complications from an over-tightened band, but also encourages adhesion to the postoperative diet providing a short “get back on track” diet period.

Patients with the LAGB and VSG follow the same diet progression as patients with the RYGB. However, LAGB and VSG patients do not experience dumping syndrome because the pyloric sphincter is left intact in those procedures.

Table 1. Comparison of Bariatric Procedures

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Mechanism of Action</th>
<th>Introduced</th>
<th>Performed Today?</th>
<th>EWL (%)</th>
<th>Nutritional Concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td>JIB</td>
<td>Malabsorptive</td>
<td>1950s</td>
<td>No</td>
<td>N/A</td>
<td>Malabsorption of macronutrients and micronutrients</td>
</tr>
<tr>
<td>RYGB</td>
<td>Combination</td>
<td>1960s</td>
<td>Yes</td>
<td>60–70</td>
<td>Malabsorption/decreased absorption of micronutrients only: iron, vitamin B₁₂, calcium, folate, thiamin; dumping syndrome</td>
</tr>
<tr>
<td>BPD/DS</td>
<td>Malabsorptive</td>
<td>1970s</td>
<td>Yes</td>
<td>60–80</td>
<td>Malabsorption of macronutrients: fats; malabsorption of micronutrients: similar to those with RYGB and fat-soluble micronutrients</td>
</tr>
<tr>
<td>VBG</td>
<td>Restrictive</td>
<td>1970s</td>
<td>No</td>
<td>45–50</td>
<td>Reduced food intake; reduced vitamin/mineral intake, particularly calcium and iron</td>
</tr>
<tr>
<td>LAGB</td>
<td>Restrictive</td>
<td>1990s</td>
<td>Yes</td>
<td>40–45</td>
<td>Reduced food intake; reduced vitamin/mineral intake, particularly calcium and iron</td>
</tr>
<tr>
<td>VSG</td>
<td>Combination</td>
<td>1970s/2000s</td>
<td>Yes</td>
<td>50–70</td>
<td>Decreased absorption: iron, calcium, and vitamin B₁₂</td>
</tr>
</tbody>
</table>
The nutritional needs of postoperative bariatric surgery patients have been documented, but they were not always stressed until studies supporting the need for adequate protein and other nutrients surfaced.\textsuperscript{19,20,27,44–50} This research led to a focus on providing patients with adequate energy, protein, and micronutrient supplementation.\textsuperscript{27,44,49–51} The average calorie intake of bariatric surgery patients may never be defined because there is much variance in postoperative calorie intake. A study by Brodin et al.\textsuperscript{22} showed that early postoperative RYGB patients consume ~800 kcal/day 6 months postoperatively because of their inability to consume high volumes of food. Warde-\textsuperscript{50} Kamar et al.\textsuperscript{50} mailed eating-behavior questionnaires to RYGB patients who were 18 months to 4 years postoperative and found an average intake of 1,733 kcal/day in patients 30 months after surgery. Yet, the range in calorie intake among these patients was quite variable, at 624–3,468 kcal/day. Also, overall sweets consumption was only 7% of daily caloric intake. In addition, they found that the percentage of EWL correlated with calorie intake.

Compared to patients undergoing the RYGB, VBG patients can consume more calories in the early postoperative period. The average intake of early postoperative VBG patients was found to be ~1,161 kcal/day 6 months after surgery, possibly because the VBG alters patients’ postoperative eating toward high-calorie, soft foods. In addition, VBG patients ate more sweets than RYGB patients.\textsuperscript{22}

Despite the differences in nutrient composition, RYGB patients still experience a greater percentage of EWL. Again, this suggests that different mechanisms of action play a role in the percentage of EWL resulting from different procedures early postoperatively, regardless of caloric intake.

Patients who are not adherent to the overall macronutrient requirements of the postoperative diet also may experience delayed weight loss. Because psychosocial variables such as self-esteem and mood, in addition to eating behaviors, affect bariatric surgery outcomes, it is important for patients to adhere to the postoperative diet and to implement long-term behavioral changes before and after surgery.\textsuperscript{23} Again, this supports the importance of dietary intervention through nutritional counseling to improve postoperative outcomes.

**Special Nutrition Considerations**

Although rare, protein energy malnutrition can occur and is more likely in complicated cases requiring parenteral nutrition.\textsuperscript{27,42} The concept that preoperative patients are over-nourished does not take into account the nutritional quality of their dietary intake. Although patients are not able to consume many calories after these procedures, adequate high-quality energy intake is required of bariatric surgery patients, and nutrition therapy and counseling is fundamental for successful weight loss and optimal nutritional status.

Patients’ protein needs became a focus because the frequent intolerance of protein foods was believed to increase the incidence of protein malnutrition.\textsuperscript{53–55} The altered digestion of the normal food pathway in RYGB patients was thought to increase patients’ need for protein. It was suggested that the lack of hydrochloric acid combining with protein in the antrum of the stomach would lead to maldigestion, and the lack of the normal musculature of the stomach to churn and grind food into pieces could increase the risk of protein malnutrition. This resulted in the recommendation of a postoperative diet high in protein sources.

A case report of severe malnutrition caused by complications\textsuperscript{27} and reports of lower protein intake after surgery\textsuperscript{44} further increased the use of a high-protein diet. However, most increased protein needs are necessary only in patients who have the BPD or DS\textsuperscript{28} or in complicated patients.\textsuperscript{28,49} In addition, the degree of protein malabsorption in RYGB patients appears to be effected by the length of the Roux limb.\textsuperscript{29} Although bariatric surgery patients have lower intakes of protein 1 year postoperatively,\textsuperscript{44} the incidence of hypoalbuminemia is low,\textsuperscript{23,29,40} and no evidence of protein malnutrition is evident 6–8 years after RYGB.\textsuperscript{43} It is not common for RYGB patients to develop protein malnutrition\textsuperscript{23,29} because the body can adapt to short-term low protein intake.

Pre- and postoperative screening of laboratory values to assess visceral status may be helpful in the diagnosis of protein malnutrition.\textsuperscript{22} Although many programs encourage patients to consume 60–80 g protein per day in the early postoperative weight loss phase, adequate protein intake meeting the daily reference intake of 46–56 g/day should be sufficient to prevent protein malnutrition in bariatric surgery patients in the later postoperative phases and is a more realistic amount of protein for patients to consume.

Other nutritional complications may occur in the early postoperative stage, including nausea, vomiting, dehydration, and diarrhea. Nausea and vomiting are often related to drinking and eating patterns. Patients should work with patients to pace their eating times, eating frequency, and food volume. Patients often eat too much too fast or advance to solid foods too quickly. If changes in eating patterns do not resolve symptoms, then strictures, ketosis, and pregnancy should be ruled out.

Some patients experience extreme nausea postoperatively, and antiemetics are a helpful aid to prevent dehydration from inadequate fluid intake. Symptoms of dehydration include dark urine, fatigue, nausea, dizziness, and extreme weight loss. Patients should be encouraged to drink clear liquids frequently, even if they are not desired. Also, patients on hypertensive medications should be monitored because hypertensive medications should be halved or discontinued before hospital discharge to prevent dehydration.

Finally, diarrhea is an early postoperative complication often seen in bariatric surgery patients. Patients often experience diarrhea as a symptom of lactose intolerance, which can develop after the RYGB procedure. Lactose in all forms should be eliminated from patients’ diet, and if the diarrhea does not resolve, then infection, dumping syndrome, and other causes of diarrhea should be ruled out.

For all of these reasons, meeting with an RD has proven to be important after bariatric surgery to increase patients’ diet adherence and reduce their postoperative complications.

Some common recommendations practiced today, related to the avoidance of caffeine, carbonation, and alcohol, are based on limited supporting evidence. Evidence has shown that caffeine is an acid-secretion stimulator,\textsuperscript{56} can cause gastric irritation,\textsuperscript{57} and, when consumed in excessive amounts, can lead to dehydration.\textsuperscript{32}
Caffeine can also increase epinephrine, which negatively influences insulin sensitivity. This has led some clinicians to recommend the avoidance of caffeine. Although there is no conclusive evidence supporting the need to avoid caffeine after bariatric surgery, clinical expertise cautions against its frequent consumption.

Similarly, patients are commonly advised to avoid carbonation, although there is limited evidence to support the familiar belief that carbonation stretches the gastric pouch. However, reports from clinical experience of patients' abdominal pain after carbonation consumption have led to the recommendation to avoid carbonated beverages.

Finally, alcohol consumption after bariatric surgery raises concern because studies have illustrated a decreased tolerance of alcohol after such procedures. In addition, the risk of ulcer formation with alcohol consumption is known, and, therefore, an increased risk after bariatric surgery is evident.

Thus, in summary, the evidence regarding alcohol consumption supports avoidance of alcohol after bariatric procedures. Recommendations regarding the avoidance of caffeine and carbonation are less clear and will need to be individualized based on patients' tolerance and clinical judgment.

**Micronutrient Supplementation**

Dating back to the 1980s and 1990s, micronutrient supplementation became important through reports of micronutrient deficiencies. As a result of these reports, prophylactic micronutrient supplementation was recommended in the early 1990s and is now a standard requirement in the 2000s.

Generally accepted supplementation for LAGB and RYGB includes 100% of the daily value (DV) and 200% of the DV, respectively, for at least two-thirds of the nutrients provided in a high-potency liquid or chewable multivitamin. A complete multivitamin containing fat-soluble vitamins, B vitamins, 18 mg iron, 400 µg folic acid, thiamin, copper, zinc, and selenium is required to prevent vitamin and mineral deficiencies.

RYGB patients take in 36 mg iron daily, 800 µg folic acid daily, and 200% of the DV for all other vitamins and minerals. In addition, vitamin B₁₂ supplementation of 350–500 µg/day is required. In addition to 36 mg iron provided in the multivitamin, 50–100 mg/day of additional elemental iron may be required for menstruating women and patients with anemia. Finally, separate calcium supplementation is required in 500–600-mg doses taken multiple times per day to total 1,200–2,000 mg/day of calcium citrate with 800–1,000 IU/day of added vitamin D. Unlike calcium carbonate, calcium citrate does not require acid to be absorbed; given the decrease in acid secretion after RYGB, calcium citrate is the better-absorbed source. LAGB patients may take calcium carbonate because there is less concern regarding a lack of gastric-acid secretion. This standard supplementation is necessary to prevent micronutrient deficiencies, although some patients may require additional supplementation of certain micronutrients.

Rationale for Nutrition Therapy and Postoperative Diet Recommendations

An understanding of the mechanisms of action of bariatric surgery is crucial to understand and build rationale for postoperative diet recommendations. The effects of gut hormones on satiety were first shown in animal studies.

Ghrelin is an orexigenic hormone secreted in the fundus of the stomach. Pre- and postprandial levels of ghrelin have been shown to be diminished in RYGB patients. Other gut hormones, such as peptide YY (PYY) and glucagon-like peptide 1 (GLP-1), may act as anorexic signals and the rise in these hormones after RYGB designate them as satiety factors.

In addition, the effects on ghrelin, PYY, and GLP-1 are thought to effect the mechanism of type 2 diabetes resolution after RYGB. Rubino et al. have also suggested that bypassing a segment of the proximal jejunum results in the resolution of type 2 diabetes independent of food intake, malabsorption, or early nutrient delivery to the hindgut.

Although the exact mechanisms of weight loss from RYGB are not known, these potential mechanisms refute the earlier presumed mechanisms of malabsorption and restriction and replace them with restriction and neurohormonal changes effecting gut-brain communication. Because appetite and satiety are affected, it is important for bariatric surgery patients to work with an RD experienced in bariatric nutrition to guide them through the postoperative diet progression and help them adopt healthy, lifelong eating habits. Frequent follow-up will help to prevent nutritional complications and will lead to positive nutrition and weight loss outcomes.

Despite the change in etiology of these mechanisms of action, nutritional complications after RYGB remain constant, and physiological changes influence these complications and the nutritional needs of patients. First, patients’ food texture and nutrient needs remain unchanged. RDs working with bariatric surgery patients should monitor appropriate food texture for GI healing and nutrient needs in the early postoperative phases. Second, the lack of the pyloric sphincter after RYGB can lead to dumping syndrome in some patients. This requires monitoring of these patients’ total carbohydrate consumption, especially sugar. Third, clinicians should be aware of early postoperative nutritional complications such as nausea and vomiting, diarrhea, and dehydration. Fourth, the conclusion that there is altered absorption of micronutrients only after RYGB (in short-limb Roux-en-Y surgeries) and that malabsorption of macronutrients does not contribute to the mechanisms of weight loss further confirms the need for standard micronutrient supplementation discussed earlier. Patients should be educated about standard micronutrient supplementation preoperatively, and RDs and clinicians should perform frequent biochemical surveillance to prevent micronutrient deficiencies.

Undocumented recommendations to avoid certain foods need further evaluation. And finally, although the mechanisms of action affect appetite and satiety, diet adherence is still important because the cognitive override of the human brain affects the maintenance of energy balance (i.e., people continue eating roughly the same amount they are accustomed to even if they lack appetite and experience satiety).

Bariatric surgery does not change environmental or societal influences on hunger. Therefore, many patients struggle with identifying physical hunger versus nonphysical hunger cues after bariatric surgery. Thus, RDs are crucial in the postoperative care of bariatric patients.
Overall, the lack of standardized postoperative nutrition guidelines and of evidence for some common nutrition recommendations has continued to make the optimal postoperative diet unclear. Current research, coupled with a growing body of clinical expertise, supports a standardized postoperative diet for bariatric surgery and particularly for RYGB and LAGB procedures. Therefore, the development of a standardized postoperative diet based on the proposed structure of texture progression, nutrient needs, and micronutrient supplementation is strongly encouraged.

Many clinicians and RDs already use the standardized postoperative diet proposed here for RYGB and LAGB patients. The postoperative diet for newer procedures such as VSG, as well as recommendations to avoid certain foods, will achieve more standardization as recommendations from further evidence-based research and additional clinical expertise are implemented together.

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